THD Doppler

Bibliography - Release Nr. 19 - 2018/07

Document intended for Health Care Professionals only.

INDEX

- **Doppler-guided hemorrhoidal artery ligation and rectoanal repair (HAL-RAR) for the treatment of grade IV hemorrhoids: long-term results in 100 consecutive patients** - Faucheron JL., Poncet G., Voirin D., Badic B., Gangner Y. - 2011

- **Evaluation of Transanal Hemorrhoidal Dearterialization as a Minimally Invasive Therapeutic Approach to Hemorrhoids** - Ratto C., Donisi L., Parello A., Litta F., Doglietto G.B. - 2010

- **Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results** - Festen S., Van Hoogstraten MJ., Van Geloven AAW., Gerhards MF. - 2009

- **Anatomical branches of the superior rectal artery in the distal rectum** - Schuurman JP., Go PMNYH., Bleys RLAW. - 2009

- **Prospective evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: three-year outcomes** - Giordano P., Nastro P., Davies A., Gravante G. - 2011

- **Transanal Hemorrhoidal Dearterialization: A Systematic Review** - Giordano P., M.D., F.R.C.S.(Edinb.), F.R.C.S.(Engl.)1., Overton J., B.Sc.2., Madeddu F., M.D.1., Zaman S., M.D.1., Gravante G, M.D.1. - 2009

- **Long-term Outcomes of Stapled Hemorrhoidopexy vs Conventional Hemorrhoidectomy – A Meta analysis of Radomized Controlled Trials** - Giordano P., MD, FRCSED, FRCS., Gravante G., MD., Segre R., PHD., Ovens L., MBCHB, MRCS., Nastro P., MD, MRCS. - 2009

- **Evaluation of the effectiveness and patients' contentment with transanal haemorrhoidal artery dearterialisation and mucopexy (THD) for treatment of haemorrhoidal disease: a 6-year study** - Ain Q., Bashir Y., Eguare E. et al - 2017

- **Treatment of Haemorrhoids by Transanal Haemorrhoidal Dearterialization. Experience of Several Specialized Units** - Noguerales F., Díaz R., Salim B. et al - 2015

- **Evaluation of transanal hemorrhoidal dearterialization: a single surgeon experience** - LaBella G. D., Main W. P. L., Hussain L. R. - 2015

- **Comparison of transanal haemorrhoidal dearterialisation and stapled haemorrhoidopexy in management of haemorrhoidal disease: a retrospective study and literature review** - Tsang Y. P., Fok K. L. B., Cheung Y. S. H. et al - 2014

- **Doppler-guided ligation of hemorrhoidal arteries with mucopexy: A technique for the future.** - Ratto C. & De Parades V. - 2014

- **Transanal haemorrhoidal de-arterialisation: changing trends in haemorrhoid surgery** - Fretwell V. & Khan A. - 2014

- **Transanal haemorrhoidal dearteralization (THD): 1 year follow-up results, the Dubai experience** - Al-Ozaibi L., Hazim W., Mazrouri A., Badri F. & Alani A. - 2014

- **A prospective and comparative study between stapled hemorrhoidopexy and hemorrhoidal artery ligation with mucopexy** - Béliard A., Labbé F., de Faucal D., Borie F. et al. - 2014

- **Transanal dearterialization with targeted mucopexy is effective for advanced haemorrhoids** - Giordano P., Tomasi I., Pascariello A. et al. - 2014

- **Efficacy of THD Doppler procedure in treating hemorrhoidal symptoms** - Ratto C., Parello A., Donisi F., Litta G. et al. - 2013

- **PPH versus THD: a comparison of two techniques for III and IV degree haemorrhoids. Personal experience** - Verre L., Rossi R., Gaggelli I., Di Bella C. et al. - 2013

- **Treatment of grade III haemorrhoids with anorectal thrombosis** - Korolenko K., Korolenko V. & Tominets M. - 2013

- **THD for chronic haemorrhoids treatment** - Pyrogovskyy V., Sorokin B., Tachiev R., Zadorozhniy S., Plemyanik S., Taranenko A., Slobenets S., Lashchenko M., Murga P., Shetelinets U. & Noyes A. - 2013

- **THD Doppler procedure decreases haemorrhoidal artery hyperflow** - De Simone V., Parello A., Donisi L., Litta F. et al. - 2013

- **THD for thrombosed haemorrhoids** - Trenchuk V., Lagoda V., Tchornous I. - 2013

- **Advantages of transanal hemorrhoidal dearterialization as compared to other surgical techniques for the treatment of hemorrhoidal disease** - Popov V., Zhivkov E., Tokov P. et al - 2013

- **Early quality of life outcomes following Doppler guided transanal haemorrhoidal dearterialisation: a prospective observational study** - Talha S., Burke J.P., Waldron D. et al - 2013

- **Desarterialización hemorroidal transanal como tratamiento quirúrgico de la enfermedad hemorroidal: Reporte inicial** - Morett R. S. - 2012

- **Resultados a un año tras desarterialización hemorroidal guida por doppler** - Gomez-Rosado J.C., Sanchez-Ramirez M. - 2012

- **Doppler-guided transanal haemorrhoidal dearterialisation with mucopexy versus Ferguson haemorrhoidectomy for Grade III or IV haemorrhoids: short-term results of a single blind randomized controlled trial** - Karas J., Chang P., Denoya P., Fakhoury M., Fakhoury J., Stein S., Gregg T., Russo N., Amrani S., Kwan A., Essani R. & Bergamaschi R. - 2012

- **Is transanal hemorrhoidal dearterialization (THD) tolerated under local anesthesia?** - Yap J.R., Ris F., Skala K., Zufferey G., Roche B. - 2012

- **Is Doppler ultrasonography essential for hemorrhoidal artery ligation?** - Avital S., Inbar R., Karin E., Greenberg R. - 2012

- **Transanal desarterialization guided by Doppler associated to anorectal repair in hemorrhoids: THD technique** - Sobrado-Junior C.W., Hora W. - 2012

- **Outcome of stapled haemorrhoidopexy versus doppler-guided haemorrhoidal artery ligation for grade III haemorrhoids (Editorial)** - Giordano P. - 2011

- **Dearterializzazione emorroidaria transanale Doppler-guidata: contributo casistico** - Cudazzo E., De Cesare C., Faraci R., Bianchi M., Mariani L. - 2011

- **Prospective randomised multicenter study comparing Stapler Haemorrhoidopexy (SH) with Doppler guided Transanal Haemorrhoid Dearterialization (THD) for III degree haemorrhoids** - Infantino A., Altomare D. F., Bottini C., Bonanno M., Mancini S. and the THD group of the SICCR (Italian Society of Colorectal Surgery) - 2011

- **Transanal Haemorrhoidal Artery Echodoppler Ligation and anopexy (THD) is effective for II and III degree haemorrhoids: a prospective multicentric study** - Infantino A., Bellomo R., Dal Monte PP., Salafia C., Tagariello C., Ionizzo CA., Spazzafumo L., Romano G., Altomare DF. - 2009

- **Desarterialización hemorroidal transanal guiada por Doppler. Una alternativa en el tratamiento de las hemorroides** - Cantero R., Balibrea JM., Ferrigni C., Sanz M., García Pérez JC., Pérez R., Luffiego A., Forero RG., Balibrea JL. - 2008

- **Transanale-Hämorrhoiden-Dearterialisation (THD) und Hämorrhoidal-Arterien-Ligatur (HAL): Evaluation der minimal-invasiven Therapie des Hämorrhoidalleidens** - Lienert M., Horstmann O. - 2008

- **Doppler-guided haemorrhoidal artery ligation, rectoanal repair, sutured haemorrhoidopexy and minimal mucocutaneous excision for grades III–IV haemorrhoids: a multicenter prospective study of safety and efficacy** - Theodoropoulos G. E., Sevrisarianos N., Papaconstantinou J. et al - 2008

- **Transanal haemorrhoidal dearterialization: non excisional surgery for the treatment of haemorrhoidal disease** - Dal Monte PP., Tagariello C., Giordano P., Cudazzo E., Shafi A., Saragò M., Franzini M. - 2007

- **Dearterializzazione Emorroidaria Transanale doppler-guidata (THD)** - Cudazzo E., Bianchi M., Mariani L., Faraci R., Iosca A., Franzini M. - 2006

- **Doppler-guided ligation of the hemorrhoidal arteries. Report of experiences with 248 patients** - Lienert M., Ulrich B. - 2004

- **Doppler-guided transanal haemorrhoidal dearterialisation is an effective technique for the treatment of symptomatic haemorrhoids** - Dal Monte PP., Tagariello C., Saragò M., Giordano P. - 2004

- **The superior rectal artery and its branching pattern with regard to its clinical influence on ligation techniques for internal hemorrhoids** - Aigner F., M.D.a,c., Bodner G., M.D.b., Conrad F., M.D.c., Mbaka G., M.D.e., Kreczy A., M.D.d., Fritsch H., M.D.a. - 2004

- **Comparison of early and 1-year follow-up results of conventional hemorrhoidectomy and hemorrhoid artery ligation: a randomized study** - Bursics A., Morvay K., Kupcsulik P., Flautner L. - 2003

- **Study of the arterial pattern of the rectum and its clinical application** - Shafik A., Mostafa H. - 1996

- **A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter** - Morinaga K., Hasuda K., Ikeda T. - 1995

- **Haemorrhoids are associated not with hypertrophy of the internal anal sphincter, but with hypertension of the anal cushions** - Sun WM., Peck RJ., Shorthouse AJ., Read NW. - 1992

- **Arterial supply to the human rectum** - Ayoub SF. - 1978

- **Vascularization of the anal canal** - Guntz M., Parnaud E., Bernard A., Chome J., Regnier J. et al. - 1976

- **The Nature of Haemorrhoids** - Thomson WH. - 1975

2017
Authors: **Ratto** C., **Campenni** P., **Papeo** F. et al
Source: Tech Coloproctol. (2017) 21:953-962.
Available for Full Open Online Access

Title: Transanal hemorrhoidal dearterialization (THD) for hemorrhoidal disease: a single-center study on 1000 consecutive cases and a review of the literature

BACKGROUND:

The transanal hemorrhoidal dearterialization (THD) Doppler procedure is a minimally invasive technique to treat symptomatic hemorrhoids. The aim of the study was to assess the clinical efficacy and the satisfaction of patients in a large series treated with THD and to review the relevant literature.

METHODS:

In this retrospective, single-institution, study consecutive patients with grade 2, 3, or 4 hemorrhoidal disease were treated with the THD Doppler procedure. Dearterialization was performed in all cases and mucopexy in case of prolapse. The dearterialization procedure evolved from "proximal artery ligation" to "distal Doppler-guided dearterialization." Follow-up was scheduled at 15 days, 1, 3, 12 months, and once a year thereafter. Complications were recorded. Clinical efficacy was assessed comparing both frequency of symptoms and disease grading (Goligher's classification) at baseline versus last follow-up. Uni-/multivariate analysis evaluated factors affecting the outcome.

RESULTS:

There were 1000 patients (619 men; mean age: 48.6 years, range 19–88 years). Acute postoperative bleeding was observed in 14 patients (1.4%), pain/tenesmus in 31 patients (3.1%), and urinary retention in 23 patients (2.3%). At mean follow-up duration of 44 ± 29 months, the symptomatic recurrence rate was 9.5% (95 patients; bleeding in 12 (1.2%), prolapse in 46 (4.6%), and bleeding and prolapse in 37 (3.7%) patients). The recurrence rate was 8.5, 8.7, and 18.1% in patients with grade 2, 3, and 4 hemorrhoids, respectively. Seventy out of 95 patients with recurrence needed surgery (reoperation rate: 7.0%). At final follow-up and taking into account the reoperations, 95.7% of patients had no hemorrhoidal disease on examination. Younger age, grade 4 disease, and high artery ligation affected the outcome negatively.

CONCLUSIONS:

Our results show that the THD Doppler procedure is safe and effective in patients with hemorrhoidal disease and associated with low morbidity and recurrence rates and a high rate percentage of treatment success.

Techniques in Coloproctology (2017) 21:953–962
https://doi.org/10.1007/s10151-017-1726-5

ORIGINAL ARTICLE

Transanal hemorrhoidal dearterialization (THD) for hemorrhoidal disease: a single-center study on 1000 consecutive cases and a review of the literature

Carlo Ratto[1] · Paola Campennì[1] · Francesco Papeo[1] · Lorenza Donisi[1] · Francesco Litta[1] · Angelo Parello[1]

Received: 28 April 2017 / Accepted: 19 September 2017 / Published online: 24 November 2017

Abstract

Background The transanal hemorrhoidal dearterialization (THD) Doppler procedure is a minimally invasive technique to treat symptomatic hemorrhoids. The aim of the study was to assess the clinical efficacy and the satisfaction of patients in a large series treated with THD and to review the relevant literature.

Methods In this retrospective, single-institution, study consecutive patients with grade 2, 3, or 4 hemorrhoidal disease were treated with the THD Doppler procedure. Dearterialization was performed in all cases and mucopexy in case of prolapse. The dearterialization procedure evolved from "proximal artery ligation" to "distal Doppler-guided dearterialization." Follow-up was scheduled at 15 days, 1, 3, 12 months, and once a year thereafter. Complications were recorded. Clinical efficacy was assessed comparing both frequency of symptoms and disease grading (Goligher's classification) at baseline versus last follow-up. Uni-/multivariate analysis evaluated factors affecting the outcome.

Results There were 1000 patients (619 men; mean age: 48.6 years, range 19–88 years). Acute postoperative bleeding was observed in 14 patients (1.4%), pain/tenesmus in 31 patients (3.1%), and urinary retention in 23 patients (2.3%). At mean follow-up duration of 44 ± 29 months, the symptomatic recurrence rate was 9.5% (95 patients; bleeding in 12 (1.2%), prolapse in 46 (4.6%), and bleeding and prolapse in 37 (3.7%) patients). The recurrence rate was 8.5, 8.7, and 18.1% in patients with grade 2, 3, and 4 hemorrhoids, respectively. Seventy out of 95 patients with recurrence needed surgery (reoperation rate: 7.0%). At final follow-up and taking into account the reoperations, 95.7% of patients had no hemorrhoidal disease on examination. Younger age, grade 4 disease, and high artery ligation affected the outcome negatively.

Conclusions Our results show that the THD Doppler procedure is safe and effective in patients with hemorrhoidal disease and associated with low morbidity and recurrence rates and a high rate percentage of treatment success.

Keywords Hemorrhoids · Transanal hemorrhoidal dearterialization · Mucopexy · Surgical management hemorrhoidal disease

Introduction

Hemorrhoidal disease is the most common benign anorectal disorder in Western countries, with an estimated prevalence between 4.4 and 12.8% in the adult population [1].

An accurate patient history, anorectal examination, and anoscopy are mandatory to estimate the degree of disease and to identify patients who are suitable for either medical or surgical treatment.

Among surgical approaches, Milligan–Morgan and Ferguson hemorrhoidectomies are still considered the "gold standard" for the treatment of advanced hemorrhoidal disease, even though there is a significant risk of postoperative complications, particularly pain. In an attempt to reduce the

This paper has been presented as Podium Presentation (S62a) at the American Society of the Colon and Rectal Surgeons (ASCRS) Annual Scientific Meeting in Los Angeles, CA, April 30–May 4, 2016.

✉ Carlo Ratto
carloratto@tiscali.it

[1] Proctology Unit, University Hospital "A. Gemelli", Catholic University, Largo A. Gemelli, 8, 00168 Rome, Italy

risk of complications, in 1995 Morinaga introduced a new non-excisional procedure providing the Doppler-guided ligation of the hemorrhoidal arteries [2], hemorrhoidal dearterialization. Several modifications of the original technique have been described, and consequently, the indications have been expanded. In particular, the addition of the endorectal plication of the redundant and prolapsing mucosa and submucosa (mucopexy) aimed to treat the hemorrhoidal prolapse, while maintaining the anatomical integrity of the hemorrhoidal piles. Later a more reliable identification of the hemorrhoidal arteries made it possible to perform distal Doppler-guided dearterialization (DDD), with further improvement in clinical results [3, 4].

The primary aim of the present study was to evaluate the clinical results obtained during a 10-year experience of using transanal hemorrhoidal dearterialization (THD) for hemorrhoidal disease in the largest series of patients to date. The secondary aim was to examine the factors related to recurrence.

Materials and methods

A retrospective study was conducted on all consecutive patients with grade 2, 3, or 4 hemorrhoidal disease who had failed conservative treatment (based on diet, fiber supplements, topical ointments, and phlebotonic drugs) and underwent THD Doppler at the University Hospital "A. Gemelli," Rome, Italy between June 2005 and June 2015. All procedures complete hemorrhoidal dearterialization, while mucopexy was carried out in patients with hemorrhoidal prolapse. All the patients provided written informed consent to undergo the procedure and subsequent follow-up. Ethical approval in our institution is not needed for this type of studies.

Preoperatively, all patients underwent full physical and clinical examination: According to Goligher's classification [5], 82 cases (8.2%) were classified as grade 2, 835 (83.5%) as grade 3, and 83 (8.3%) as grade 4. A symptoms-based questionnaire (recording bleeding, prolapse, manual reduction, impact on quality of life, discomfort/pain) was administered to all patients, before the operation and at follow-up; this questionnaire was based on five different parameters characterizing the hemorrhoidal disease, with a grading from 0 (no symptom) to 4 (daily presence of the symptom(s)) for each symptom [6]. The total score of all five parameters was used to evaluate the patient's condition: 0 indicated the total absence of a symptom, while a score of 20 represented the worst clinical scenario. After the patients were examined and the above symptoms were discussed, the examining clinician made a final assessment of symptomatic recurrences that needed to be addressed medically or surgically.

THD technique

THD Doppler technique has been described in detail elsewhere [4, 7]. Patients were treated under general or spinal anesthesia. No antibiotics were administered before, during, or after the operation. With the patient in the lithotomy position, the THD Doppler proctoscope was introduced transanally for its full length to reach the lower rectum. Under Doppler guidance, the signal from six arteries was found in all the patients. During the 10-year study period, the equipment has been progressively improved (all the devices were produced by THD S.p.A., Correggio, Italy) [8]. The first model of the proctoscope (hereafter referred to as "first device") had a very small operative window that limited the possibilities for mucopexy in very advanced cases. Then, THD Surgery (hereafter referenced to as "second device") was introduced, improving the first model of the proctoscope by providing a fully opened operative window, to better expose the site of the mucopexy. The last proctoscope model (THD Slide, hereafter referred to as "third device") was introduced in 2009. It provided an improved Doppler system and a sliding component, which significantly facilitated both a reliable dearterialization and an effective and complete mucopexy.

Up to 2009, the hemorrhoidal arteries were searched for at the higher part of the low rectum, reached by fully introducing the THD proctoscope. However, following the results of a study which highlighted that the arterial hemorrhoidal branches became more superficial and submucosal in the distal rectum [9], artery identification and ligation was targeted to the distal part of the low rectum (within 2 cm of the anorectal junction). This distal Doppler-guided dearterialization (DDD) has been used to perform the dearterialization since 2009 [3]. Using electrocautery, a small marker point was made on the mucosa where the best Doppler signal was obtained. Thereafter, in patients with prolapsing hemorrhoids requiring mucopexy, the proctoscope was fully reintroduced into the low rectum. Mucopexy started at 6–7 cm from the anal verge with a *Z*-shaped proximal fixation stitch. Then it continued distally with several passages (roughly 5 mm from each other), through the rectal mucosa and submucosa, finally reaching the anorectal junction. The running suture always stopped above the hemorrhoid tissue. Along the continuous suture of mucopexy, the "marker point" was incorporated by passages of suture above and below therefore occluding the hemorrhoidal artery lying in the submucosa. Postoperatively, patients were advised to avoid prolonged straining and heavy physical activity for 1 month, and a fiber- and fluid-rich diet was prescribed for 2 weeks. Stool softeners, analgesics, and anti-inflammatory drugs (paracetamol, nonsteroidal anti-inflammatory drugs) were administered for postoperative days 1–3, and thereafter only if necessary. No antibiotics were administered.

Follow-up

Routine follow-up visits were scheduled at 2 weeks, 1 month and 3 months, and then 1 year after the operation. Patients with a follow-up longer than 1 year were recalled and examined to evaluate the results of the operation at longer follow-up. Postoperative symptoms occurring within 30 days were recorded. The medical or surgical treatment needed to resolve complications and recurrence was also recorded. At the last follow-up visit, the symptom questionnaire was readministered and compared with the preoperative data. If patients suffered from a recurrence, the results from the questionnaire at the time of recurrence were considered final. Recurrence was defined as the presence of recurrent bleeding or recurrent hemorrhoidal prolapse requiring medical or surgical therapy after the first THD surgery. Anatomical recurrence was defined as presence of hemorrhoidal tissue on physical examination and anoscopy at the last visit, including patients who underwent surgical procedures for recurrent disease.

Statistical analysis

The following baseline variables were evaluated as predictive factors of failure: age, gender, hemorrhoid grade, recurrent disease, type of THD procedure performed, morbidity, need for therapy, follow-up period, use of first or second device, and use of "high ligation." Continuous data were analyzed as means (with SD and range) and compared using the paired samples *t* test. Categorical data were analyzed as frequencies and percentages, and compared using either the Chi-square test or the marginal homogeneity test, as necessary. To assess factors potentially predictive of failure, univariate and multivariate logistic regression models were applied. A $p < 0.05$ was considered statistically significant. Analyses were carried out with SPSS—version 21.0 software for Windows—(SPSS, Chicago, IL, USA).

Results

Intra- and postoperative findings

A total of 1000 consecutive patients with symptomatic hemorrhoids (619 men; mean age 48.6 years; range 19–88 years) underwent THD Doppler during the study period (Fig. 1).

General anesthesia was given to 915 patients (91.5%), and spinal anesthesia to 85 patients (8.5%). The mean duration of surgical procedure was 20 ± 5 min when only dearterialization was performed and 30 ± 10 min when mucopexy was added. In 931 patients (93.1%), hemorrhoidal dearterialization and mucopexy were performed, while in 69 patients (6.9%) only dearterialization was performed. The mean postoperative hospital stay was 1 ± 0.2 day. Table 1 reports the intra- and postoperative results. One hundred and one patients (10.1%) were treated with the first THD Doppler device, 36 (3.6%) with the THD Surgery, and 863 (86.3%) with the THD Slide. Concomitant surgical procedures were carried out in 243 patients (24.3%): The most frequent was skin tag(s) removal (in 145 patients, 14.5%); internal lateral sphincterotomy was performed in 103 patients (10.3%) with anal fissure, and fistulotomy in 10 patients (1.0%). Morbidity (within 30 days) included mainly pain and/or tenesmus (31 patients, 3.1%), which required medical therapy (anti-inflammatory and/or analgesic drug) for more than 5 days; urinary retention was observed in 23 patients (2.3%) treated with bladder catheterization; and thrombosed external hemorrhoids in eight patients (0.8%). Only 14 cases (1.4%) of acute bleeding were registered, requiring surgical or endoscopic hemostasis. Neither postoperative anal abscess nor anal fissure was reported.

Long-term follow-up

The mean follow-up period was 44 ± 29 months (median 36 months, range 6–124). A significant mean reduction in the symptom-based questionnaire score was calculated following the primary THD Doppler operation when compared with the preoperative values (mean score: 13.8 ± 2.3 at baseline vs. 1.1 ± 0.8 at last follow-up; $p < 0.0001$). With regard to each component of the questionnaire administered after the primary THD Doppler procedure (Fig. 2), no bleeding was reported by 928 of patients (92.8%), no prolapse by 881 patients (88.1%), no manual reduction of hemorrhoids by 926 patients (92.6%), no anal discomfort/pain by 935 patients (93.5%), and no impact on quality of life (QoL) by 936 patients (93.6%). The comparison between frequency of symptoms preoperatively and during follow-up, as investigated by the questionnaire, revealed a statistical significant difference for every item ($p < 0.0001$; Fig. 2).

Recurrence, which was evaluated by taking into account patient examination and severity of symptoms, was 9.5% (95 patients): 12 patients (1.2%) had recurrence of bleeding, 46 (4.6%) of prolapse, and 37 (3.7%) of both bleeding and prolapse. Only 26 patients (2.6%) needed to reduce prolapsing piles every day, 14 (1.4%) had daily anal discomfort/pain, and 12 (1.2%) daily significant impact on their quality of life. The mean time until recurrence was 13 ± 4.3 months. The detailed distribution of the patients with recurrence related to the classification of the primary disease is reported in Table 2. Recurrence occurred in 7 out of 82 grade 2 patients (8.5%), 73 out of 835 grade 3 patients (8.7%), and 15 out of 83 grade 4 patients (18.1%) ($p = 0.021$). Twenty-five patients (2.5%) having recurrence did not need any further surgery as their symptoms were minimal or very infrequent (Fig. 1). On the other hand, 70 patients (7.0%) underwent a

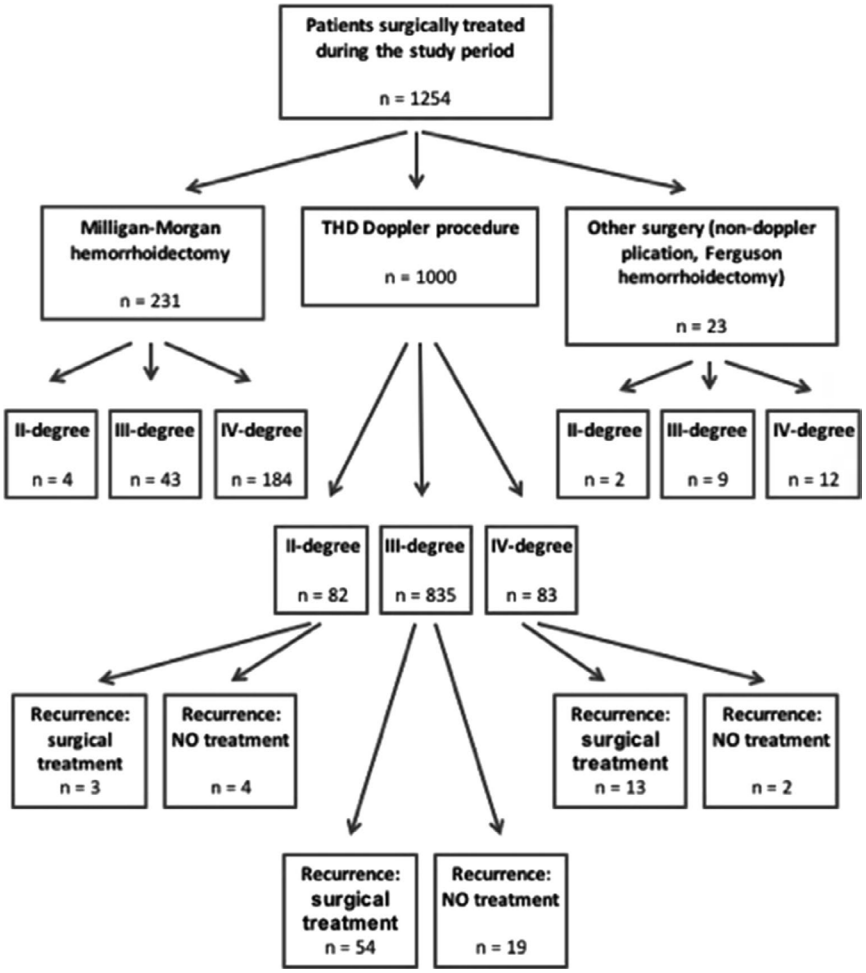


Fig. 1 Flow diagram of the surgical treatment

Table 1 Intra- and postoperative results

	No. of patients	%
Device used		
First model device	101	10.1
Second model device (THD Surgy)	36	3.6
Third model device (THD Slide)	863	86.3
Concomitant surgical procedures		
Skin tag(s) removal	145	14.5
Lateral internal sphincterotomy	103	10.3
Fistulotomy	10	1
Total	243	24.3
Mortality	0	0
Morbidity (≤ 30 postop days)		
Pain/tenesmus	31	3.1
Urinary retention	23	2.3
Bleeding	14	1.4
Total	68	6.8

second surgical procedure (performed in either our institution or other hospitals) for symptomatic hemorrhoids: 32 were treated again with the THD Doppler procedure, 23 underwent Milligan–Morgan hemorrhoidectomy, 11 Ferguson hemorrhoidectomy, 2 stapled hemorrhoidopexy, and 2 stapled transanal rectal resection.

As far as anatomical recurrence at the final evaluation, taking into account reoperations, 95.7% of patients (957/1000) was free of hemorrhoidal disease, while 0.2% (2 patients) had grade 1 hemorrhoids, 1.1% (11 patients) grade 2, 2.5% (25 patients) grade 3, and 0.5% (5 patients) grade 4. Residual skin tags were present in 53 patients (5.3%). No patient reported defecatory urgency, fecal incontinence, or chronic pain.

At univariate analysis, high ligation of hemorrhoidal arteries, age < 40 years, and grade 4 hemorrhoidal disease were all variables associated with a significantly higher recurrence rate. These three variables have proven their

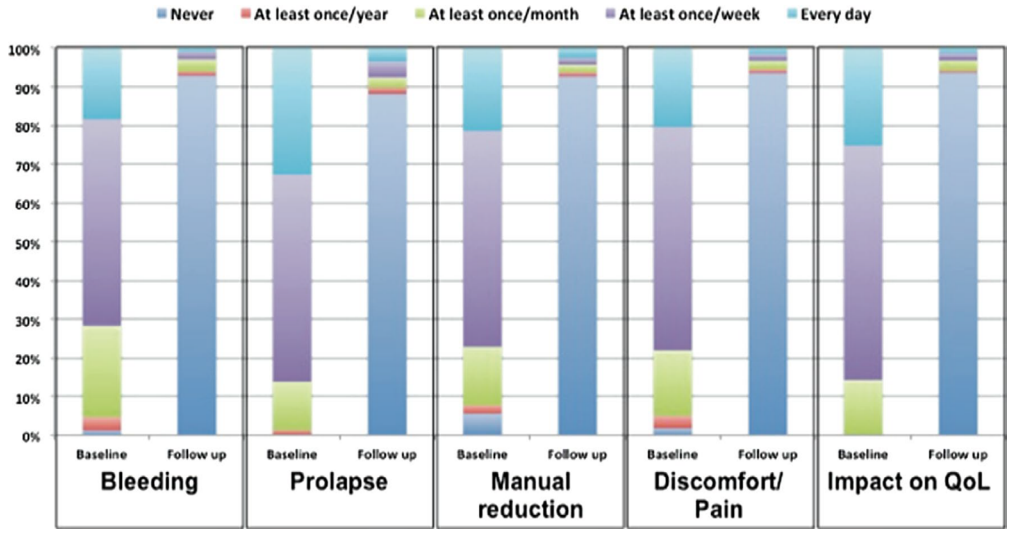


Fig. 2 Results of symptoms-based questionnaire at preoperative evaluation (baseline) and last visit (follow-up): distribution of patients (percentage). Statistics: marginal homogeneity test; for each item, baseline versus follow-up: $p < 0.0001$

Table 2 Recurrence following THD Doppler procedure: distribution based on the preoperative Goligher classification of hemorrhoidal disease

Type of failure	Hemorrhoidal disease grade No. of patients (%)				*p* value[a]
	II	III	IV	Overall	
Bleeding	2 (2.4)	10 (1.2)	0	12 (1.2)	0.355
Prolapse	1 (1.2)	37 (4.4)	8 (9.6)	46 (4.6)	0.030
Bleeding and prolapse	4 (4.9)	26 (3.1)	7 (8.4)	37 (3.7)	0.042
Overall failure	7 (8.5)	73 (8.7)	15 (18.1)	95 (9.5)	0.021

[a]Chi-square test

value as independent factors affecting the outcome of the disease also at multivariate analysis (Table 3).

Discussion

In recent years, several studies have legitimized the THD Doppler procedure as an effective non-excisional operation for symptomatic hemorrhoidal disease. Progressively, the improvement in targeted hemorrhoidal artery ligation [3, 4, 9] and the addition of the appropriate mucopexy in those patients presenting hemorrhoidal/muco-hemorrhoidal prolapse [4, 7] have obtained high success rates in treating the

Table 3 Uni-/multivariate analysis of factors affecting the final outcome following THD Doppler procedure

Factors	Univariate analysis Relative risk (95% CI)	*p* value	Multivariate analysis Relative risk (95% CI)	*p* value
Age < 40 years	2.004 (1.284–3.128)	0.002	1.945 (1.234–3.065)	0.004
Male	1.010 (0.653–1.561)	0.965		
Baseline grade 4 hemorrhoidal disease[a]	2.308 (1.261–4.223)	0.005	2.367 (1.261–4.442)	0.007
First device usage	1.472 (0.788–2.750)	0.223		
Second device usage	1.966 (0.797–4.852)	0.135		
Third device usage	0.600 (0.350–1.028)	0.060	0.949 (0.485–1.855)	0.878
High ligation of arteries	2.155 (1.375–3.377)	0.001	1.881 (1.083–3.269)	0.025
No morbidity within 30 days	1.508 (0.694–3.279)	0.296		
Follow-up < 12 months	0.447 (0.160–1.249)	0.115	0.613 (0.216–1.744)	0.359

[a]Goligher classification

symptoms of hemorrhoidal disease (mainly bleeding and prolapse). The literature on this subject includes studies conducted during the first period of THD Doppler use, with only the hemorrhoidal dearterialization, and several, more recent, papers that have reported data about the addition of mucopexy (Table 4). There are also papers reporting trials comparing THD Doppler to other procedures: Table 5 summarizes the data and lists some critical points concerning the results. In four studies, THD was compared to hemorrhoidectomy (in 2 with the Milligan–Morgan procedure [19, 20], in 1 with the Ferguson procedure [17, 18], and 1 with hemorrhoidectomy using LigaSure™ [16]. In four other studies [11, 13, 15, 23], THD was compared to stapled hemorrhoidopexy.

To our knowledge, this is the first study showing a 10-year experience using the THD Doppler procedure in a single institution, with the largest series of patients ever published.

In other studies (Table 4), the reported operating time was 20–45 min; the number of arteries ligated 5–8. In the present series, the operating time was 20–30 min, and the number of arteries ligated was always 6.

In the previous series (Table 4), pain was the most often reported postoperative complication following THD in up to 35% of patients. However, in the majority of papers, less than 10% of patients complained of significant postoperative pain. In a selected subset of grade 4 patients, Giordano et al. [21] reported pain in 71% (severe pain in only 16%). In the few studies which reported tenesmus following the operation, it was more frequent in patients who underwent mucopexy. Postoperative bleeding was reported in up to 13% of patients; the majority of the published papers report an incidence rate below 6%. Moreover, not all the patients having postoperative bleeding needed surgical reintervention for hemostasis. Hemorrhoidal thrombosis was observed in up to 8.6% of patients but was less than 3% in the majority of papers. Anal fissure was considered a postoperative complication in up to 1.5% of patients.

Urinary retention was reported only in a few papers, possibly because it was not considered an actual postoperative complication. The urge to defecate is infrequently described as a transient postoperative symptom, possibly related to both tenesmus and acute inflammation. In the literature, there is no mention of any life-threatening complication, nor other morbidity observed after different surgical procedures (i.e., rectovaginal fistula, rectal necrosis, retrorectal hematoma, events requiring stoma formation).

In the present study, the overall morbidity rate was below 7%; however, no complication had long-term effects. Pain and tenesmus occurred only within the first few postoperative weeks. Very few cases of postoperative bleeding required reoperation for hemostasis.

In 11 of the 18 papers that report THD Doppler data (Table 4), the follow-up period was longer than 12 months. The overall recurrence rate was 3–20%; no series showed a recurrence rate $\geq$ 20%. Recurrence of bleeding was reported in 3–16.7% of patients. Recurrent prolapse was observed in 2.7–16.7% of patients. Only in a two-center study (which included our institution) on grade 4 patients was the prolapse recurrence rate higher (28.6%) [6]. During follow-up, anal pain was reported in up to 10% of patients; only De Nardi et al. [20] reported a higher incidence rate of 16.6%. Reoperation, due to the recurrence of symptoms, was necessary in 4.1–17.8% of cases.

The present series has the longest mean follow-up in the literature (44 $\pm$ 29 months), with the exception of one other series [10]. The clinical efficacy of the THD Doppler procedure was demonstrated by the subjective improvement of symptoms (as reported by the results of the symptoms-based questionnaire showing a significant decrease in the score from 13.8 to 1.1, $p < 0.0001$). Less than 10% of patients in the present series experienced recurrence of hemorrhoidal disease following the primary THD Doppler procedure, and recurrence mainly concerned hemorrhoidal prolapse. Recurrence was significantly more frequent in patients treated with high ligation of the arteries (used in the first period of the present series), demonstrating that DDD was effective (Table 3). Grade 4 disease predisposed to the worst outcome, as shown by the multivariate analysis, mainly due to prolapse recurrence (15 cases). However, it was possible to treat the recurrence with a single procedure (12 patients) or conservative management only (3 cases). Almost half the patients with recurrence (32 out of 70) were treated with a redo THD procedure, mainly aimed at repositioning the prolapsing hemorrhoids inside the anal canal. The other 38 patients underwent different operations (including hemorrhoid excision in 34 cases). It is interesting that, at last follow-up visit, 95.7% of the patients were disease-free, and only 30 out of 1000 patients had grade 3 (25 cases) or grade 4 (5 cases) disease.

Another predictive factor of failure was age below 40 years, and the reason for this is not clear. However, we can speculate that younger patients' failure to fully respect the recommendations to avoid straining and physical activity may partly explain this result. A similar result, even if not confirmed at the multivariate analysis, emerged in another multicenter trial [24].

Main limitations of the study are: (1) retrospective design; (2) single-institution series: The results could be different in other patient populations, although our results are similar to those of a multicenter trial which includes our experience [24]; (3) variable technique and equipment: To better evaluate this limitation, we have analyzed the impact of the adoption of different devices and techniques on the results; (4) in our center, rubber band ligation or sclerosing injections

Table 4 Results of the analyzed cohort studies

Study	No. patients	Operation time (min.)	No. ligatedarteries	Postoperative complications				Follow-up (months)	Recurrence rate (%)	Symptoms at follow-up			Reoperation rate (%)
				Pain (%)	Bleeding (%)	Thrombosis (%)	Fissure (%)			Bleeding (%)	Prolapse (%)	Pain (%)	
Dal Monte [10]	330 (grades 2–3–4)	n.a.	n.a.	19†	2	1.5	0.6	46 (22–79)	7.5	3	2.7	n.a.	n.a.
Festen et al. [11]	23 (grades 2–3)	34	n.a.	n.a.	n.a.	n.a.	n.a.	1.5	17	4.3	n.a.	n.a.	n.a.
Ratto et al. [8]	170 (grades 2–3–4)	20 ± 5.30 ± 10 (with RAR)	6	15.9	1.2	2.3	n.a.	11.5 ± 12 (1–41)	n.a.	6.5	10.5	0	4.1
Infantino [12]	112 (grades 2–3)	33.9 ± 8.8	7.2 ± 1.5	28.6	0.9	2.7	n.a.	15.6 ± 6.5 (6–32)	14.3	20	6.3	3.6	12.5
Rattoet al. [6]	35 (grade 4)	33 ± 12	6	14.3	5.7	8.6	n.a.	10 (6–28)	n.a.	25.7	28.6	8.6	5.7
Giordano et al. [13]	28 (grades 2–3)	30 (20–45)	n.a.	0	0	n.a.	n.a.	38 (33–48)	14	4	11	n.a.	n.a.
Schuurman et al. [14]	38 (grades 2–3)	n.a.	5.2 ± 0.71	0	2.6	2.6	n.a.	6	n.a.	n.a.	n.a.	n.a.	13.2
Infantino et al. [15]	85 (grade 3)	n.a.	n.a.		5.9	2.4	n.a.	17 ± 0.4 (15–20)	14	n.a.	n.a.	n.a.	11.3
Zampieriet al. [16]	46 (grades 3–4)	20 ± 5.1	n.a.	6.5	0	0	0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Denoya et al. [17, 18]	20 (grades 3–4)	36.6 ± 12.7	6	10	10	0	0	35 (27–43)	16.7	16.7	16.7	8.3	8.3
Elmér et al. [19]	20 (grades 2–3)	36 (30–45)	6	5	0	5	0	12	20.0	15.0	20.0	10–0	10.0
De Nardi et al. [20]	25 (grade 3)	25 ± 10	6	0	0	0	0	24	12.5	4.2	0	16.6	4.2
Giordano et al. [21]	31 (grade 4)	32 (23–47)	6 (5–8)	71	0	3.2	0	32 (6–58)	3.2	n.a.	n.a.	n.a.	3.2
Tempel et al. [22]	216 (grade n.a.)	n.a.	n.a.	10.4	0	0	0	23 (1–42)	n.a.	n.a.	n.a.	n.a.	n.a.
Béliard et al. [23]	54 (grades 2–3)	n.a.	n.a.	0	0	0	0	24	9.3	n.a.	n.a.	n.a.	n.a.
Ratto et al. [24]	803 (grades: 2–3–4)	34.3 ± 5.9 (24–47)	6	13	2.2	0.5	0.1	11.1 ± 9.2 (3–57)	9.3	3.0	6.9	0	5.6
LaBella et al. [25]	108 (grades 2–3–4)	n.a.	6	8	13	0	0	12	10.3	0	10.3	0	10.3
Rubbini et al. [26]	106 (grades 3–4)	25 (16–65)	n.a.	35	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Table 5 Comparative trials comparing THD Doppler procedure with other techniques

Study	No. patients, grade	Compared procedure	Outcome
Festen et al. [11]	Total: 23 Grade 3: 19 Grade 4: 4	PPH	No significant difference in complications. However, significantly shorter operative time for DGHL (23 vs. 34 min, $p < 0.001$) and less pain (pain score at day 7: 1.6 vs. 3.2, $p < 0.01$)
Giordano et al. [13]	Total: 28 Grade 2: 16 Grade 2: 12	PPH	No significant difference in pain, operative time, complications, or recurrence rate. Patients returned to normal activities faster after DGHL (3.2 vs. 6.3 days, $p < 0.01$)
Schuurman et al. [14]	Total: 38 (grades 2–3)	HL	No significant difference in patient-reported severity of bleeding, pain, defecation problems, and discomfort. Greater improvement in prolapse symptoms in non-Doppler group ($p = 0.047$). Higher rate of complications for DGHL ($p < 0.0005$)
Infantino et al. [15]	Total: 85 (grade 3)	PPH	No significant difference in pain, postoperative complications, recurrence, or reoperation rates. Higher rate of late complications for PPH ($p = 0.028$). Shorter length of stay and lower equipment cost for DGHL
Zampieriet al. [16]	Total: 46 Grade 3: 21 Grade 4: 25	Ligasure hemorrhoidectomy	In DGHL group, lower length of procedure (20 ± 5.1 vs. 28 ± 4.2 min, $p < 0.05$), higher pain resolution rate (87 vs. 81%, $p < 0.05$), better QoL, lower number of constipation days
Elmér et al. [19]	Total: 20 Grade 2: 3 Grade 3: 17	MMH	Postop peak pain lower in DGHL during first week ($p < 0.05$), but no difference in overall pain. More patients with normal well-being in DGHL ($p = 0.05$). Pain, bleeding, and manual reduction in prolapse improved in all DGHL pts. At 1-year follow-up, grade of hemorrhoids reduced for both methods (more patients with remaining grade II for DGHL ($p = 0.06$)
Denoya et al. [17]	Total: 20 Grade 3: 16 Grade 4: 4	Ferguson hemorrhoidectomy	In DGHL group, lower postop narcotics use (25 vs. 100%, $p < 0.001$), shorter postop analgesics use (0 vs. 7 days, $p = 0.001$), earlier first bowel movement (1.3 ± 0.9 vs. 4.6 ± 3.1 days, $p = 0.001$), lower pain intensity rate (2.9 ± 3.5 vs. 7.6 ± 2.9, $p = 0.001$), less frequent urinary retention (0 vs. 23.5%, $p = 0.012$), less laxative use (8.3 vs. 23.5%, $p = 175$), less anal pain (8.3 vs. 64.7%, $p = 0.001$)
Denoya et al. [18]	Total: 12	Ferguson hemorrhoidectomy	In DGHL group, similar recurrence rate (16.7 vs. 6.7%, $p = 0.411$), reintervention rate (8.3 vs. 6,7%, $p = 809$), no chronic complications (0 vs. 13.3%, $p = 0.189$), similar rate of recurrent symptoms (50 vs. 26.7%, $p = 0.212$), similar pain severity, similar QoL, similar incontinence-related QoL
De Nardi et al. [20]	Total: 25 (grade 3)	MMH	Similar pain level by 30th postop day. In DGH, shorter work resumption and higher patient satisfaction, but not significantly. Similar recurrence rates needing additional surgery (4.2 vs. 4.2%, $p = 0.55$) at 1-year follow-up
Béliard et al. [23]	Total: 54 (grade 2)	PPH	In DGHL group, shorter disability for work (4.4 ± 6.6 vs. 18.6 ± 13.7, $p < 0.001$), significantly more improved prolapse, similar improvement of bleeding, significant improvement of tenesmus at 3 months, similar incontinence score, lower pain level at 1 month, significantly higher patient satisfaction, higher recurrence rate, similar reoperation rate

PPH procedure for prolapse and hemorrhoids (stapled hemorrhoidopexy); *HL* hemorrhoidal artery ligation (without Doppler guidance); *DGHL* Doppler-guided hemorrhoidal artery ligation; *MMH* Milligan–Morgan hemorrhoidectomy; *QoL* quality of life

are not used as a first-line approach, so it is possible that in a practice that includes these ambulatory treatments the results of THD may be different because of patient selection.

Conclusions

Data from this 10-year retrospective study support the safety and the clinical efficacy of the THD procedure in patients with hemorrhoidal disease. The procedure is associated with a high level of treatment success, significant QoL benefits, a low recurrence rate, and good long-term outcome; THD Doppler therefore seems a valid

therapeutic option for primary hemorrhoidal disease and selected recurrences.

Authors contribution CR contributed to study conception and design; analysis and interpretation of data; drafting the article and revising it critically for important intellectual content; and final approval of the version to be published. PC contributed to study conception and design; acquisition and interpretation of data; drafting the article; and final approval of the version to be published. FP helped in study conception and design; acquisition, analysis, and interpretation of data; drafting the article; and final approval of the version to be published. LD contributed to acquisition of data; drafting the article; and final approval of the version to be published. FL helped in study conception, acquisition, analysis, and interpretation of data; drafting the article; and final approval of the version to be published. AP helped in study conception, acquisition, and interpretation of data; revision of the article critically for important intellectual content; and final approval of the version to be published.

Compliance with ethical standards

Conflict of interest Carlo Ratto was, for 1 year, a member of the THD Advisory Board; no personal salary was received. The other authors declare that they have no conflict of interest.

Ethical approval All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. Ganz RA (2013) The evaluation and treatment of hemorrhoids: a guide for the gastroenterologist. Clin Gastroenterol Hepatol 11:593–603. https://doi.org/10.1016/j.cgh.2012.12.020
2. Morinaga K, Hasuda K, Ikeda T (1995) A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. Am J Gastroenterol 90:610–613
3. Ratto C, Donisi L, Parello A, Litta F, Zaccone G, De Simone V (2012) 'Distal doppler-guided dearterialization' is highly effective in treating by transanal haemorrhoidal dearterialization. Colorectal Dis 14:e786–e789. https://doi.org/10.1111/j.1463-1318.2012.03146.x
4. Ratto C (2014) THD Doppler procedure for hemorrhoids: the surgical technique. Tech Coloproctol 18:291–298. https://doi.org/10.1007/s10151-013-1062-3
5. Goligher JC, Leacock AG, Brossy JJ (1955) The surgical anatomy of the anal canal. Br J Surg 43:51–61
6. Ratto C, Giordano P, Donisi L, Parello A, Litta F, Doglietto GB (2011) Transanal haemorrhoidal dearterialization (THD) for selected fourth-degree haemorrhoids. Tech Coloproctol 15:191–197. https://doi.org/10.1007/s10151-011-0689-1
7. Ratto C, de Parades V (2015) Doppler-guided ligation of hemorrhoidal arteries with mucopexy: a technique for the future. J Visc Surg 152(2 Suppl):S15–S21. https://doi.org/10.1016/j.jviscsurg.2014.08.003
8. Ratto C, Donisi L, Parello A, Litta F, Doglietto GB (2010) Evaluation of transanal hemorrhoidal dearterialization as a minimally invasive therapeutic approach to hemorrhoids. Dis Colon Rectum 53:803–811. https://doi.org/10.1007/DCR.0b013e3181cdafa7
9. Ratto C, Parello A, Donisi L, Litta F, Zaccone G, Doglietto GB (2012) Assessment of haemorrhoidal artery network using colour duplex imaging and clinical implications. Br J Surg 99:112–118. https://doi.org/10.1002/bjs.7700
10. Dal Monte PP, Tagariello C, Sarago M et al (2007) Transanal haemorrhoidal dearterialisation: nonexcisional surgery for the treatment of haemorrhoidal disease. Tech Coloproctol 11:333–338. https://doi.org/10.1007/s10151-007-0376-4
11. Festen S, Van Hoogstraten MJ, Van Geloven AA, Gerhards MF (2009) Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results. Int J Colorectal Dis 24:1401–1405. https://doi.org/10.1007/s00384-009-0803-2
12. Infantino A, Bellomo R, Dal Monte PP et al (2010) Transanal haemorrhoidal artery echodoppler ligation and anopexy (THD) is effective for II and III degree haemorrhoids: a prospective multicentric study. Colorectal Dis 12:804–809. https://doi.org/10.1111/j.1463-1318.2009.01915.x
13. Giordano P, Nastro P, Davies A, Gravante G (2011) Prospective evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: three-year outcomes. Tech Coloproctol 15:67–73. https://doi.org/10.1007/s10151-010-0667-z
14. Schuurman JP, Rinkes I, Go P (2012) Hemorrhoidal artery ligation procedure with or without doppler transducer in grade II and III hemorrhoidal disease. Ann Surg 255:840–845. https://doi.org/10.1097/SLA.0b013e31824e2bb5
15. Infantino A, Altomare DF, Bottini C et al (2012) Prospective randomized multicentre study comparing stapler haemorrhoidopexy with Doppler-guided transanal haemorrhoid dearterialization for third-degree haemorrhoids. Colorectal Dis 14:205–211. https://doi.org/10.1111/j.1463-1318.2011.02628.x
16. Zampieri N, Castellani R, Andreoli R, Geccherle A (2012) Long-term results and quality of life in patients treated with hemorrhoidectomy using two different techniques: ligasure versus transanal hemorrhoidal dearterialization. Am J Surg 204:684–688. https://doi.org/10.1016/j.amjsurg.2012.01.014
17. Denoya PI, Fakhoury M, Chang K, Fakhoury J, Bergamaschi R (2013) Dearterialization with mucopexy versus haemorrhoidectomy for grade III or IV haemorrhoids: short-term results of a double-blind randomized controlled trial. Colorectal Dis 15:1281–1288. https://doi.org/10.1111/codi.12303
18. Denoya P, Tam J, Bergamaschi R (2014) Hemorrhoidal dearterialization with mucopexy versus hemorrhoidectomy: 3-year follow-up assessment of a randomized controlled trial. Tech Coloproctol 18:1081–1085. https://doi.org/10.1007/s10151-014-1219-8
19. Elmér SE, Nygren JO, Lenander CE (2013) A randomized trial of transanal hemorrhoidal dearterialization with anopexy compared with open hemorrhoidectomy in the treatment of hemorrhoids. Dis Colon Rectum 56:484–490. https://doi.org/10.1097/DCR.0b013e31827a8567
20. De Nardi P, Capretti G, Corsaro A, Staudacher C (2014) A prospective, randomized trial comparing the short- and long-term results of doppler-guided transanal hemorrhoid dearterialization with mucopexy versus excision hemorrhoidectomy for grade III hemorrhoids. Dis Colon Rectum 57:348–353. https://doi.org/10.1097/DCR.0000000000000085
21. Giordano P, Tomasi I, Pascariello A, Mills E, Elahi S (2014) Transanal dearterialization with targeted mucopexy is effective for advanced haemorrhoids. Colorectal Dis 16:373–376. https://doi.org/10.1111/codi.12574

22. Tempel MB, Pearson EG, Page M et al (2014) Survey of patient satisfaction after Doppler-guided transanal hemorrhoidal dearterialization performed in ambulatory settings. Tech Coloproctol 18:607–610. https://doi.org/10.1007/s10151-013-1104-x
23. Béliard A, Labbé F, de Faucal D, Fabreguette JM, Pouderoux P, Borie F (2014) A prospective and comparative study between stapled hemorrhoidopexy and hemorrhoidal artery ligation with mucopexy. J Visc Surg 151:257–262. https://doi.org/10.1016/j.jviscsurg.2014.03.009
24. Ratto C, Parello A, Veronese E et al (2015) Doppler-guided transanal haemorrhoidal dearterialization for haemorrhoids: results from a multicentre trial. Colorectal Dis 17:10–19. https://doi.org/10.1111/codi.12779
25. LaBella GD, Main WPL, Hussain LR (2015) Evaluation of transanal hemorrhoidal dearterialization: a single surgeon experience. Tech Coloproctol 19:153–157. https://doi.org/10.1007/s10151-015-1269-6
26. Rubbini M, Tartari V (2015) Doppler-guided hemorrhoidal artery ligation with hemorrhoidopexy: source and prevention of postoperative pain. Int J Colorect Dis 30:625–630. https://doi.org/10.1007/s00384-015-2148-3

2017

Authors: **Trenti** L., **Biondo** S., **Galvez** A. et al

Source: Tech Coloproctol. 2017 May;21(5):337-344.

Available for Full Open Online Access

Title: Distal Doppler-guided transanal hemorrhoidal dearterialization with mucopexy versus conventional hemorrhoidectomy for grade III and IV hemorrhoids: postoperative morbidity and long-term outcomes

BACKGROUND:

Distal Doppler-guided transanal hemorrhoidal dearterialization with mucopexy (Doppler-guided THD) seems to be associated with better short-term outcomes than conventional hemorrhoidectomy, but there are little data about long-term recurrence. The aim of this study was to compare Doppler-guided THD for grade III-IV hemorrhoids with conventional hemorrhoidectomy with regard to long-term postoperative morbidity and recurrence.

METHODS:

This was a single-center longitudinal and comparative study of a cohort of patients who underwent either distal Doppler-guided THD with low ligation of the hemorrhoidal artery and mucopexy or conventional excisional hemorrhoidectomy (Milligan and Morgan or Ferguson) for grade III and IV hemorrhoids. Short- and long-term postoperative morbidity was recorded. Severity of hemorrhoid symptoms (bleeding, prolapse, manual reduction, discomfort or pain and impact on quality of life) and fecal continence status (Vaizey score) were evaluated before surgery and at minimum of 1 year after surgery.

RESULTS:

Eighty-three patients were included in the study. Forty-nine patients (59%) underwent Doppler-guided THD, and 34 (41%) patients underwent conventional hemorrhoidectomy. The 30-day postoperative surgical morbidity was 26.5% in the Doppler-guided THD group and 8.82% in the conventional hemorrhoidectomy group ($p = 0.085$). No significant differences between the groups were observed in terms of persistence of bleeding, prolapse, need for manual reduction in prolapse and pain. One (2%) patient in the THD group and 2 (5.4%) patients in the conventional hemorrhoidectomy group needed further surgical procedures. Minor fecal incontinence occurred only after conventional hemorrhoidectomy in 2 (5.4%) patients.

CONCLUSIONS:

Our results showed that Doppler-guided THD is not inferior to conventional excisional hemorrhoidectomy for advanced hemorrhoidal disease in terms of postoperative complications and long-term recurrence of symptoms.

Tech Coloproctol
DOI 10.1007/s10151-017-1620-1

ORIGINAL ARTICLE

Distal Doppler-guided transanal hemorrhoidal dearterialization with mucopexy versus conventional hemorrhoidectomy for grade III and IV hemorrhoids: postoperative morbidity and long-term outcomes

L. Trenti[1,2] · S. Biondo[1,2] · A. Galvez[1,2] · A. Bravo[1,2] · J. Cabrera[3] · E. Kreisler[1,2]

Received: 2 February 2017 / Accepted: 29 March 2017

Abstract
Background Distal Doppler-guided transanal hemorrhoidal dearterialization with mucopexy (Doppler-guided THD) seems to be associated with better short-term outcomes than conventional hemorrhoidectomy, but there are little data about long-term recurrence. The aim of this study was to compare Doppler-guided THD for grade III–IV hemorrhoids with conventional hemorrhoidectomy with regard to long-term postoperative morbidity and recurrence.
Methods This was a single-center longitudinal and comparative study of a cohort of patients who underwent either distal Doppler-guided THD with low ligation of the hemorrhoidal artery and mucopexy or conventional excisional hemorrhoidectomy (Milligan and Morgan or Ferguson) for grade III and IV hemorrhoids. Short- and long-term postoperative morbidity was recorded. Severity of hemorrhoid symptoms (bleeding, prolapse, manual reduction, discomfort or pain and impact on quality of life) and fecal continence status (Vaizey score) were evaluated before surgery and at minimum of 1 year after surgery.
Results Eighty-three patients were included in the study. Forty-nine patients (59%) underwent Doppler-guided THD, and 34 (41%) patients underwent conventional hemorrhoidectomy. The 30-day postoperative surgical morbidity was 26.5% in the Doppler-guided THD group and 8.82% in the conventional hemorrhoidectomy group ($p = 0.085$). No significant differences between the groups were observed in terms of persistence of bleeding, prolapse, need for manual reduction in prolapse and pain. One (2%) patient in the THD group and 2 (5.4%) patients in the conventional hemorrhoidectomy group needed further surgical procedures. Minor fecal incontinence occurred only after conventional hemorrhoidectomy in 2 (5.4%) patients.
Conclusions Our results showed that Doppler-guided THD is not inferior to conventional excisional hemorrhoidectomy for advanced hemorrhoidal disease in terms of postoperative complications and long-term recurrence of symptoms.

Keywords Doppler-guided THD · Hemorrhoidectomy · Dearterialization · Mucopexy · Long-term results

Introduction

Hemorrhoids are the most common anal pathology and constitute a major socioeconomic and medical problem. It is estimated that 90% of the general population suffers from hemorrhoidal symptoms at least once in their life [1–3]. Therapeutical options for symptomatic hemorrhoids vary from medical treatment for mild cases to surgical procedures for severe cases or those which fail nonoperative treatment [3]. Although conventional excisional hemorrhoidectomy techniques [4, 5] are considered the gold standard for the treatment of grade III and IV hemorrhoids, minimally invasive procedures have been introduced into

✉ S. Biondo
sbn.biondo@gmail.com

[1] Colorectal Unit, Department of General and Digestive Surgery, Bellvitge University Hospital, University of Barcelona, C/Feixa Llarga s/n, L'Hospitalet de Llobregat, 08907 Barcelona, Spain

[2] IDIBELL (Bellvitge Biomedical Investigation Institute), Barcelona, Spain

[3] Department of General and Digestive Surgery, Reina Sofia de Cordoba University Hospital, Córdoba, Spain

Published online: 27 April 2017

clinical practice in order to reduce postsurgical pain and postsurgical functional limitations [6].

Distal Doppler-guided transanal hemorrhoidal dearterialization associated with mucopexy (Doppler-guided THD) is a recently introduced nonexcisional surgical technique for treating hemorrhoids [7, 8].

Doppler-guided THD seems to be associated with less postsurgical pain, a shorter hospital stay and an earlier return to normal life than conventional hemorrhoidectomy procedures such as Milligan–Morgan or Ferguson hemorrhoidectomy [9–14].

Evidence about long-term outcomes in terms of recurrence and chronic complications after surgery for grade III and IV hemorrhoids is scarce due to the heterogeneity of the studies available. A high long-term symptomatic recurrence rate has been described after conventional hemorrhoidectomy (20–40%) [15, 16]. Some studies report noninferior or better results for Doppler-guided THD in terms of long-term recurrence compared to conventional hemorrhoidectomy techniques, but results are difficult to compare due to their different inclusion criteria and methods for assessing recurrence [1, 11, 13, 17, 18].

The aim of this study was to compare the long-term results of Doppler-guided THD for grade III–IV hemorrhoids and conventional hemorrhoidectomy (Milligan and Morgan or Ferguson techniques).

Materials and methods

This was a single-center, longitudinal and comparative study of a cohort of patients treated for grade III–IV hemorrhoids at the Colorectal Unit of the Bellvitge University Hospital (Barcelona, Spain) between January 2010 and December 2015. Approval for the study was obtained from the hospital ethics committee (PR030/16), and written and verbal informed consent was obtained from all patients. All data were collected and registered prospectively as consecutive cases in an electronic database. Preoperative assessment, diagnosis and classification of hemorrhoids were made by a colorectal surgeon from our center on the basis of physical examination, and anoscopy or proctoscopy in the outpatients' clinic. The Goligher classification was used to establish the grade of hemorrhoids [8]. Colonoscopy was recommended before surgery to rule out colorectal polyps or cancer depending on the patient's age, family history and symptoms.

All patients with grade III and IV hemorrhoids in a minimum of 2 anal quadrants who underwent Doppler-guided THD with mucopexy (*Group I*) or conventional excisional hemorrhoidectomy (Milligan and Morgan or Ferguson) (*Group II*) in the study period were included in the analysis. The exclusion criteria were: age younger than 18 years, hemorrhoids treated using other procedures (rubber band ligation, sclerotherapy, stapled hemorrhoidectomy), those with altered cognitive status, inflammatory bowel disease, previous fecal incontinence (Vaizey score $\geq$5) and/or other associated anorectal pathology that could alter the evaluation of the outcomes. The first 15 patients operated on with Doppler-guided THD were also excluded.

All patients were prepared preoperatively with two enemas. Both procedures were performed under general or spinal anesthesia according to anesthesiologist and/or patient preference, with the patient in the lithotomy position. The doppler-guided THD procedure was performed using the THD kit (THD Italy, Corregio, Italy) as described by Ratto et al. [8, 19]. Using the Doppler device of the THD Slide proctoscope, the 6 hemorrhoidal arteries were identified, the proctoscope was moved distally, and when the best Doppler signal was obtained (usually within the most distal 2 cm of the rectum), a small 'marker point' was placed on the mucosa using electrocautery. Arteries were ligated separately at 1, 3, 5, 7, 9, 11 o'clock of the rectal circumference marking the arterial pulse and including it in a pexy starting all the way inside the rectum about 2 cm above the anorectal junction with a transfixing mucosal and submucosal stitch. The mucopexy was performed under direct vision with a continuous suture including prolapsing mucosa and submucosa in a proximal-to-distal direction up to 1 cm from the dentate line. Conventional hemorrhoidectomy was performed as described by Milligan and Morgan [5] or Ferguson [20].

All surgical procedures were performed by experienced surgeons specialized in coloproctology. Patients that underwent Doppler-guided THD were operated on by the same surgeon (SB). In the absence of postoperative complications or difficult pain control, the patients were discharged home the same day of the surgery or after 24 h depending on associated comorbidities and/or social problems. Patients were recommended to adopt a fiber-rich diet in order to avoid fecal impaction. A standardized analgesic protocol with nonsteroidal anti-inflammatory drugs and acetaminophen was recommended for the first 3 days after surgery. After postoperative day 3, patients were advised to reduce the analgesic doses depending on the severity of the pain. Patients were followed up in the outpatient clinic 30 days after surgery and at 1 year.

Short- and long-term postoperative morbidity was reviewed by medical report and by the prospective database of the colorectal unit. The Clavien–Dindo system was used to classify surgical complications [21].

Baseline and recurrent hemorrhoid symptoms were evaluated prospectively before surgery and at 1 year after surgery by a specific questionnaire designed by Giordano et al. [22]. The questionnaire assesses 5 different

parameters (bleeding, prolapse, manual reduction, discomfort or pain and impact on quality of life), each scoring from 0 to 4 with 0 corresponding to no symptoms at all and 4 to the presence of the symptoms on a daily basis or with every bowel movement. A total score of 0 corresponded to the complete absence of hemorrhoid symptoms, while a total score of 20 corresponded to the greatest possible intensity of symptoms (Table 1).

The fecal continence status before surgery and at minimum of 1 year after surgery was measured by the Vaizey score [23]. Need for further surgery for persisting or recurring hemorrhoid symptoms and surgery-related complications during follow-up were recorded.

Statistical analysis

Quantitative data are presented as mean and standard deviation or median and interquartile range. Qualitative data are presented as absolute numbers and percentages. Differences between groups were evaluated using a parametric or nonparametric test as appropriate. Qualitative variables were analyzed using the Chi-square test. Quantitative variables were analyzed using Student's *t* test or the Mann–Whitney *U* test. The statistical analysis was performed using Software R 3.3.2 (R Foundation for Statistical Computing, Vienna, Austria), and significance was set at a p value of <0.05.

Results

Between 2010 and 2015, 230 patients were treated for hemorrhoidal disease at Bellvitge University Hospital. Eighty-three patients met the inclusion SEE P.4 criteria and were included in the study analysis (Fig. 1). Baseline characteristics of the patients are shown in Table 2.

Forty-nine patients (59%) underwent the Doppler-guided THD procedure (Group I), and 34 (41%) patients underwent conventional excisional hemorrhoidectomy (Group II). In Group I, all patients underwent complete circumferential mucopexy. In Group II, 21 patients (61.8%) underwent Ferguson hemorrhoidectomy and 13 patients (38.2%) underwent Milligan and Morgan hemorrhoidectomy. All excisional hemorrhoidectomy was performed using electrocautery. Nineteen patients (23.8%) underwent an additional procedure during the same surgery: in Group I, 13 patients underwent skin tag excision and 4 underwent anal polyp excision, while in Group II, 3 patients underwent an additional rubber banding procedure.

Postoperative morbidity

No intraoperative complications were observed in either group. The 30-day postoperative surgical morbidity was 26.5% in Group I and 8.82% in Group II ($p = 0.085$). Postoperative complications are listed in Table 3.

Long-term outcomes

Five patients were lost to follow-up and not available for long- term evaluation (4 in Group I and 1 in Group II). The mean follow-up period was 1.9 years (SD $\pm$ 1.4): 1.13 years (SD $\pm$ 0.40) for Group I and 2.89 years (SD $\pm$ 1.63) for Group II.

During follow-up, in Group I, 1 patient underwent excision for single pile prolapse and 2 patients are on the waiting list for excision of symptomatic persistent external hemorrhoids.

Long-term symptom recurrence was evaluated using the questionnaire shown in Table 1. No significant differences were observed between the mean baseline and last total score between the 2 groups (Table 4; Fig. 2).

Table 1 Hemorrhoid symptom questionnaire score [22]

	Never	At least once per year	At least once per month	At least once per week	With every bowel movement
Bleeding	0	1	2	3	4
Prolapse	0	1	2	3	4
Manual reduction	0	1	2	3	4
Discomfort/pain	0	1	2	3	4
	Not at all	Minimal	Moderate	Severe	Very severe
Impact on quality of life	0	1	2	3	4

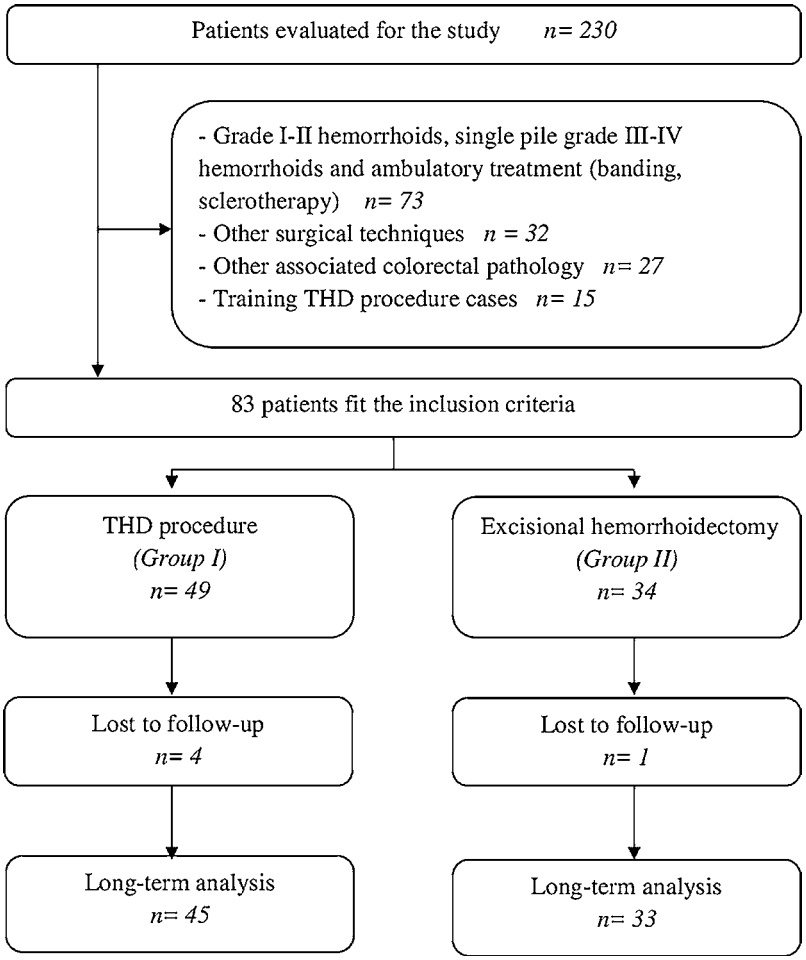


Fig. 1 Flowchart of the study cohort

Table 2 Baseline characteristics of patients

	All patients $n = 83$	THD procedure (Group I) $n = 49$	Excisional hemorrhoidectomy (Group II) $n = 34$	p
Age, years (mean, SD)	55.4 (11.4)	53.8 (11.6)	57.7 (10.9)	0.121
Gender				0.310
Male	52 (62.7%)	28 (57.1%)	24 (70.6%)	
Female	31 (37.3%)	21 (42.9%)	10 (29.4%)	
Goligher classification				0.823
III	47 (56.6%)	27 (55.1%)	20 (58.8%)	
IV	36 (43.4%)	22 (44.9%)	14 (41.2%)	
Recurrent hemorrhoids	4 (4.8%)	1 (3.12%)	3 (6.12%)	1.000
Hemorrhoid symptomatology score (mean, SD)	11.8 (3.26)	11.7 (2.93)	11.9 (3.73)	0.797

Analyzing separately grade III and IV hemorrhoids, there was no difference in the results for patients with grade IV hemorrhoids, while for patients with grade III hemorrhoids, the THD procedure appears to better reduce the total symptoms score than excisional hemorrhoidectomy (Table 4; Fig. 2).

No statistical differences between the groups were observed in terms of persistence of some degree of

Table 3 Postoperative morbidity

Type of complication (related treatment)	Group I (*n*)	Group II (*n*)
Acute urinary retention (bladder catheterization)	7	1
Hemorrhoid thrombosis (thrombectomy under local anesthesia)	4	–
Acute bleeding (hemostasis UA)	–	1
Perianal/anal infection (debridement UA plus antibiotic)	1	–
Perianal/anal infection (antibiotics)	1	1

n number of complications

Group I THD procedure; Group II conventional excisional hemorrhoidectomy; *UA* under anesthesia

Table 4 Long-term follow-up of the hemorrhoid symptoms

Hemorrhoid symptoms score	Grade III–IV hemorrhoids			Grade III hemorrhoids			Grade IV hemorrhoids		
	Group I $n = 45$	Group II $n = 33$	*p*	Group I $n = 24$	Group II $n = 19$	*p*	Group I $n = 21$	Group II $n = 14$	*p*
Total score mean (SD)									
Basal	11.6 (2.93)	12.0 (3.75)	0.574	11.6 (2.92)	12.1 (4.14)	0.679	11.5 (3.01)	11.9 (3.29)	0.715
Last follow-up	1.24 (2.39)	1.52 (2.28)	0.613	0.79 (1.59)	1.74 (2.77)	0.196	1.76 (3.02)	1.21 (1.42)	0.477
Differential[a] *mean* (SD)									
Value	−10.31 (3.29)	−10.48 (4.70)	0.856	−10.79 (3.19)	−10.32 (5.41)	0.737	−9.76 (3.40)	−10.71 (3.71)	0.449
Percentage	−90.01 (18.2)	−84.52 (25.2)	0.292	−93.23 (12.9)	−81.42 (31.19	0.135	−86.32 (22.6)	−88.71 (13.8)	0.700

Group I THD procedure; Group II conventional excisional hemorrhoidectomy

[a] Differential has been calculated subtracting the value of the total last follow-up score from the total baseline score; only patients with completed follow-up data are considered for the analysis

bleeding, prolapse, need for manual reduction in prolapse, pain and quality of life impairment (Table 5).

No patients in Group I reported fecal incontinence, though 2 women, 58 and 47 years old, reported persistent postsurgical urgency of defecation at the last follow-up. In Group II, 2 patients reported fecal incontinence as a consequence of surgery. The first one was a 62-year-old male with a preoperative Vaizey score of 4, due to occasional incontinence to liquid stool, but 3 years after surgery a Vaizey score of 14, with monthly episodes of incontinence for solid and liquid stool, difficulty in flatus control and the need to wear pads. No other events happened which could justify this deterioration in his fecal continence. This patient refused any other treatment because the impact of the symptoms on his quality of life was low. The second patient was a 43-year-old woman without a history of previous fecal incontinence, but 1 year after surgery persistent occasional incontinence to liquid and solid stool with a Vaizey score of 6. Biofeedback therapy was indicated.

In Group I, 1 patient was diagnosed after two months with a submucosal anal fistula that was laid open and another patient was diagnosed with a postoperative anal fissure which responded to topical treatment.

Discussion

The most important finding of this study is that the Doppler-guided THD procedure is not inferior to conventional excisional hemorrhoidectomy for advanced hemorrhoidal disease in terms of postoperative complications and long-term symptom recurrence.

The major strength of this study is that only patients with grade III and IV hemorrhoids were included. Short- and long-term follow-up was performed by the same surgical team during the study period, and recurrence or persistence of hemorrhoid symptoms was evaluated using a symptomatic score that takes into account bleeding, prolapse, pain and impact of hemorrhoidal disease on quality of life. Clinical evaluation using only the Goligher grade could cause confusion regarding true symptomatic recurrence or symptom persistence, the elimination of which must be considered the real goal of surgery for hemorrhoids.

The study has some limitations. First, the number of patients included was relatively small due to the restricted inclusion criteria, which may be responsible for a power error. Nevertheless, these were consecutively enrolled patients, and there were no differences in demographics

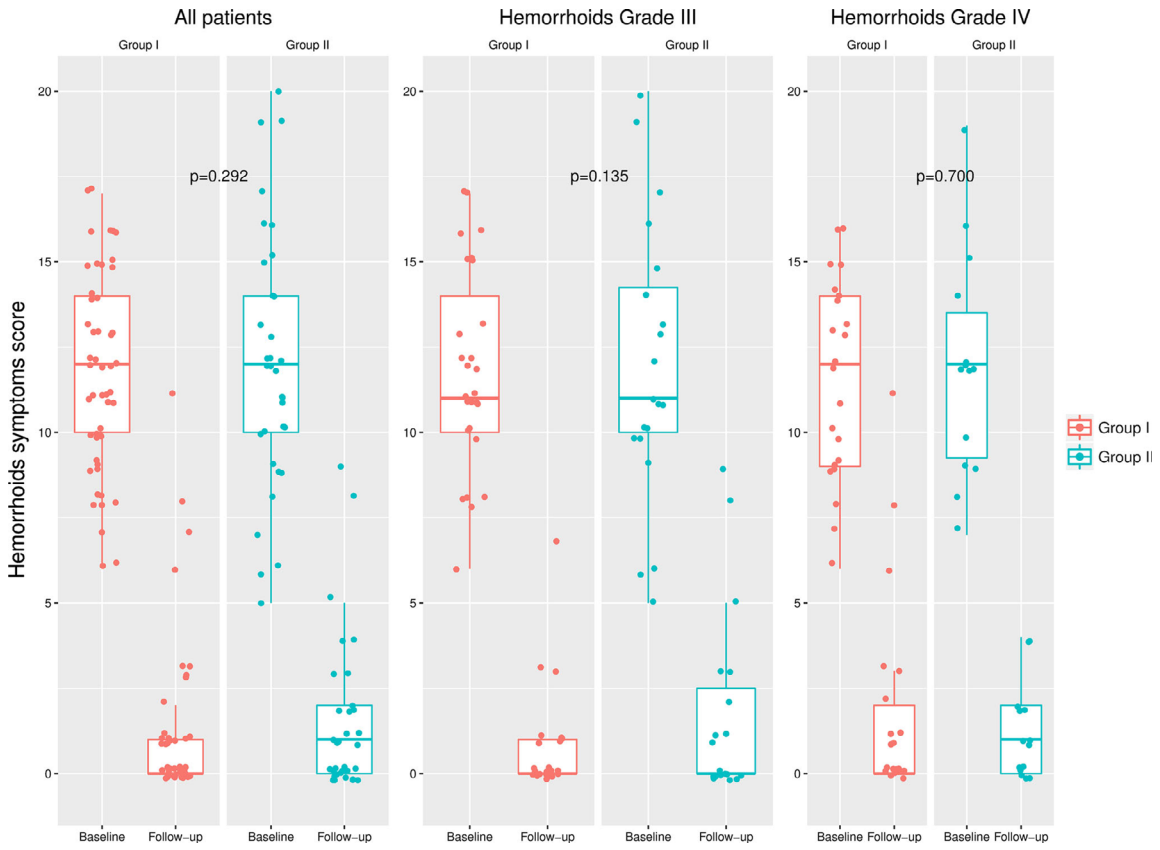


Fig. 2 Boxplot of basal and long-term symptoms score according to the surgical techniques and hemorrhoids grade. Group I Doppler-guided THD procedure; Group II conventional excisional hemorrhoidectomy

Table 5 Long-term symptom persistence

Patients with persistent symptoms at last follow-up/patients with symptoms at baseline (%)			
	THD procedure (Group I)	Excisional hemorrhoidectomy (Group II)	*p*
Bleeding	9/42 (21.4)	9/28 (32.1)	0.468
Prolapse	7/44 (15.9)	3/32 (9.4)	0.505
Manual reduction	1/25 (4)	1/19 (5.3)	1.000
Discomfort/pain	6/35 (17.1)	7/31 (22.6)	0.807
Impairment of quality of life	3/39 (7.7)	6/31 (19.4)	0.171

Percentages are calculated considering patients that presented symptoms of any degree or frequency at the baseline and at the last follow-up

and disease grade between the 2 groups. Second, a classic well-known surgical technique (hemorrhoid excision) was compared with Doppler-guided THD which is a relatively new procedure. This could introduce a bias in the analysis of the results. Actually, as recently observed [24], the number of complications can decrease with increasing surgeon experience. To reduce this error, before starting the inclusion of patients for the study, the Doppler-guided THD procedure was performed on 15 patients. Moreover, it was performed only by 1 surgeon. Another weakness of the present study is that postoperative pain has not been studied. Considering that most of the published studies aim to analyze the relationship between type of procedure and postoperative pain, we focussed our analysis on early

complications and long-term results. In addition, postoperative pain is a difficult point to study outside of a targeted randomized trial, because it depends on many variables which are not directly related to the surgical technique such as pain medication protocol, anesthesia and scales used to record the pain. In a recent double-blind randomized controlled trial comparing 20 patients who underwent Doppler-guided THD with mucopexy with 20 patients who underwent conventional hemorrhoidectomy, the authors found that the dearterialization led to less postoperative pain [12]. Other authors found that pain was similar after both surgical techniques [11, 13].

As reported in others studies [11–13, 25], we did not find statistical differences in overall postoperative morbidity between the two techniques. Nevertheless, a higher number of acute urinary retention occurred after Doppler-guided THD. This is not a major complication and all the cases were effectively treated by a temporary bladder catheterization removed the same day or the day after surgery. However, frequently this mild complication implied a delay in hospital discharge. Four patients experienced acute internal hemorrhoid thrombosis during the first 30 days after Doppler-guided THD. All cases were treated successfully by thrombectomy under local anesthesia with immediate relief of pain. While uncommon after excisional hemorrhoidectomy, thrombosis needs to be suspected when a patient presents acute anal pain in the first weeks after a THD procedure.

A recent meta-analysis including 316 patients from 4 randomized controlled trials, which evaluate the surgical and postoperative outcomes of Doppler-guided THD procedure versus open conventional hemorrhoidectomy, finds no differences in terms of recurring disease between the surgical procedures [25]. These results are in line with our findings in which long-term symptom recurrence or persistence was similar in the 2 groups. However, when a separate analysis was performed for different grades of hemorrhoids, for grade III the Doppler-guided THD procedure appears to be more effective in long-term symptom control compared to excisional hemorrhoidectomy, although this result did not reach statistical significance. This could be explained by a minor effect of the mucopexy on grade IV hemorrhoids in which the chronic prolapsed piles are often epithelialized making fibrosis less effective in maintaining the piles in the anal canal. The same trend was observed by Denoya et al. in a recent randomized double-blinded trial comparing Doppler-guided THD with excisional hemorrhoidectomy, in which all patients who experienced recurrence in either arms had grade IV hemorrhoids [17].

Analyzing separately the symptoms included in the Giordano score, no differences between the 2 groups were observed in terms of persistence of symptoms. Although the rate of persistence of symptoms is apparently high, in most patients, symptoms were occasional and therefore had a low clinical impact. Actually, only 3 patients included in the study have been considered for further surgical treatment.

Long-term chronic complications such as anal stricture, nonhealing wounds and fecal incontinence as consequence of sphincter lesions have been reported after conventional excisional hemorrhoidectomy but not after Doppler-guided THD [16, 17]. In the present study, we did not observe any anal stricture or chronic nonhealing wounds, but 2 patients reported fecal incontinence after excisional hemorrhoidectomy. One of these patients had previous mild continence impairment that worsened after surgery. Due to the fact that sphincter lesions are only anecdotal after Doppler-guided THD, this surgical technique should be preferred for patients at high risk of fecal incontinence.

Operation time was not analyzed in the present study. As reported in several publications, the operation time for the Doppler-guided THD procedure is longer than for excisional hemorrhoidectomy [13, 25]. This disadvantage must be balanced with the fact that Doppler-guided THD is less invasive than conventional hemorrhoidectomy because no wounds are created and there is no risk of sphincter damage. Another potential advantage of Doppler-guided THD, though time-demanding, is that it can correct the physiology of the hemorrhoidal plexus by of the arterial blood flow to the hemorrhoidal cushions through dearterialization and eliminate the mucosal prolapse by mucopexy in 6 different points of the anal canal [22, 26, 27].

Conclusions

Our results showed that Doppler-guided THD is a safe and effective technique for treating grade III–IV symptomatic hemorrhoids. When compared to conventional excisional hemorrhoidectomy, results in terms of symptom recurrence or persistence at long-term follow-up are similar. These results need to be validated in large and multicenter randomized trials to elucidate whether Doppler-guided THD procedure is truly better than conventional hemorrhoidectomy.

Acknowledgements The authors thank Mr Bernat Miguel, Data Manager of the Colorectal Unit, University Hospital of Bellvitge and IDIBELL, for the statistical analysis.

Compliance with ethical standards

Conflict of interest Sebastiano Biondo is a trainer for the Doppler-guided THD procedure. The other authors have no conflicts of interest.

Ethical approval Approval for the study was obtained from the hospital ethics committee (PR030/16).

Informed consent Written and verbal informed consent was obtained from all patients.

References

1. Zampieri N, Castellani R, Andreoli R, Geccherle A (2012) Long-term results and quality of life in patients treated with hemorrhoidectomy using two different techniques: ligasure versus transanal hemorrhoidal dearterialization. Am J Surg 204:684–688
2. Johanson JF, Sonnenberg A (1990) The prevalence of hemorrhoids and chronic constipation. an epidemiologic study. Gastroenterology 98:380–386
3. Madoff RD, Fleshman JW, Clinical Practice Committee, American Gastroenterological Association (2004) American Gastroenterological Association technical review on the diagnosis and treatment of hemorrhoids. Gastroenterology 126:1463–1473
4. Ferguson JA, Mazier WP, Ganchrow MI, Friend WG (1971) The closed technique of hemorrhoidectomy. Surgery 70:480–484
5. Milligan E, Morgan C, Jones L, Officer R (1937) Surgical anatomy of the anal canal and the operative treatment of hemorrhoids. Lancet 2:1119–1124
6. Joshi GP, Neugebauer EAM, PROSPECT Collaboration (2010) Evidence-based management of pain after haemorrhoidectomy surgery. Br J Surg 97:1155–1168
7. Dal Monte PP, Tagariello C, Sarago M et al (2007) Transanal haemorrhoidal dearterialisation: nonexcisional surgery for the treatment of haemorrhoidal disease. Tech Coloproctol 11:333–338 **(discussion 338–9)**
8. Ratto C (2014) THD Doppler procedure for hemorrhoids: the surgical technique. Tech Coloproctol 18:291–298
9. Infantino A, Bellomo R, Dal Monte PP et al (2010) Transanal haemorrhoidal artery echodoppler ligation and anopexy (THD) is effective for II and III degree haemorrhoids: a prospective multicentric study. Colorectal Dis 12:804–809
10. Giordano P, Tomasi I, Pascariello A, Mills E, Elahi S (2014) Transanal dearterialization with targeted mucopexy is effective for advanced haemorrhoids. Colorectal Dis 16:373–376
11. De Nardi P, Capretti G, Corsaro A, Staudacher C (2014) A prospective, randomized trial comparing the short- and long-term results of doppler-guided transanal hemorrhoid dearterialization with mucopexy versus excision hemorrhoidectomy for grade III hemorrhoids. Dis Colon Rectum 57:348–353
12. Denoya PI, Fakhoury M, Chang K, Fakhoury J, Bergamaschi R (2013) Dearterialization with mucopexy versus haemorrhoidectomy for grade III or IV haemorrhoids: short-term results of a double-blind randomized controlled trial. Colorectal Dis 15:1281–1288
13. Elmér SE, Nygren JO, Lenander CE (2013) A randomized trial of transanal hemorrhoidal dearterialization with anopexy compared with open hemorrhoidectomy in the treatment of hemorrhoids. Dis Colon Rectum 56:484–490
14. Ratto C, Giordano P, Dionisi L, Parello A, Litta F, Doglietto G (2011) Transanal haemorrhoidal dearterialization (THD) for selected fourth-degree haemorrhoids. Tech Coloproctol 15:191–197
15. Konsten J, Baeten CG (2000) Hemorrhoidectomy vs. Lord's method: 17-year follow-up of a prospective, randomized trial. Dis Colon Rectum 43:503–506
16. Qarabaki MA, Mukhashavria GAGGA, Mukhashavria GAGGA, Giorgadze NG (2014) Circular vs. three-quadrant hemorrhoidectomy for end-stage hemorrhoids: short- and long-term outcomes of a prospective randomized trial. J Gastrointest Surg 18:808–815
17. Denoya P, Tam J, Bergamaschi R (2014) Hemorrhoidal dearterialization with mucopexy versus hemorrhoidectomy: 3-year follow-up assessment of a randomized controlled trial. Tech Coloproctol 18:1081–1085
18. Bursics A, Morvay K, Kupcsulik P, Flautner L (2004) Comparison of early and 1-year follow-up results of conventional hemorrhoidectomy and hemorrhoid artery ligation: a randomized study. Int J Colorect Dis 19:176–180
19. Ratto C, Dionisi L, Parello A, Litta F, Zaccone G, De Simone V (2012) "Distal Doppler-guided dearterialization" is highly effective in treating haemorrhoids by transanal haemorrhoidal dearterialization. Colorect Dis 14:e786–e789
20. Ferguson JA, Heaton JR (1959) Closed hemorrhoidectomy. Dis Colon Rectum 2:176–179
21. Dindo D, Demartines N, Clavien P-A (2004) Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg 240:205–213
22. Giordano P, Nastro P, Davies A, Gravante G (2011) Prospective evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: three-year outcomes. Tech Coloproctol 15:67–73
23. Vaizey C, Carapeti E, Chaill J, Kamm M (1999) Prospective comparison of faecal incontinence grading systems. Gut 44:77–80
24. Bjelanovic Z, Draskovic M, Veljovic M, Lekovic I, Karanikolas M, Stamenkovic D (2016) Transanal hemorrhoid dearterialization is a safe and effective outpatient procedure for the treatment of hemorrhoidal disease. Cir Esp 94:588–594
25. Xu L, Chen H, Lin G, Ge Q, Qi H, He X (2016) Transanal hemorrhoidal dearterialization with mucopexy versus open hemorrhoidectomy in the treatment of hemorrhoids: a meta-analysis of randomized control trials. Tech Coloproctol 20:825–833. doi:10.1007/s10151-016-1551-2
26. Morinaga K, Hasuda K, Ikeda T (1995) A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. Am J Gastroenterol 90:610–613
27. Ratto C, de Parades V (2015) Doppler-guided ligation of hemorrhoidal arteries with mucopexy: a technique for the future. J Visc Surg 152:s15–s21

2016

Authors: **Atallah** S., **Maharaja** G.K., **Martin-Perez** B. et al

Source: Tech Coloproctol, (2016) 20: 461-466

Available for Full Open Online Access

Title: **Transanal hemorrhoidal dearterialization (THD): a safe procedure for the anticoagulated patient?**

BACKGROUND:

Approximately one in five persons living in the USA is maintained on oral anticoagulation. It has typically been recommended that anticoagulation be withheld prior to hemorrhoidal procedures. Transanal hemorrhoidal dearterialization (THD) is a minimally invasive treatment for symptomatic hemorrhoids, and outcomes with patients on anticoagulation who have undergone this procedure have not been previously reported. Here, we report our preliminary results of patients who underwent THD while on anticoagulation.

METHODS:

During a 53-month period (February 2009–July 2015), patients with symptomatic hemorrhoids refractory to medical management who underwent surgical treatment with THD were retrospectively reviewed. The subset of patients who underwent THD while anticoagulated was compared to a cohort of patient who were not taking anticoagulation and who otherwise demonstrated normal coagulation profiles and who did not have a known predisposition to bleeding or inherited coagulopathy. The primary study endpoint was to assess postoperative bleeding in patients who were maintained on anticoagulation before and after surgery.

RESULTS:

During the 53-month study period, 106 patients underwent the THD procedure for symptomatic hemorrhoids. Of these, seventy patients underwent THD without anticoagulation therapy, while 36 patients underwent THD while taking one or more oral anticoagulants. The postoperative morbidity between the two cohorts was similar, and specifically there was no statistical difference in the rate of postoperative hemorrhage (19.4 vs. 15.7 %; odds ratio 1.295, 95 % CI 0.455–3.688, p = 0.785). No patient, in either cohort, required re-intervention for any reason during the study period. Patients who underwent THD while on anticoagulation were less likely to have recurrent hemorrhoidal disease during the study's 6-month median follow-up period (2.8 vs. 7.1 %, p = 0.049).

CONCLUSIONS:

These preliminary data reveal that THD can be performed on anticoagulated patients without cessation of oral agents without increasing morbidity from postoperative bleeding.

Tech Coloproctol (2016) 20:461–466
DOI 10.1007/s10151-016-1481-z

ORIGINAL ARTICLE

Transanal hemorrhoidal dearterialization (THD): a safe procedure for the anticoagulated patient?

S. Atallah[1] · G. K. Maharaja[1] · B. Martin-Perez[1] · J. P. Burke[1] · M. R. Albert[1] · S. W. Larach[1]

Received: 21 February 2016 / Accepted: 28 April 2016 / Published online: 12 May 2016

Abstract
Background Approximately one in five persons living in the USA is maintained on oral anticoagulation. It has typically been recommended that anticoagulation be withheld prior to hemorrhoidal procedures. Transanal hemorrhoidal dearterialization (THD) is a minimally invasive treatment for symptomatic hemorrhoids, and outcomes with patients on anticoagulation who have undergone this procedure have not been previously reported. Here, we report our preliminary results of patients who underwent THD while on anticoagulation.
Methods During a 53-month period (February 2009–July 2015), patients with symptomatic hemorrhoids refractory to medical management who underwent surgical treatment with THD were retrospectively reviewed. The subset of patients who underwent THD while anticoagulated was compared to a cohort of patient who were not taking anticoagulation and who otherwise demonstrated normal coagulation profiles and who did not have a known predisposition to bleeding or inherited coagulopathy. The primary study endpoint was to assess postoperative bleeding in patients who were maintained on anticoagulation before and after surgery.
Results During the 53-month study period, 106 patients underwent the THD procedure for symptomatic hemorrhoids. Of these, seventy patients underwent THD without anticoagulation therapy, while 36 patients underwent THD while taking one or more oral anticoagulants. The postoperative morbidity between the two cohorts was similar, and specifically there was no statistical difference in the rate of postoperative hemorrhage (19.4 vs. 15.7 %; odds ratio 1.295, 95 % CI 0.455–3.688, $p = 0.785$). No patient, in either cohort, required re-intervention for any reason during the study period. Patients who underwent THD while on anticoagulation were less likely to have recurrent hemorrhoidal disease during the study's 6-month median follow-up period (2.8 vs. 7.1 %, $p = 0.049$).
Conclusions These preliminary data reveal that THD can be performed on anticoagulated patients without cessation of oral agents without increasing morbidity from postoperative bleeding.

Keywords THD · Anticoagulation · Postoperative hemorrhage · Transanal hemorrhoidal dearterialization · Hemorrhoids

Introduction

A significant proportion of the Western population is prescribed maintenance anticoagulation with a variety of agents including oral acetylsalicylic acid (ASA), warfarin, clopidogrel, and/or direct thrombin inhibitors. Approximately one in five (19.3 %) persons living in the USA is maintained on monotherapy with the oral antiplatelet medication ASA [1, 2]. Among individuals aged 45–75, the incidence is higher, with more than half (52 %) of this population segment taking oral ASA therapy daily [2]. Clopidogrel has also become an anticoagulant of choice, and in 2010 it was the second most prescribed drug in the world, generating a $9 billion industry [3]. Warfarin, although less utilized than other anticoagulants, is commonly administered, and a total of 1 % of the UK's 64.1 million population is prescribed this medication annually [4]. Combined, up to one-quarter of the adult population in

✉ S. Atallah
atallah@post.harvard.edu

[1] Florida Hospital, Winter Park, FL, USA

the USA and Europe are estimated to be taking oral anticoagulation as monotherapy or as a multi-drug regimen (e.g., combination of ASA and clopidogrel). Because of this, surgeons must contend with the anticoagulated patient. With the increasing use of synthetic, direct thrombin inhibitors, e.g., argatroban (univalent), hirudin (bivalent), surgeons must also be able to surgically manage this subset of patient for which reversal is not always possible [5], and only recently andexanet alfa has been shown to reverse factor Xa inhibitors (apixaban and rivaroxaban) when given minutes after administration of these anticoagulants [6].

The frequent use of anticoagulation has likely led to an increased incidence of patients presenting with clinically significant internal hemorrhoidal bleeding. When medically refractory, surgeons must consider invasive procedures and surgery to resolve patient symptoms, and in some instances the cessation of anticoagulation or dose reduction is not safe.

One in 20 Americans and almost one-half of persons older than 50 experience hemorrhoidal symptoms during their lifetime, and surgical intervention is often required [7, 8]. It is recommended that anticoagulation—including ASA—be withheld for 7 days prior to office-based procedures, such as hemorrhoidal banding, or surgical interventions, such as hemorrhoidectomy and especially procedure for prolapsed hemorrhoids (PPH) [9, 10]. The risk of significant bleeding after hemorrhoidal banding, although uncommon, has been well documented [11–13]. Post-hemorrhoidectomy bleeding also occurs, to a lesser degree—approximately 1 % of the time [14]—range 0.5–2.0 % [15]. In one series, among the patients who had post-hemorrhoidectomy bleeding, 37 % were on maintenance anticoagulation [15]. For these reasons, most surgeons and society guidelines recommend that anticoagulation be held prior to hemorrhoidal surgery and procedures. However, whether or not this is mandatory for all types of hemorrhoidal procedures has not been fully studied. Transanal hemorrhoidal dearterialization (THD) is a relatively recent minimally invasive treatment for symptomatic hemorrhoids and may have important advantages over conventional hemorrhoidectomy [16–18]. Its application toward the control of rectal outlet bleeding has been previously realized [19]. However, outcomes with patients on anticoagulation who have undergone THD have not been previously reported, to our knowledge. Here, we report our preliminary results of patients who underwent THD while on anticoagulation and compared them to a cohort of patients who underwent THD without anticoagulation.

Materials and methods

During a 53-month period (February 2009–July 2015), patients with symptomatic hemorrhoids refractory to medical management who underwent surgical treatment with THD were retrospectively reviewed. The study was performed with internal review board (IRB) approval [Florida Hospital, Orlando, FL USA, IRB #670312-2], and all THD operations were performed at a single hospital system. The data were collected, tabulated, and placed into a prospective database, which was then analyzed retrospectively.

Under the study protocol, patients taking oral anticoagulation medications continued taking these medications before and after the procedure, but anticoagulation was held on the day of surgery. Exclusion criteria included patients on warfarin with an international normalized ratio (INR) greater than 3X normal and patients with a platelet count measuring <10,000, known inborn error of metabolism with coagulopathy due to genetic mutation, age <18 or >95, and severe comorbidity (ASA IV, or higher).

The subset of patients who underwent THD while anticoagulated was compared to patient who were not taking anticoagulation and who otherwise demonstrated normal coagulation profiles (PT, PTT, INR, and PLT) and who did not have a known predisposition to bleeding or inherited coagulopathy. Indication for THD was the same in both cohorts. The indications were medically refractory hemorrhoidal disease in patients who failed to respond to standard conservative therapy, including dietary changes and topical corticosteroid application in combination with (a) persistent, clinically significant rectal outlet hemorrhage and/or (b) grade III hemorrhoidal prolapse in more than one hemorrhoidal column according to the Goligher classification system [20]. The primary study endpoint was to assess postoperative bleeding in patients who were on anticoagulation. The secondary endpoint was control of hemorrhoidal disease with THD.

Surgical technique

THD was performed in a standardized fashion with figure-of-eight ligation using absorbable suture under Doppler guidance at six positions correlating with the odd numbers of the clock in the patient positioned in dorsal lithotomy. No fewer than 6 ligations were performed on each patient, but if a Doppler signal was detected after 6 ligations, then an additional suture ligation was performed, up to a maximum of eight. Mucopexy was performed for all patients with prolapsing hemorrhoidal mucosa, and the number of columns in which mucopexy was performed varied depending on degree and number of hemorrhoidal columns which exhibited prolapse. The surgical technique for THD was the same regardless of whether or not the patients were on anticoagulation.

Statistical analysis

Data analyses were performed using the SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA). A two-sided Fisher's

exact test was used, and odds ratio analysis was conducted to evaluate the differences between the two cohorts. A statistical difference was denoted by $p \leq .05$, and all clinically relevant data were evaluated in each of the two study cohorts.

Results

During the 53-month study period, 106 patients underwent the THD procedure for symptomatic hemorrhoids. Of these, seventy patients underwent THD without anticoagulation therapy, while 36 patients underwent THD while taking one or more oral anticoagulants, without discontinuation except for the day of surgery. There was no statistical difference in the demographics of the two groups or the hemorrhoidal grade (Table 1). However, prolapse was more likely to be the indication for THD for the cohort of patients not taking anticoagulation, while bleeding was more likely to be the reason why THD was performed on anticoagulated patients. There was no statistical difference between median operative times, which measured 31 min (14–102 min) for patients on anticoagulation and 28.5 min (18–76 min) for patients off anticoagulation. Interestingly, the median blood loss was less during THD in which patients were anticoagulated, with 15 ml (5–15 ml) vs. 20 ml (2–100 ml) for patients not on anticoagulation, $p = 0.03$. The postoperative morbidity between the two cohorts was similar, and specifically there was no statistical difference in the rate of postoperative hemorrhage (19.4 vs. 15.7 %; odds ratio 1.295, 95 % CI 0.455–3.688, $p = 0.785$) (Table 2). Of the 7 patients who presented with postoperative bleeding in the anticoagulated cohort, two represented to the emergency center. One of these presentations was on postoperative day 11 in a 73-year-old male on apixaban monotherapy, while the other was on postoperative day seven in a 73-year-old male who was on monotherapy with 81 mg ASA. Neither patient required re-intervention, admission, or transfusion as these were self-limited bleeding events that resolved without therapy. The remaining 5 patients only reported self-limited bleeding on their 4-week follow-up appointment. No patient, in either cohort, required re-intervention for any reason during the study period. Patients who underwent THD while on anticoagulation were less likely to have recurrent hemorrhoidal disease during the study's 6-month (3–24 months) median follow-up period (2.8 vs. 7.1 %, $p = 0.049$).

The type of anticoagulation varied and is detailed in Table 3. The most common type of anticoagulation was once daily oral 81 mg ASA with 20/36 (55.6 %) taking this medication once daily. Of the seven patients in the THD + anticoagulation group who experienced bleeding in the postoperative period, only two were on ASA monotherapy, while 5/7 were taking warfarin as monotherapy or dual anticoagulation therapy in combination with either fondaparinux, enoxaparin, or apixaban (Table 3).

Discussion

The approach to the treatment of hemorrhoidal disease remains individualized, and management often requires the ability to provide a spectrum of interventions based on

Table 1 Clinical characteristics of patients undergoing THD

	THD on anticoagulation (%)	THD off anticoagulation (%)	*p* value
n	36	70	
Age (range)[a] (years)	64 (35–79)	48 (22–86)	NS
Male/female	2.6:1	1.6:1	
BMI[a]	28 (24–35)	27 (23–33)	NS
Grade of hemorrhoid[b]			
Grade 1	5 (13.8)	10 (14.2)	
Grade 2	17 (47.2)	35 (50.0)	
Grade 3	13 (36.1)	24 (34.2)	
Grade 4	1 (2.7)	1 (1.4)	
Presenting preoperative symptoms			
Bleeding[c]	33 (86.8)	49 (73.1)	0.006
Prolapse[c]	9 (25.0)	27 (38.5)	0.0004
Other[c]	10 (26.3)	8 (11.9)	NS

THD Transanal hemorrhoidal dearterialization, *BMI* Body mass index expressed in kg/m^2

[a] Age and BMI reported as median (range)

[b] Grade of hemorrhoid and presenting symptoms reported in absolute value. Patients reported by preoperative graded severity of hemorrhoids according to Goligher's classification

[c] Presenting preoperative symptoms (bleeding, prolapse, and other) reported as absolute values

Table 2 Operative outcomes for patients undergoing THD

	THD on anticoagulation (%)	THD off anticoagulation (%)	*p* values
OR time[a]	31 (14–102)	28.5 (18–76)	NS
EBL[a]	15 (5–50)	20 (2–100)	0.03
ASA score[a]	2.2	1.4	
Mucopexy[b]	33 (91.7)	54 (77.1)	0.019
Postop morbidity			
Bleeding[b]	7 (19.4)	11 (15.7)	NS
Pain[b]	7 (19.4)	9 (12.8)	NS
Urinary retention[b]	1	1	NS
Recurrence[b]	1 (2.8)	5 (7.1)	0.049

THD Transanal hemorrhoidal dearterialization, *OR time* Median operating time in minutes (range); *EBL* Median estimated blood loss in milliliters (range); *ASA* American Society of Anesthesiologists score reported as mean

[a] values reported in median (range)

[b] Mucopexy, bleeding, pain, urinary retention, and recurrence reported in absolute value (percent); *NS* Not significant

Table 3 List of specific anticoagulation medications for patients who underwent THD while on anticoagulation

	Patients on anticoagulation (*n*)	Postoperative bleeding (*n*)
Aspirin 81 mg	20	1
Aspirin 325 mg	5	1
Clopidogrel	3	0
Warfarin	3	2
Apixaban	1	1
Apixaban + warfarin	1	1
Fondaparinux + warfarin	1	1
Enoxaparin + warfarin	1	0
Aspirin/dipyridamole	1	0
Total	36	7

THD Transanal hemorrhoidal dearterialization

extent, chronicity, and pathoanatomy. But treatment must also be tailored to a given patient in the context of clinical parameters, which commonly—and importantly—include the requirement for anticoagulation [21, 22]. This is a key component of the surgeon's decision matrix when determining how to proceed with intervention, once surgery is considered a necessary pathway toward ameliorating hemorrhoidal symptoms. Physicians and surgeons understand that some patients present an increased risk of thromboembolic or cardiac events when anticoagulation is held—even temporarily. In the ROCKET AF trial, 4.8 % of patients experienced gastrointestinal (GI) bleeding and 29 % rectal origin [23]; however, the risk of gastrointestinal bleeding related to novel oral anticoagulants appears similar to that of warfarin [24].

Furthermore, there is a risk of so-called rebound hypercoagulability in patients who undergo cessation of anticoagulants and then restart them, thus increasing the risk of adverse thrombotic events [25–27]. For patients with bare-metal or drug-eluting stents [28, 29], prosthetic heart valves [30, 31], recent prosthetic peripheral arterial grafts [32], and recent thromboembolic events [33], the risk of anticoagulant cessation can be significant. Thus, for select patients, the surgeon must estimate the procedural bleeding risk and weigh this against the estimated thromboembolic or cardiac event risk when deciding whether or not anticoagulation can be safely interrupted, and whether or not bridging is required [34–40].

In this study, it is demonstrated that the incidence of hemorrhage requiring intervention after THD is not statistically different between anticoagulated and non-anticoagulated patient cohorts undergoing the procedure. These early data suggest that THD could be a safe operation for anticoagulated patients, which is an important clinical demographic confronting colorectal surgeons. However, the authors recognize important limitations of this study, which are principally the small sample size and the retrospective non-randomized nature of the study design. A blinded, randomized trial in which patients already on anticoagulation were assessed for the morbidity of postoperative hemorrhage and also thromboembolic events would be necessary to support or refute the validity of performing THD on patients on systemic anticoagulation therapy. Furthermore, the study is limited by the heterogeneity of the types of anticoagulation agents, and because the majority (55.6 %) of the anticoagulated cohort were on monotherapy with low-dose, oral 81 mg ASA. Since complications of aspirin treatment increase proportionally with dose, the results of the present study may not reflect the complication rate of patients taking moderate (100–200 mg/day) or high (>200 mg/day) doses [41]. Notwithstanding, in this study only two patients (5.6 %) in the anticoagulated cohort presented for medical evaluation

after THD at an emergency center, but neither required transfusion, surgical intervention, or other specific therapy and were categorized as self-limited postoperative hemorrhage. Thus, for high-risk cardiovascular patients the need to bridge with low molecular weight heparin as a bridge to surgery may be obviated by using THD procedure—without significantly increasing the risk of postoperative bleeding.

Because patients with cardiovascular disease are often recommended to remain on anticoagulation to maintain homeostasis and also to prevent the described phenomenon of rebound hypercoagulability, surgeons must often tailor the approach to hemorrhoidal disease based on these factors which can restrict the safe and permissible options to manage hemorrhoidal disease. For example, many experts do not recommend hemorrhoidal band ligation for anticoagulated patients unless the anticoagulation has been held prior to (and after) hemorrhoidal ligation [42, 43]. Likewise, excisional hemorrhoidectomy mandates that anticoagulation be held due to the increased risk of significant bleeding postoperatively. THD could be a 'middle ground' between less invasive procedures such as hemorrhoidal band ligation and excisional procedures (Ferguson or Milligan–Morgan) for hemorrhoidal treatment, for which—as these data suggest—the cessation of oral anticoagulation may not be necessary.

Conclusions

These preliminary data suggest that THD can be performed on anticoagulated patients without cessation of oral agents without increasing the morbidity from postoperative bleeding. Although encouraging, the small sample size limits the overall generalizability of the study findings, and further investigation is necessary prior to concluding that THD should be routinely performed without prerequisite cessation of oral anticoagulants.

Compliance with ethical standards

Funding The study was not funded and did not receive financial support. Dr. S. Atallah is a paid consultant for THD America, ConMed, Inc., and Applied Medical, Inc. Dr. M Albert is a paid consultant for The Medicines Company, Applied Medical, Inc., and ConMed, Inc. Dr. G. Maharaja, B. Martin-Perez, J. Burke, and S. Larach have no financial disclosures to report.

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This research was conducted in accordance with the ethical standards set forth by the institution and are in compliance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent All patients enrolled in this study received informed consent as mandated by the code of ethics at our institution and by the internal review board.

References

1. Ajani UA, Ford ES, Greenland KJ, Giles WH, Mokdad AH (2006) Aspirin use among US adults: behavioral risk factor surveillance system. Am J Prev Med 30:74–77
2. Anita Soni (2005) Aspirin use among the adult U.S. noninstitutionalized population, with and without indicators of heart disease. Statistical Brief #179. http://meps.ahrq.gov/mepsweb/data_files/publications/st179/stat179.pdf
3. Topol EJ, Schork NJ (2011) Catapulting clopidogrel pharmacogenomics forward. Nat Med 17:40–41
4. Pirmohamed M (2006) Warfarin: almost 60 years old and still causing problems. Br J Clin Pharmacol 62:509–511
5. Di Nisio M, Middeldorp S, Büller H (2005) Direct thrombin inhibitors. N Engl J Med 353:1028–1040
6. Siegal DM, Curnutte JT, Connolly SJ et al (2015) Andexanet Alfa for the reversal of factor Xa inhibitor activity. N Engl J Med 17:2413–2424
7. Fox A, Tietze PH, Ramakrishnan K (2014) Anorectal conditions: hemorrhoids. FP Essent 419:11–19
8. Cataldo P, Ellis CN, Gregorcyk S et al (2005) Standards Practice Task Force, The American Society of Colon and Rectal Surgeons, USA. Practice parameters for the management of hemorrhoids (revised). Dis Colon Rectum 48:189–194
9. Wang Q, Cai C, Dong W, Du J (2014) Severe intra-abdominal bleeding leading to hemorrhagic shock, rectal perforation and bilateral hydrothorax after stapling procedure for prolapsed hemorrhoids. Tech Coloproctol 18:771–772
10. Festen S, van Hoogstraten MJ, van Geloven AA, Gerhards MF (2009) Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results. Int J Colorectal Dis 24:1401–1405
11. Odelowo O, Mekasha G, Johnson MA (2002) Massive life-threatening lower gastrointestinal hemorrhage following hemorrhoidal rubber band ligation. J Natl Med Assoc 94:1089–1092
12. Patel S, Shahzad G, Rizvon K, Subramani K, Viswanathan P, Mustacchia P (2014) Rectal ulcers and massive bleeding after hemorrhoidal band ligation while on aspirin. World J Clin Cases 16:86–89
13. Bat L, Melzer E, Koler M, Dreznick Z, Shemesh E (1993) Complications of rubber band ligation of symptomatic internal hemorrhoids. Dis Colon Rectum 36:287–290
14. Chen HH, Wang JY, Changchien CR et al (2002) Risk factors associated with posthemorrhoidectomy secondary hemorrhage: a single-institution prospective study of 4880 consecutive closed hemorrhoidectomies. Dis Colon Rectum 45:1096–1099
15. Rosen L, Sipe P, Stasik JJ, Riether RD, Trimpi HD (1993) Outcome of delayed hemorrhage following surgical hemorrhoidectomy. Dis Colon Rectum 36:743–746
16. De Nardi P, Capretti G, Corsaro A, Staudacher C (2014) A prospective, randomized trial comparing the short- and long-term results of doppler-guided transanal hemorrhoid dearterialization with mucopexy versus excision hemorrhoidectomy for grade III hemorrhoids. Dis Colon Rectum 57:348–353
17. Ratto C, Parello A, Veronese E et al (2015) Doppler-guided transanal haemorrhoidal dearterialization for haemorrhoids: results from a multicentre trial. Colorectal Dis 17:O10–O19
18. Denoya P, Tam J, Bergamaschi R (2014) Hemorrhoidal dearterialization with mucopexy versus hemorrhoidectomy: 3-year

follow-up assessment of a randomized controlled trial. Tech Coloproctol 18:1081–1085
19. Cavazzoni E, Bugiantella W, Graziosi L et al (2013) Emergency transanal haemorrhoidal Doppler guided dearterialization for acute and persistent haemorrhoidal bleeding. Colorectal Dis 15:e89–e92
20. Goligher JC, Leacock AG, Brossy JJ (1955) The surgical anatomy of the anal canal. Br J Surg 43:51–61
21. Kearon C, Hirsh J (1997) Management of anticoagulation before and after elective surgery. N Engl J Med 22:1506–1511
22. Douketis JD, Crowther MA, Cherian SS, Kearon CB (1999) Physician preferences for perioperative anticoagulation in patients with a mechanical heart valve who are undergoing elective noncardiac surgery. Chest 1:1240–1246
23. Sherwood MW, Nessel CC, Hellkamp AS et al (2015) Gastrointestinal bleeding in patients with atrial fibrillation treated with rivaroxaban or warfarin: ROCKET AF Trial. J Am Coll Cardiol 1:2271–2281
24. Abraham NS, Singh S, Alexander GC et al (2015) Comparative risk of gastrointestinal bleeding with dabigatran, rivaroxaban, and warfarin: population based cohort study. BMJ 24:h1857
25. Genewein U, Haeberli A, Straub PW, Beer JH (1996) Rebound after cessation of oral anticoagulant therapy: the biochemical evidence. Br J Haemotol 1:479–485
26. Harenberg J, Haas R, Zimmermann R (1983) Plasma hypercoagulability after termination of oral anticoagulants. Thromb Res 15:627–633
27. Sise HS, Moschos CB, Gauthier J, Becker R (1961) The risk of interrupting long-term anticoagulant treatment a rebound hypercoagulable state following hemorrhage. Circulation 1:1137–1142
28. Lagerqvist B, James SK, Stenestrand U, Lindbäck J, Nilsson T, Wallentin L (2007) Long-term outcomes with drug-eluting stents versus bare-metal stents in Sweden. N Engl J Med 8:1009–1019
29. Pfisterer M, Brunner-La Rocca HP, Buser PT et al (2006) Late clinical events after clopidogrel discontinuation may limit the benefit of drug-eluting stents: an observational study of drug-eluting versus bare-metal stents. J Am Coll Cardiol 19:2584–2591
30. Cannegieter SC, Rosendaal FR, Wintzen AR, Van der Meer FJ, Vandenbroucke JP, Briet E (1995) Optimal oral anticoagulant therapy in patients with mechanical heart valves. N Engl J Med 6:11–17
31. Hammerstingl C, Tripp C, Schmidt H, von der Recke G, Omran H (2007) Periprocedural bridging therapy with low-molecular-weight heparin in chronically anticoagulated patients with prosthetic mechanical heart valves: experience in 116 patients from the prospective BRAVE registry. J Heart Valve Dis 16:285–292
32. Smith SC, Allen J, Blair SN et al (2006) AHA/ACC guidelines for secondary prevention for patients with coronary and other atherosclerotic vascular disease: 2006 update: endorsed by the National Heart. J Am Coll Cardiol 16:2130–2139
33. Larsen TB, Lip GY, Gorst-Rasmussen A (2016) Anticoagulant therapy after venous thromboembolism and 10-year mortality. Int J Cardiol 18:72–78
34. Douketis JD, Healey JS, Brueckmann M et al (2015) Perioperative bridging anticoagulation during dabigatran or warfarin interruption among patients who had an elective surgery or procedure. Substudy of the RE-LY trial. Thromb Haemost 113:625–632
35. Kozek-Langenecker SA (2014) Perioperative management issues of direct oral anticoagulants. Semin Hematol 51:112–120
36. Dunn AS, Spyropoulos AC, Turpie AG (2007) Bridging therapy in patients on long-term oral anticoagulants who require surgery: the Prospective Peri-operative Enoxaparin Cohort Trial (PROSPECT). J Thromb Haemost 1:2211–2218
37. Douketis JD, Johnson JA, Turpie AG (2004) Low-molecular-weight heparin as bridging anticoagulation during interruption of warfarin: assessment of a standardized periprocedural anticoagulation regimen. Arch Intern 28:1319–1326
38. Hammerstingl C, Schmitz A, Fimmers R, Omran H (2009) Bridging of chronic oral anticoagulation with enoxaparin in patients with atrial fibrillation: results from the prospective BRAVE registry. Cardiovasc Ther 1:230–238
39. Spyropoulos AC, Jenkins P, Bornikova L (2004) A disease management protocol for outpatient perioperative bridge therapy with enoxaparin in patients requiring temporary interruption of long-term oral anticoagulation. Pharmacotherapy 24:649–658
40. Seshadri N, Goldhaber SZ, Elkayam U et al (2005) The clinical challenge of bridging anticoagulation with low-molecular-weight heparin in patients with mechanical prosthetic heart valves: an evidence-based comparative review focusing on anticoagulation options in pregnant and nonpregnant patients. Am Heart J 1:27–34
41. Serebruany VL, Steinhubl SR, Berger PB et al (2005) Analysis of risk of bleeding complications after different doses of aspirin in 192,036 patients enrolled in 31 randomized controlled trials. Am J Cardiol 15:1218–1222
42. Nelson RS, Thorson AG (2009) Risk of bleeding following hemorrhoidal banding in patients on antithrombotic therapy. Gastroenterol Clin Biol 33:463–465
43. Iyer VS, Shrier I, Gordon PH (2004) Long-term outcome of rubber band ligation for symptomatic primary and recurrent internal hemorrhoids. Dis Colon Rectum 1:1364–1370

2016

Authors: Marleny Novaes **Figueiredo**, Guilherme **Campos** F.

Source: World J Gastrointest Surg 2016 March 27; 8(3): 232-237

Available for Open Online Access

Title: Doppler-guided hemorrhoidal dearterialization/transanal hemorrhoidal dearterialization: Technical evolution and outcomes after 20 years

In the setting of Hemorrhoidal Disease treatment, the option of conventional hemorrhoidectomy is highly effective, but it is still associated with postoperative pain and discomfort. For this reason, technical alternatives have been developed in order to reduce complications and to provide better postoperative recovery. To accomplish this aim, non-excisional techniques such as stapled hemorrhoidectomy and Doppler-guided hemorrhoidal ligation have been introduced into clinical practice with high expectations. The aim of this article is to revise the literature about transanal hemorrhoidal dearterialization technique in the treatment of hemorrhoidal disease, looking into its evolution, results and possible benefits over other modalities of surgical treatment. The literature review showed that Doppler guided hemorrhoidal dearterialization is a safe and effective method to treat grades II to IV hemorrhoidal disease. Outcomes in patients presenting prolapse are satisfactory and the association of anopexy is an important aspect of this operation. Anal physiology disturbances are rarely observed and mainly transitory. This technique is an excellent option for every patient, especially in those with previous anal surgeries and in patients with previous alterations of fecal continence, when an additional procedure might represent a risk of definitive incontinence.

CORE TIP:

Management of hemorrhoidal disease is a tough task. First of all, because there are some technical alternatives that should be adequately indicated to different patients; secondly, because patients desire a good alternative associated with low morbidity, good long-term results and less postoperative pain. In this setting, the transanal hemorrhoidal dearterialization (THD) technique is considered a safe and effective choice for internal hemorrhoids of grades II to IV. The present paper reviews technical aspects and literature results of THD in comparison to other operative techniques.

World Journal of Gastrointestinal Surgery

Submit a Manuscript: http://www.wjgnet.com/esps/
Help Desk: http://www.wjgnet.com/esps/helpdesk.aspx
DOI: 10.4240/wjgs.v8.i3.232

World J Gastrointest Surg 2016 March 27; 8(3): 232-237
ISSN 1948-9366 (online)

Doppler-guided hemorrhoidal dearterialization/transanal hemorrhoidal dearterialization: Technical evolution and outcomes after 20 years

Marleny Novaes Figueiredo, Fábio Guilherme Campos

Marleny Novaes Figueiredo, Department of Gastroenterology, University of São Paulo Medical School, São Paulo, PC 01411-000, Brazil

Fábio Guilherme Campos, Department of Gastroenterology, Hospital das Clínicas, University of São Paulo Medical School, São Paulo, PC 01411-000, Brazil

Author contributions: Both authors performed research and wrote the paper.

Conflict-of-interest statement: None of the authors have any conflict of interest.

Correspondence to: Fábio Guilherme Campos, MD, PhD, Associate Professor of Surgery, Colorectal Surgery Division Staff Surgeon, Department of Gastroenterology, Hospital das Clínicas, University of São Paulo Medical School, Rua Padre João Manoel, 222 - Cj 120 - Cerqueira César, São Paulo, PC 01411-000, Brazil. fgmcampos@terra.com.br
Telephone: +55-11-30610108
Fax: +55-11-30610108

Received: August 29, 2015
Peer-review started: September 7, 2015
First decision: December 7, 2015
Revised: December 19, 2015
Accepted: January 21, 2016
Article in press: January 22, 2016
Published online: March 27, 2016

Abstract

In the setting of Hemorrhoidal Disease treatment, the option of conventional hemorrhoidectomy is highly effective, but it is still associated with postoperative pain and discomfort. For this reason, technical alternatives have been developed in order to reduce complications and to provide better postoperative recovery. To accomplish this aim, non-excisional techniques such as stapled hemorrhoidectomy and Doppler-guided hemorrhoidal ligation have been introduced into clinical practice with high expectations. The aim of this article is to revise the literature about transanal hemorrhoidal dearterialization technique in the treatment of hemorrhoidal disease, looking into its evolution, results and possible benefits over other modalities of surgical treatment. The literature review showed that Doppler-guided hemorrhoidal dearterialization is a safe and effective method to treat grades II to IV hemorrhoidal disease. Outcomes in patients presenting prolapse are satisfactory and the association of anopexy is an important aspect of this operation. Anal physiology disturbances are rarely observed and mainly transitory. This technique is an excellent option for every patient, especially in those with previous anal surgeries and in patients with previous alterations of fecal continence, when an additional procedure might represent a risk of definitive incontinence.

Key words: Doppler-guided hemorrhoidal dearterialization; Hemorrhoids; Transanal hemorrhoidal dearterialization

Core tip: Management of hemorrhoidal disease is a tough task. First of all, because there are some technical alternatives that should be adequately indicated to different patients; secondly, because patients desire a good alternative associated with low morbidity, good long-term results and less postoperative pain. In this setting, the transanal hemorrhoidal dearterialization

(THD) technique is considered a safe and effective choice for internal hemorrhoids of grades II to IV. The present paper reviews technical aspects and literature results of THD in comparison to other operative techniques.

Figueiredo MN, Campos FG. Doppler-guided hemorrhoidal dearterialization/transanal hemorrhoidal dearterialization: Technical evolution and outcomes after 20 years. *World J Gastrointest Surg* 2016; 8(3): 232-237 Available from: URL: http://www.wjgnet.com/1948-9366/full/v8/i3/232.htm DOI: http://dx.doi.org/10.4240/wjgs.v8.i3.232

INTRODUCTION

For over 60 years, since the description of hemorrhoidectomy by Milligan and Morgan *et al*[1] and Ferguson *et al*[2], conventional hemorrhoidectomy (CH) has been the standard treatment for grades III and IV hemorrhoids. It is also indicated for grade II hemorrhoids refractory to conservative methods (such as rubber band ligation or infrared coagulation) or to those that have recurred. However, CH is still associated with postoperative pain and discomfort. Thus, technical alternatives to manage hemorrhoidal disease have been sought, in order to reduce complications and to provide better postoperative recovery, especially less pain.

In this scenario, stapled hemorrhoidectomy (SH) and Doppler-guided hemorrhoidal ligation have been introduced in our practice since the 90's[3,4]. Whether called Doppler-guided hemorrhoidal artery ligation (DG-HAL) or transanal hemorrhoidal dearterialization (THD), it is a technique for the treatment of internal hemorrhoids and it was first described by Morinaga *et al*[3] in 1995. Few studies have addressed the technique until after the year 2000, with a lot of papers since then.

The aim of this article was to revise the literature about this technique in the treatment of hemorrhoidal disease, looking into its evolution, results and possible benefits over other modalities of surgical treatment.

A literature search was performed in PubMed, looking for "THD", "transanal hemorrhoidal dearterialization", "DG-HAL" and "Doppler guided hemorrhoidal artery ligation". References from the selected articles were also reviewed in order to find additional studies in the subject.

TECHNICAL ASPECTS

Before Morinaga's work for the surgical treatment of hemorrhoids with Doppler-guided ligation, Jaspersen *et al*[5] described the successful use of Doppler-guided location of hemorrhoidal vessels for phenol injection for treatment of 1st grade hemorrhoids.

Hemorrhoidal vessels are usually found in the mucosa within 2 cm up from the anorectal junction[6] and this is the place where the sutures should be made in this technique (the Dearterialization itself). In the case anopexy is also to be made, this is the position where the first ligation should be made, before the running suture for the anopexy is continued distally.

Different devices were developed to accomplish the location of vessels by Doppler signal as well as to permit the ligation at the same time. Morinaga *et al*[3] used a device called the Moricorn to find Doppler signal 2 cm above the dentate line and then ligate arterioles at this point. Afterwards, other proctoscopes were developed and nowadays most studies use THD (THD S.p.A. Correggio, Italy), DG-HAL/DG-RAR (Agency for Medical Innovations GmbH (AMI), Feldkirch, Osterreich, Austria) or HAL-Doppler (AMI Dufour MedicalTM, Maurepas, France).

There does not seem to exist any difference in results according to the type of device used, since they operate in the same way despite the different appearance of each one.

Table 1 refers to difference in rates of success and recurrence for each technique used for the treatment of hemorrhoidal disease: conventional, stapled and dearterialization.

INITIAL RESULTS WITH THD/HAL

When we look at the studies published in the first 12 years following Morinaga's publication, only ligation was performed (without anopexy). It was only in 2007 when a modification of the technique was made, with additional anopexy for patients with prolapse[7]. Morinaga *et al*[3] reported this first series with 112 patients, obtaining satisfactory results in 78% of patients with prolapse, as well as resolution of pain in 96% of patients and of bleeding in 95%.

After 6 years, Sohn *et al*[8] published another series of patients treated with hemorrhoidal ligation in 2001. Sixty patients were submitted to a procedure (THD) based on the principles described by Morinaga, and the authors achieved complete success in 92% of patients with prolapse, 88% of those with bleeding and 71% of those with pain. Early postoperative pain, precluding normal activities, was reported in only 8% of patients.

Giordano *et al*[9] published the first systematic review concerning THD/DG-HAL in 2009, analyzing 17 papers from 1995 to 2008. In all articles revised no anopexy was performed. The rate of recurrent prolapse varied between 0% and 37%. In the study where this recurrence rate of 37% was found, most patients were lost to follow up, which might have interfered in the results[10]. The overall rate of prolapse, according to the review, was 9%. Regarding recurrent anal bleeding, the rates ranged between 0% and 21% in those 17 studies, with most papers reporting rates around 4% to 10%. The overall rate of recurrent bleeding, also according with this systematic review, is 7.8%. Early post-operative pain was reported in 18% of patients in

Table 1 Rates of success, post-operative pain and long-term recurrence after different techniques for treatment of hemorrhoidal disease

Technique	Symptom control	Post-operative pain	Recurrence
Conventional hemorrhoidectomy	95%	70%-75%	5%
Stapled hemorrhoidectomy	85%-90%	5%-20%	2%-24%
THD/DG-HAL	80%-95%	2%-20%	8%-10%
THD/DG-HAL + Anopexy	85%-95%	6%-50%	8%

THD: Transanal hemorrhoidal dearterialization; DG-HAL: Doppler-guided hemorrhoidal artery ligation.

the review.

ADDITIONAL ANOPEXY

In 2007, Dal Monte *et al*[7] were the first to describe a modification of THD/HAL, adding anopexy of the cushions where prolapse was found. They included patients with hemorrhoidal disease grades Ⅱ to Ⅳ, and anopexy was performed in a group of patients with disease grades Ⅲ and Ⅳ. They compared the latter with patients not submitted to anopexy and there was a tendency of worse prolapse relapse without anopexy, although not statistically significant.

Technical aspects of anopexy consist of extending the suture in a continuous manner after the first figure-of-eight stitch, involving mucosa more superficially than the first stitch, until above the pectinate line. The exact point where the suture is to be ended is identified with an audible Doppler signal before the sutures are done. The rationale of this modification was to treat prolapse at the same procedure.

Infantino *et al*[11] published a multicentric study showing results of the modified technique, treating grades Ⅱ and Ⅲ hemorrhoids. Their recurrence rate was 14.3% and patient satisfaction after 15 mo was 87%. Other 4 papers in 2009 and 2010 showed prolapse recurrence in 5%-17%[12-15].

Several articles on THD/DGHAL with anopexy were published, and the reported prolapse recurrence rates ranged between 3% and 21% and satisfaction rates of 84% to 96%, with follow ups of until 3 to 37 mo[12-14,16-24]. Scheyer *et al*[25] reported good results with Dearterialization and anopexy, but in their conclusion results were not good when prolapse was not the main complaint. In one of the most recent papers on the matter, Ratto *et al*[26] reported a recurrence of prolapse in only 6.3% and a satisfaction rate of 90% after a 11 mo follow up. In this series, 13% of patients suffered pain or tenesmus after surgery.

THD/HAL IN THE TREATMENT OF GRADE IV HEMORRHOIDAL DISEASE

Results of this treatment in patients with high-grade disease (grade Ⅳ) seem to be satisfactory in terms of prolapse resolution.

Two series were published involving only patients with grade Ⅳ disease. In both studies anopexy was performed in addition of hemorrhoidal ligation. Giordano *et al*[19] found an incidence of pain in 70% of patients in the first postoperative day, tenesmus in 10%, but a recurrence of prolapse of only 3% after a follow up of almost 3 years. Faucheron *et al*[22] reported postoperative pain in only 6% of patients, tenesmus in 1% and recurrence of prolapse in 9% after 34-mo follow up.

COMPARATIVE STUDIES WITH SH

Ramírez *et al*[27] were the first to publish a randomized trial comparing THD and PPH in 2005. Several other studies compared both techniques from 2009 until 2014. Festen *et al*[28] published a series comparing 18 patients submitted to stapled hemorroidopexy and 23 patients submitted to THD. After a very short follow up of only 3 wk, THD patients had less pain in the first week, with similar results after 3 wk. Symptoms resolution was also similar between groups[28].

Three studies found that THD patients had an earlier return to normal activities[29-31]. Tsang *et al*[31] found similar complication rates and similar satisfaction rates but follow up after procedures was very different (8 mo after THD and 36 mo after SH). Verre *et al*[32] published a prospective randomized trial in 2013, with 7.9% bleeding rate after SH and none after THD. Postoperative pain was lower in THD group although not statistically significant.

Lucarelli *et al*[33] reported a randomized trial with long-term follow up, where recurrent prolapse was the primary outcome, after a follow up of 40-43 mo. The technique performed in their study was THD with anopexy *vs* stapled hemorrhoidopexy. The last follow up was done through a telephone interview, with reports of prolapse recurrence in 25% of patients in the THD group *vs* 8.2% (P = 0.021) in the SH group. In spite of that, patient satisfaction was 73% in THD group *vs* 86.9% in the SH group. One might argue about detecting recurrence of prolapse by phone interviews, when one study by Ratto *et al*[13] showed that patients misreported skin tags for prolapse, after a physical examination took place.

As in the study by Infantino *et al*[34], Lucarelli *et al*[33] did not find significant difference in levels of post-operative pain. Other studies have found lower pain levels after THD when compared to stapled hemorrhoidopexy[30,31,35] while in some it was a trend in the group submitted to THD but did not reach statistical significance[28,29,32].

Giordano *et al*[29] compared THD *vs* SH for grades Ⅱ and Ⅲ, and reported a recurrence of symptoms recurrence of 14% *vs* 13%, while satisfaction was also similar between groups (89% *vs* 87%), respectively. THD technique comprised also anopexy in this study. There were no reports of fecal incontinence in both

groups.

A systematic review included 3 trials comparing these techniques, with a total of 150 patients concluded that both techniques were effective, but THD patients had less immediate postoperative pain[36].

COMPARISON WITH CH

In our literature search, three studies were found comparing Dearterialization and CH.

In a non-blind randomized study, Elmér *et al*[37] compared 20 patients in each group. Although patients presented less postoperative pain after THD, symptoms were effectively controlled in both groups after long-term follow-up.

Bursics *et al*[38] randomized 60 patients in 2 groups and also showed similar results after 12 mo of follow up. THD group had an earlier return to normal activities ($P < 0.0005$) and less post-operative pain ($P < 0.005$). Another randomized trial was published recently, with a follow up of 24 mo, showing no difference between groups in terms of postoperative pain in the first month after surgery or regarding resumption of normal activities. Patient satisfaction in the end of follow up was also similar between THD and CH ($P > 0.05$)[39].

Denoya *et al*[40] published the article with the longest follow up, 3 years. Forty patients were randomized in each group, and they also found similar results regarding resolution of symptoms and patient satisfaction.

RESULTS REGARDING ANAL PHYSIOLOGY

According to Walega *et al*[41], resting and squeeze pressures following DG-RAR were lower 3 mo after surgery comparing to pre-operative measures ($P < 0.05$) and this result was maintained after 12 mo after surgery.

In their comparative article, Giordano *et al*[29], found no complaint of incontinence after THD or SH. Only 2 patients in the SH group ($n = 24$) complained of transient urgency. Tsang *et al*[31] described 1 case of incontinence in SH group ($n = 37$) and none in THD group ($P = 0.111$).

In the systematic review by Giordano *et al*[9] the overall incontinence rate after THD was 0.4%.

IMPORTANT CONSIDERATIONS

Morinaga *et al*[3] described Doppler arterial hemorrhoidal ligation in 1995 as a novel treatment for hemorrhoids. This technique has become more popular and, nowadays, it is used worldwide. It is based on the premise that arterial ligation would lead to a lesser pressure on the vessels on the anal canal, thus relieving the symptoms as bleeding and prolapse. Initial articles reporting this technique showed satisfactory results. On 2007 Dal Monte *et al*[7] were the first to publish a modification on the described technique, including anopexy in order to better treat prolapse for 3rd and 4th grade hemorrhoids. With this, treatment of prolapse associated with 3rd and 4th grade hemorrhoids was guaranteed and recurrence rates were better.

One of the main advantages of the THD/DG-HAL is the low morbidity rate. After CH pain can be an important distress for the patient, influencing return to normal activities. Postoperative pain seems to be lower after THD when compared to CH, as seem in comparative studies[37,38,40]. In a systematic review concerning THD, 18.5% of patients suffered from pain in the first operative day[9]. Although this review points out that published data on THD was low quality, thus low significance/power, many studies evaluating this technique showed good results in short-term follow-up, with immediate postoperative bleeding occurring in 0%-8% and recurrence of 3%-20%.

Some works show a high recurrence rate related to grade Ⅲ or Ⅳ hemorrhoids[10,42,43], but those studies were done before the anopexy was associated with the arterial ligation. The study with the longest follow up showed a trend to higher recurrence rate for grade Ⅲ hemorrhoids compared to grade Ⅱ after 5 years, but the difference was not statistically significant[42]. Two studies involving patients only with grade Ⅳ hemorrhoidal disease showed a recurrence of 3%-9% after a follow up of almost 3 years.

SH was first described by Longo[4] in 1998 and is also a non-excisional technique for the treatment of hemorrhoidal disease. As THD, the goal is to treat hemorrhoids without the risk of sphincter impairment and to reduce postoperative pain. However, serious complications after SH, such as major bleeding, rectovaginal fistulas and perianal sepsis, have been described[44]. One study prospectively comparing SH and THD for grades Ⅱ and Ⅲ hemorrhoidal disease showed no difference regarding recurrent symptoms or patients' satisfaction with their results[29].

Regarding anal physiology, it seems reasonable to believe that hemorrhoidal dearterialization may contribute with only minor disruption of continence, since there is no risk of anal sphincter damage. On the other hand, the technique affects hemorrhoidal cushions in the anal canal, which play a role in anal continence as well. At the same time, all techniques interfere with the cushions, since it is the goal of the treatment. Maybe due to the fact that THD is a non-excisional technique, the impact after surgery might be reduced compared to excisional techniques.

Incontinence is rarely described, and when it happens it is transitory. More important is the complaint of tenesmus after THD surgery, which is rather common, in about 10% of patients, but also transitory. In a study by Ratto *et al*[13], tenesmus was reported by 24% of patients but symptoms disappeared 10 d following surgery. Even though alterations in resting

and squeeze anal pressures might be seen in anorectal manometry after THD, there is no evidence of risk of incontinence with this procedure[41].

In conclusion, Doppler-guided hemorrhoidal dearterialization is a safe and effective method to treat grades II to IV hemorrhoidal disease. Outcomes in patients presenting prolapse are satisfactory and the association of anopexy has become an important aspect of this operation, contributing to a higher success rate. Anal physiology disturbances are rarely observed and are transitory. This technique is an excellent option for every patient, especially in those with previous anal surgeries and in patients with previous alterations of fecal continence, when an additional procedure might represent a risk of definitive incontinence.

REFERENCES

1 **Milligan E**, Morgan C, Jones L, Officer R. Surgical anatomy of the anal canal and the operative treatment of haemorrhoids. *The Lancet* 1937; **2**: 1119-1123 [DOI: 10.1016/S0140-6736(00)88465-2]

2 **Ferguson JA**, Heaton JR. Closed hemorrhoidectomy. *Dis Colon Rectum* 1959; **2**: 176-179 [PMID: 13652788]

3 **Morinaga K**, Hasuda K, Ikeda T. A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. *Am J Gastroenterol* 1995; **90**: 610-613 [PMID: 7717320]

4 **Longo A**. Treatment of hemorrhoidal disease by reduction of mucosa and hemorrhoidal prolapse with a circular-suturing device: a new procedure. Proceedings of the 6th World Congress of Endoscopic Surgery. Italy: Rome, 1998: 777-784

5 **Jaspersen D**, Koerner T, Schorr W, Hammar CH. Proctoscopic Doppler ultrasound in diagnostics and treatment of bleeding hemorrhoids. *Dis Colon Rectum* 1993; **36**: 942-945 [PMID: 8404386]

6 **Ratto C**, Parello A, Donisi L, Litta F, Zaccone G, Doglietto GB. Assessment of haemorrhoidal artery network using colour duplex imaging and clinical implications. *Br J Surg* 2012; **99**: 112-118 [PMID: 22021046 DOI: 10.1002/bjs.7700]

7 **Dal Monte PP**, Tagariello C, Sarago M, Giordano P, Shafi A, Cudazzo E, Franzini M. Transanal haemorrhoidal dearterialisation: nonexcisional surgery for the treatment of haemorrhoidal disease. *Tech Coloproctol* 2007; **11**: 333-338; discussion 338-339 [PMID: 18060529]

8 **Sohn N**, Aronoff JS, Cohen FS, Weinstein MA. Transanal hemorrhoidal dearterialization is an alternative to operative hemorrhoidectomy. *Am J Surg* 2001; **182**: 515-519 [PMID: 11754861]

9 **Giordano P**, Overton J, Madeddu F, Zaman S, Gravante G. Transanal hemorrhoidal dearterialization: a systematic review. *Dis Colon Rectum* 2009; **52**: 1665-1671 [PMID: 19690499 DOI: 10.1007/DCR.0b013e3181af50f4]

10 **Scheyer M**, Antonietti E, Rollinger G, Mall H, Arnold S. Doppler-guided hemorrhoidal artery ligation. *Am J Surg* 2006; **191**: 89-93 [PMID: 16399113]

11 **Infantino A**, Bellomo R, Dal Monte PP, Salafia C, Tagariello C, Tonizzo CA, Spazzafumo L, Romano G, Altomare DF. Transanal haemorrhoidal artery echodoppler ligation and anopexy (THD) is effective for II and III degree haemorrhoids: a prospective multicentric study. *Colorectal Dis* 2010; **12**: 804-809 [PMID: 19508513 DOI: 10.1111/j.1463-1318.2009.01915.x]

12 **Walega P**, Krokowicz P, Romaniszyn M, Kenig J, Sałówka J, Nowakowski M, Herman RM, Nowak W. Doppler guided haemorrhoidal arterial ligation with recto-anal-repair (RAR) for the treatment of advanced haemorrhoidal disease. *Colorectal Dis* 2010; **12**: e326-e329 [PMID: 19674029 DOI: 10.1111/j.1463-1318.2009.02034.x]

13 **Ratto C**, Donisi L, Parello A, Litta F, Doglietto GB. Evaluation of transanal hemorrhoidal dearterialization as a minimally invasive therapeutic approach to hemorrhoids. *Dis Colon Rectum* 2010; **53**: 803-811 [PMID: 20389215 DOI: 10.1007/DCR.0b013e3181cdafa7]

14 **Satzinger U**, Feil W, Glaser K. Recto Anal Repair (RAR): a viable new treatment option for high-grade hemorrhoids. One year results of a prospective study. *Pelviperineology* 2009; **28**: 37-42

15 **Testa A**, Torino G, Gioia A. DG-RAR (Doppler-guided recto-anal repair): a new mini invasive technique in the treatment of prolapsed hemorrhoids (grade III-IV): preliminary report. *Int Surg* 2010; **95**: 265-269 [PMID: 21067008]

16 **LaBella GD**, Main WP, Hussain LR. Evaluation of transanal hemorrhoidal dearterialization: a single surgeon experience. *Tech Coloproctol* 2015; **19**: 153-157 [PMID: 25637412 DOI: 10.1007/s10151-015-1269-6]

17 **Deutsch CJ**, Chan K, Alawattegama H, Sturgess J, Davies RJ. Doppler-Guided Transanal Haemorrhoidal Dearterialisation Is a Safe and Effective Daycase Procedure for All Grades of Symptomatic Haemorrhoids. *Surgical Science* 2012; **3**: 542-545 [DOI: 10.4236/ss.2012.311107]

18 **Ratto C**. THD Doppler procedure for hemorrhoids: the surgical technique. *Tech Coloproctol* 2014; **18**: 291-298 [PMID: 24026315 DOI: 10.1007/s10151-013-1062-3]

19 **Giordano P**, Tomasi I, Pascariello A, Mills E, Elahi S. Transanal dearterialization with targeted mucopexy is effective for advanced haemorrhoids. *Colorectal Dis* 2014; **16**: 373-376 [PMID: 24460621 DOI: 10.1111/codi.12574]

20 **Ratto C**, Giordano P, Donisi L, Parello A, Litta F, Doglietto GB. Transanal haemorrhoidal dearterialization (THD) for selected fourth-degree haemorrhoids. *Tech Coloproctol* 2011; **15**: 191-197 [PMID: 21505901 DOI: 10.1007/s10151-011-0689-1]

21 **Szmulowicz UM**, Gurland B, Garofalo T, Zutshi M. Doppler-guided hemorrhoidal artery ligation: the experience of a single institution. *J Gastrointest Surg* 2011; **15**: 803-808 [PMID: 21359596 DOI: 10.1007/s11605-011-1460-7]

22 **Faucheron JL**, Poncet G, Voirin D, Badic B, Gangner Y. Doppler-guided hemorrhoidal artery ligation and rectoanal repair (HAL-RAR) for the treatment of grade IV hemorrhoids: long-term results in 100 consecutive patients. *Dis Colon Rectum* 2011; **54**: 226-231 [PMID: 21228673 DOI: 10.1007/DCR.0b013e318201d31c]

23 **Theodoropoulos GE**, Sevrisarianos N, Papaconstantinou J, Panoussopoulos SG, Dardamanis D, Stamopoulos P, Bramis K, Spiliotis J, Datsis A, Leandros E. Doppler-guided haemorrhoidal artery ligation, rectoanal repair, sutured haemorrhoidopexy and minimal mucocutaneous excision for grades III-IV haemorrhoids: a multicenter prospective study of safety and efficacy. *Colorectal Dis* 2010; **12**: 125-134 [PMID: 19055522 DOI: 10.1111/j.1463-1318.2008.01739.x]

24 **Testa A**, Torino G. Doppler-guided hemorrhoidal artery ligation (DG-HAL): a safe treatment of II-III degree hemorrhoids for all patients. Could it be potentially also good prophylaxis? *Minerva Chir* 2010; **65**: 259-265 [PMID: 20668415]

25 **Scheyer M**, Antonietti E, Rollinger G, Lancee S, Pokorny H. Hemorrhoidal artery ligation (HAL) and rectoanal repair (RAR): retrospective analysis of 408 patients in a single center. *Tech Coloproctol* 2015; **19**: 5-9 [PMID: 25407664 DOI: 10.1007/s10151-014-1246-5]

26 **Ratto C**, de Parades V. Doppler-guided ligation of hemorrhoidal arteries with mucopexy: A technique for the future. *J Visc Surg* 2015; **152**: S15-S21 [PMID: 25262549 DOI: 10.1016/j.jviscsurg.2014.08.003]

27 **Ramírez JM**, Aguilella V, Elía M, Gracia JA, Martínez M. Doppler-guided hemorrhoidal artery ligation in the management of symptomatic hemorrhoids. *Rev Esp Enferm Dig* 2005; **97**: 97-103 [PMID: 15801885]

28 **Festen S**, van Hoogstraten MJ, van Geloven AA, Gerhards MF. Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results. *Int J Colorectal Dis* 2009; **24**: 1401-1405 [PMID: 19798507 DOI: 10.1007/s00384-009-0803-2]

29 **Giordano P**, Nastro P, Davies A, Gravante G. Prospective

evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: three-year outcomes. *Tech Coloproctol* 2011; **15**: 67-73 [PMID: 21318581 DOI: 10.1007/s10151-010-0667-z]

30 **Avital S**, Itah R, Skornick Y, Greenberg R. Outcome of stapled hemorrhoidopexy versus doppler-guided hemorrhoidal artery ligation for grade III hemorrhoids. *Tech Coloproctol* 2011; **15**: 267-271 [PMID: 21678068 DOI: 10.1007/s10151-011-0699-z]

31 **Tsang YP**, Fok KL, Cheung YS, Li KW, Tang CN. Comparison of transanal haemorrhoidal dearterialisation and stapled haemorrhoidopexy in management of haemorrhoidal disease: a retrospective study and literature review. *Tech Coloproctol* 2014; **18**: 1017-1022 [PMID: 24906978 DOI: 10.1007/s10151-014-1170-8]

32 **Verre L**, Rossi R, Gaggelli I, Di Bella C, Tirone A, Piccolomini A. PPH versus THD: a comparison of two techniques for III and IV degree haemorrhoids. Personal experience. *Minerva Chir* 2013; **68**: 543-550 [PMID: 24193286]

33 **Lucarelli P**, Picchio M, Caporossi M, De Angelis F, Di Filippo A, Stipa F, Spaziani E. Transanal haemorrhoidal dearterialisation with mucopexy versus stapler haemorrhoidopexy: a randomised trial with long-term follow-up. *Ann R Coll Surg Engl* 2013; **95**: 246-251 [PMID: 23676807 DOI: 10.1308/003588413X13511609958136]

34 **Infantino A**, Altomare DF, Bottini C, Bonanno M, Mancini S, Yalti T, Giamundo P, Hoch J, El Gaddal A, Pagano C. Prospective randomized multicentre study comparing stapler haemorrhoidopexy with Doppler-guided transanal haemorrhoid dearterialization for third-degree haemorrhoids. *Colorectal Dis* 2012; **14**: 205-211 [PMID: 21689317 DOI: 10.1111/j.1463-1318.2011.02628.x]

35 **Béliard A**, Labbé F, de Faucal D, Fabreguette JM, Pouderoux P, Borie F. A prospective and comparative study between stapled hemorrhoidopexy and hemorrhoidal artery ligation with mucopexy. *J Visc Surg* 2014; **151**: 257-262

36 **Sajid MS**, Parampalli U, Whitehouse P, Sains P, McFall MR, Baig MK. A systematic review comparing transanal haemorrhoidal de-arterialisation to stapled haemorrhoidopexy in the management of haemorrhoidal disease. *Tech Coloproctol* 2012; **16**: 1-8 [PMID: 22183450 DOI: 10.1007/s10151-011-0796-z]

37 **Elmér SE**, Nygren JO, Lenander CE. A randomized trial of transanal hemorrhoidal dearterialization with anopexy compared with open hemorrhoidectomy in the treatment of hemorrhoids. *Dis Colon Rectum* 2013; **56**: 484-490 [PMID: 23478616 DOI: 10.1097/DCR.0b013e31827a8567]

38 **Bursics A**, Morvay K, Kupcsulik P, Flautner L. Comparison of early and 1-year follow-up results of conventional hemorrhoidectomy and hemorrhoid artery ligation: a randomized study. *Int J Colorectal Dis* 2004; **19**: 176-180 [PMID: 12845454]

39 **De Nardi P**, Capretti G, Corsaro A, Staudacher C. A prospective, randomized trial comparing the short- and long-term results of doppler-guided transanal hemorrhoid dearterialization with mucopexy versus excision hemorrhoidectomy for grade III hemorrhoids. *Dis Colon Rectum* 2014; **57**: 348-353 [PMID: 24509458 DOI: 10.1097/DCR.0000000000000085]

40 **Denoya P**, Tam J, Bergamaschi R. Hemorrhoidal dearterialization with mucopexy versus hemorrhoidectomy: 3-year follow-up assessment of a randomized controlled trial. *Tech Coloproctol* 2014; **18**: 1081-1085 [PMID: 25248418 DOI: 10.1007/s10151-014-1219-8]

41 **Walega P**, Romaniszyn M, Kenig J, Herman R, Nowak W. Doppler-guided hemorrhoid artery ligation with Recto-Anal-Repair modification: functional evaluation and safety assessment of a new minimally invasive method of treatment of advanced hemorrhoidal disease. *ScientificWorldJournal* 2012; **2012**: 324040 [PMID: 22547979]

42 **Avital S**, Inbar R, Karin E, Greenberg R. Five-year follow-up of Doppler-guided hemorrhoidal artery ligation. *Tech Coloproctol* 2012; **16**: 61-65 [PMID: 22190190]

43 **Conaghan P**, Farouk R. Doppler-guided hemorrhoid artery ligation reduces the need for conventional hemorrhoid surgery in patients who fail rubber band ligation treatment. *Dis Colon Rectum* 2009; **52**: 127-130 [PMID: 19273967 DOI: 10.1007/DCR.0b013e3181973639]

44 **Pescatori M**, Gagliardi G. Postoperative complications after procedure for prolapsed hemorrhoids (PPH) and stapled transanal rectal resection (STARR) procedures. *Tech Coloproctol* 2008; **12**: 7-19 [PMID: 18512007 DOI: 10.1007/s10151-008-0391-0]

P- Reviewer: Widmann G, Zampieri N **S- Editor**: Ji FF
L- Editor: A **E- Editor**: Wu HL

2014

Authors: **Denoya** P., **Tam** J., **Bergamaschi** R.

Source: Tech Coloproctol 2014 Sept. 24.

Available for Open Online Access

Title: Hemorrhoidal dearterialization with mucopexy versus hemorrhoidectomy: 3-year follow-up assessment of a randomized controlled trial

BACKGROUND:

A randomized controlled trial showed that patients with grade III or IV internal hemorrhoids had similar symptomatic relief of symptoms up to 3 months following dearterialization with mucopexy or hemorrhoidectomy albeit with less postoperative pain after the former. This study aimed to compare hemorrhoidal recurrence and chronic complications at 3-year follow-up.

METHODS:

This study was carried out on 40 patients with grade III or IV internal hemorrhoids previously enrolled to a randomized trial comparing dearterialization to hemorrhoidectomy. Recurrence was defined as internal hemorrhoids diagnosed on proctoscopy. Chronic complications were nonresolving adverse events related to surgery. Outcome measures included patient-reported outcomes and quality of life measured by brief pain inventory (BPI), SF-12, and fecal incontinence surveys.

RESULTS:

At median follow-up of 36 (27-43) months, 13 patients (32.5 %) were lost to follow-up. Patient-reported outcomes suggested no difference between dearterialization and hemorrhoidectomy in persistent symptoms, occurring in 1 (8.3 %) vs. 2 (13.3 %) patients ($p = 0.681$) and in symptom recurrence, occurring in 6 (50 %) vs. 4 (26.7 %) patients ($p = 0.212$). On proctoscopy, recurrence was seen in 2 (13.3 %) vs. 1 (6.7 %) patients ($p = 0.411$), all with index grade IV disease. One patient in each arm required reoperation ($p = 0.869$). Chronic complications were not seen in the dearterialization arm while they occurred in 2 (13.3 %) hemorrhoidectomy patients ($p = 0.189$) and included unhealed wound ($n = 1$), anal fissure ($n = 1$) and fecal incontinence ($n = 1$). There was a trend toward more patient reported than actual recurrence on proctoscopy (10 vs. 3, $p = 0.259$). There was no difference in BPI, SF-12, and fecal incontinence quality of life scores.

CONCLUSION:

Recurrence rates did not differ significantly at 3-year follow-up and occurred in patients with index grade IV hemorrhoids. Chronic complications occurred only after hemorrhoidectomy.

Tech Coloproctol (2014) 18:1081–1085
DOI 10.1007/s10151-014-1219-8

ORIGINAL ARTICLE

Hemorrhoidal dearterialization with mucopexy versus hemorrhoidectomy: 3-year follow-up assessment of a randomized controlled trial

P. Denoya · J. Tam · R. Bergamaschi

Received: 15 July 2014 / Accepted: 15 September 2014 / Published online: 24 September 2014

Abstract
Background A randomized controlled trial showed that patients with grade III or IV internal hemorrhoids had similar symptomatic relief of symptoms up to 3 months following dearterialization with mucopexy or hemorrhoidectomy albeit with less postoperative pain after the former. This study aimed to compare hemorrhoidal recurrence and chronic complications at 3-year follow-up.
Methods This study was carried out on 40 patients with grade III or IV internal hemorrhoids previously enrolled to a randomized trial comparing dearterialization to hemorrhoidectomy. Recurrence was defined as internal hemorrhoids diagnosed on proctoscopy. Chronic complications were nonresolving adverse events related to surgery. Outcome measures included patient-reported outcomes and quality of life measured by brief pain inventory (BPI), SF-12, and fecal incontinence surveys.
Results At median follow-up of 36 (27–43) months, 13 patients (32.5 %) were lost to follow-up. Patient-reported outcomes suggested no difference between dearterialization and hemorrhoidectomy in persistent symptoms, occurring in 1 (8.3 %) vs. 2 (13.3 %) patients ($p = 0.681$) and in symptom recurrence, occurring in 6 (50 %) vs. 4 (26.7 %) patients ($p = 0.212$). On proctoscopy, recurrence was seen in 2 (13.3 %) vs. 1 (6.7 %) patients ($p = 0.411$), all with index grade IV disease. One patient in each arm required reoperation ($p = 0.869$). Chronic complications were not seen in the dearterialization arm while they occurred in 2 (13.3 %) hemorrhoidectomy patients ($p = 0.189$) and included unhealed wound ($n = 1$), anal fissure ($n = 1$) and fecal incontinence ($n = 1$). There was a trend toward more patient reported than actual recurrence on proctoscopy (10 vs. 3, $p = 0.259$). There was no difference in BPI, SF-12, and fecal incontinence quality of life scores.
Conclusions Recurrence rates did not differ significantly at 3-year follow-up and occurred in patients with index grade IV hemorrhoids. Chronic complications occurred only after hemorrhoidectomy.

Keywords Hemorrhoids · Ligation · Doppler · Dearterialization

P. Denoya · J. Tam · R. Bergamaschi (✉)
Division of Colon and Rectal Surgery, Health Science Center, State University of New York, T18, Suite 046B, Stony Brook, NY 11794-8191, USA
e-mail: rcmbergamaschi@gmail.com

Introduction

Hemorrhoidal artery dearterialization was first described as a treatment for internal hemorrhoids in 1995 by Morinaga [1] and has been popularized over the last decade with the development of specialized anoscopes, which facilitate this procedure. However, there is still controversy and skepticism surrounding this procedure as an alternative to hemorrhoidectomy or stapled hemorrhoidopexy. While there is a sufficient short-term data in the surgical literature, long-term data and randomized data are lacking. While three quadrant excisional hemorrhoidectomy is considered the gold standard procedure for advanced hemorrhoidal disease, it is not a perfect operation. There is a significant pain and morbidity in the short term, and recurrence and chronic complications are reported in the long term. A British study with 17-year follow-up reported 26 % recurrence of hemorrhoids after excisional hemorrhoidectomy [2], and another study with median of 7-year follow-up reported that 40 % of patients complained of recurrent symptoms and 4 % developed anal strictures [3]. In 2013, we published the short-term results of a randomized controlled

study treating grade III and IV internal hemorrhoids with either hemorrhoidal dearterialization with mucopexy or Ferguson hemorrhoidectomy [4]. The study found less postoperative pain in the dearterialization patients and similar resolution of preoperative symptoms with up to 3-month follow-up. The aim of this study is to report and characterize the long-term results of these two techniques.

Methods

Study design

This was a follow-up study performed by telephone survey of patients who underwent either hemorrhoidal dearterialization with mucopexy or excisional hemorrhoidectomy as part of a randomized double-blinded trial [4]. All the patients included in the study had grade III or IV internal hemorrhoids in a minimum of three quadrants. Grade III internal hemorrhoids prolapse but are reducible and grade IV internal hemorrhoids prolapse and are not reducible by the patient or do not remain reduced [5]. Diagnosis was established by examination and anoscopy or proctoscopy by a colorectal surgeon. As patients often present with anorectal symptoms, which may be due to causes other than internal hemorrhoids, only patients who were symptomatic and were found to have grade III or IV internal hemorrhoids on examination were included in the study. This assured a reproducible patient population. Patients were excluded if they had undergone surgery for hemorrhoids previously. The procedures were performed under general anesthesia or intravenous sedation with local anesthetic infiltration, in the ambulatory surgery setting. Hemorrhoidal dearterialization with mucopexy was performed using the THD kit (THD Italy, Corregio, Italy). The surgical technique involves identifying six hemorrhoidal arteries by Doppler guidance and suture ligating each one separately with a 2–0 absorbable suture. The same suture is then used to perform the mucopexy up to 1 cm proximal to dentate line. This technique was described by Ratto et al. [6]. The hemorrhoidectomy was performed as described by Ferguson and Heaton [7]. Each hemorrhoid was excised by an elliptical incision under exposure by an anal retractor. The incision was extended cephalad. The hemorrhoidal pedicle was suture ligated, and the incision was closed primarily. Patients were all discharged to home on the same day, with a prescription for hydrocodone or oxycodone and instructions to use stool softeners, water baths, and laxatives. They were seen 2 weeks after surgery and followed routinely up to 3 months. Following that period, they were seen on an as needed basis.

Institutional review board approval was obtained for this study. Patients were contacted by telephone and asked to participate in the survey. The telephone surveys were conducted by a blinded research assistant, who also reviewed the chart for additional data. Patients who reported continued or recurrent anal symptoms were asked to return to the office for examination by the surgeon.

Study endpoints

The primary endpoint for this study was rate of recurrence of internal hemorrhoids. Recurrence was defined as internal hemorrhoids seen by the colorectal surgeon on anoscopic or proctoscopic examination in patients who were symptomatic. Additional endpoints examined included chronic complications, need for reoperations, and patient-reported outcomes such as anal pain, anal bleeding, other anal symptoms, current level of pain, level of fecal continence, and overall quality of life. Chronic complications included anal stenosis, unhealed wounds, and anal fissures persistent since surgery, and fecal incontinence developing immediately after surgery. Current level of pain was measured using the brief pain inventory (BPI), which is a validated pain assessment tool based on the Wisconsin Brief Pain questionnaire [8–10]. Fecal continence was measured using the Fecal Incontinence Quality of Life tool [11]. Overall quality of life was measured using the SF-12 tool [12].

Statistical methods

Patient data were entered into a Microsoft Excel© spreadsheet. SPSS© software was used to analyze the data. Pearson's chi-squared test was used for categorical data, and Student's t test was used for continuous data. Significance was predetermined at $\alpha = 0.05$.

Results

Of the original 40 patients, 12 were lost to follow-up and 1 dearterialization patient refused to participate, resulting in a 68 % retention rate. A total of 12 dearterialization patients and 15 hemorrhoidectomy patients were included in the study. The median follow-up was 35 months (range 27–43). The two arms of patients had similar demographics except for gender distribution (42 vs. 94 % male, $p = 0.003$). Demographics are summarized in Table 1.

Table 1 Demographics

	Dearterialization $n = 12$	Hemorrhoidectomy $n = 15$	*P*
Gender	5 (41.7 %)	14 (93.9 %)	0.003
Age at index surgery	53.8 ± 8.8	53.1 ± 9.0	0.854
BMI	28.5 ± 6.9	29.3 ± 5.6	0.732
ASA	2.1 ± 0.3	1.9 ± 0.5	0.333

Table 2 Physician-reported recurrence of internal hemorrhoids

	Dearterialization $n = 12$ (%)	Hemorrhoidectomy $n = 15$ (%)	P
Recurrence of internal hemorrhoids	2 (16.7)	1 (6.7)	0.411
Treated by intervention	1 (8.3)	1 (6.7)	0.869
THD	1 (8.3)	0 (0.0)	0.255
Ferguson	0 (0.0)	1 (6.7)	0.362
Nonoperative management	1 (8.3)	0 (0.0)	0.255

Table 3 Physician-reported chronic complications

	Dearterialization $n = 12$ (%)	Hemorrhoidectomy $n = 15$ (%)	P
Any complication	0 (0.0)	2 (13.3)	0.189
Anal stenosis	0 (0.0)	0 (0.0)	–
Unhealed wound	0 (0.0)	1 (6.7)*	0.362
Fissure	0 (0.0)	1 (6.7)	0.362
Fecal incontinence	0 (0.0)	1 (6.7)*	0.362

* Same patient

All of the patients who reported recurrent or persistent anorectal symptoms on the telephone survey returned to the office for examination. Recurrence of internal hemorrhoids was found on physician examination in two dearterialization patients and one hemorrhoidectomy patient (16.7 vs. 6.7 %, $p = 0.411$). One dearterialization patient was found to have a single grade III internal hemorrhoid, which was treated with repeat dearterialization, and the other patient had recurrent grade IV hemorrhoids and opted for nonoperative management with stool softener and fiber supplementation. The patient who recurred after hemorrhoidectomy was found to have grade IV hemorrhoids and was treated with repeat hemorrhoidectomy. This patient had three very large prolapsing hemorrhoids at the index operation. On examination at the time of recurrence, he again had three large prolapsing hemorrhoids and significant bleeding requiring blood transfusion. These results are summarized in Table 2. All three patients who had a recurrence had grade IV internal hemorrhoids prior to the index surgery. Additional findings reported on physician examination were external residual skin tags in five dearterialization patients and one hemorrhoidectomy patient. Chronic complications were reported in no dearterialization patients and two hemorrhoidectomy patients (Table 3). These included an unhealed wound in one patient and a fissure and fecal incontinence in another.

Table 4 Patient-reported outcomes

	Dearterialization $n = 12$ (%)	Hemorrhoidectomy $n = 15$ (%)	P
Symptoms never went away	1 (8.3)	2 (13.3)	0.681
Pt reported recurrence of hemorrhoids	6 (50.0)	4 (26.7)	0.212
Anal pain	1 (8.3)	1 (6.7)	0.869
Anal bleeding	2 (16.7)	2 (13.3)	0.809
Anal itching	1 (8.3)	0 (0.0)	0.255

Table 5 Functional data

	Dearterialization $n = 12$	Hemorrhoidectomy $n = 15$	P
BPI pain severity	0.25 ± 0.62	0.60 ± 1.60	0.481
BPI pain interference	0.08 ± 0.29	0.40 ± 0.91	0.259
FIQOL			
Lifestyle	1.18 ± 0.60	1.13 ± 0.52	0.827
Coping	1.27 ± 0.91	1.13 ± 0.52	0.623
Depression	1.18 ± 0.60	1.20 ± 0.56	0.938
Embarrassment	1.27 ± 0.91	1.13 ± 0.52	0.623
SF-12			
PCS	56.09 ± 2.59	55.47 ± 3.31	0.609
MCS	55.09 ± 6.91	55.80 ± 6.86	0.797

In the telephone survey results, one dearterialization patient and two hemorrhoidectomy patients reported that the symptoms for which they had surgery never resolved ($p = 0.681$). Six dearterialization patients and four hemorrhoidectomy patients reported recurrent symptoms, including anal pain, bleeding, and itching ($p = 0.212$). (Table 4) These symptoms were treated with stool softeners, fiber supplements, warm water baths, and ointments, or suppositories. Interestingly, there was a difference between patient-reported recurrent symptoms (10) and actual confirmation of recurrent internal hemorrhoids (3) by a physician ($p = 0.259$), though it was not statistically significant.

The BPI was used to assess current pain in the patients. Results were similar in both pain severity ($p = 0.481$) and interference in lifestyle due to pain ($p = 0.259$) between the two arms. Quality of life was assessed both in terms of overall quality (SF-12) and in terms of incontinence (FIQOL). In both scales, the quality of life results were similar in both arms of the study. Results are summarized in Table 5.

Discussion

The gold standard surgical treatment for hemorrhoids is excisional hemorrhoidectomy. While this method seems to have the best long-term result in terms of recurrence of disease, it has several drawbacks. These include significant postoperative pain, bleeding, constipation, urinary retention, and long-term complications such as anal stenosis, nonhealing wounds, residual skin tags, and anal incontinence. Surgeons have developed several less invasive procedures in the search for a balance between acceptable relief of symptoms and less postoperative pain and other complications. As with all new procedures, long-term results take years to study, and the technology often becomes accepted into practice without knowing how the procedure will hold up to the test of time.

Hemorrhoidal artery dearterialization was described two decades ago, but did not become popular until more recently; therefore, long-term results are not widely available. Additionally, many different terms are used to describe essentially the same procedure in the literature. In order to identify studies reporting on this procedure, one must use multiple terms, including combinations of "transanal hemorrhoidal dearterialization (THD)," "Doppler-guided hemorrhoidal artery ligation (DGHAL)," "mucopexy," "anopexy," "suture mucosal pexy," and "rectoanal repair." Randomized trials or even comparative studies such as case–control retrospective series are rarely available.

Zampieri et al. [13] reported in 2012 on a randomized trial studying transanal hemorrhoidal dearterialization with proctopexy and ligasure hemorrhoidectomy. The study included 114 patients, and follow-up was 1 year. Follow-up was conducted by telephone interview. Patients included had at least grade III internal hemorrhoids. The primary-reported outcome was resolution of pain. At 6 months, THD patients had statistically significantly less pain than hemorrhoidectomy patients, but at 1 year, pain was similar between the two groups. Recurrence of internal hemorrhoids was not reported.

Another researcher randomized 40 patients to either THD with anopexy or hemorrhoidectomy [14]. All patients had grade II or III internal hemorrhoids. At 1-year follow-up, two patients who underwent THD had remaining grade III hemorrhoids and seven patients had grade II hemorrhoids, and one patient who underwent hemorrhoidectomy had remaining grade III hemorrhoids and three patients had Grade II hemorrhoids. This difference in residual hemorrhoids was not statistically significant between the groups.

Infantino et al. [15] randomized 167 patients to receive either stapled hemorrhoidopexy (PPH) or THD. All patients had grade III internal hemorrhoids. The authors report similar short-term complications, with long-term complications occurring only in the PPH group. They report persistence or recurrence of internal hemorrhoids in 14 % of THD patients and 7 % of PPH patients, which was not a statistically significant difference. The mean follow-up was 17 months.

Avital et al. [16] reported 5-year follow-up on 100 patients who underwent DGHAL without mucopexy by a single surgeon for grade II and III internal hemorrhoids. Ninety-six patients answered the survey at 1 year and 92 at 5 years. In total, 89 % were asymptomatic at 1 year and 73 % at 5 years. They found that most recurrences occurred during the first year after surgery, and there was a trend toward more recurrence in patients with grade III internal hemorrhoids.

Faucheron et al. [17] reported long-term results of 100 patients with grade IV internal hemorrhoids who underwent DGHAL with rectoanal repair. The patients were prospectively followed for a mean of 34 months. In total, 9 % had a recurrence of hemorrhoidal prolapse at 11 months. Treatment for recurrence included repeat DGHAL in three patients, hemorrhoidectomy in three patients, and nonoperative management in the other three patients.

De Nardi et al. [18] recently reported a randomized trial of 50 patients with grade III internal hemorrhoids who underwent either THD with mucopexy or hemorrhoidectomy. The study period was up to 24 months. The authors noted less pain in the THD arm in the first postoperative week, but no difference in pain thereafter. Regarding recurrent symptoms, both techniques were equivalent after 2 years of follow-up.

In this study, we report long-term results of a randomized trial of patients with grade III or IV internal hemorrhoids who underwent either transanal hemorrhoidal dearterialization (THD) with mucopexy or three quadrant excisional hemorrhoidectomy and were followed for a median of 35 months. The recurrence of internal hemorrhoids did not differ significantly between the two groups. Additionally, all the patients who recurred in both arms had grade IV internal hemorrhoids at the time of the index operation. Long-term complications, including unhealed wounds, fissures, and incontinence, were only found in patients who underwent hemorrhoidectomy, though this difference was not statistically significant. The patients themselves reported similar numbers of symptoms and recurrence in both arms, and quality of life and pain scores were similar in both arms as well.

This study has several weaknesses. We lost 13 patients from follow-up, which leads to lower numbers and selection bias. This is an unfortunate consequence of our patient population, which tends to change address or phone numbers frequently when compared to some European populations. However, this reflects the real-life scenario of any

long-term follow-up study in the USA. The demographics of the patients were similar in both arms except for gender distribution. Additionally, there were no changes in surgical technique during the study period, and the two surgeons involved performed both operations during the entire period of time. As with any long-term study, the patients themselves choose whether to participate in the survey or not, so this may lead to some selection or reporting bias. This may lead to over or under reporting of recurrences or complications depending on which patients choose to answer the questions. The total number of patients was small, so it is possible that in a larger patient population, the difference in recurrence of hemorrhoids would have been statistically significant. However, the number of patients included is similar to other two-arm studies.

However, the study has significant strengths. We compared two surgical treatments for hemorrhoids. We had strict definitions of the severity of disease being treated, as well as definitions of complications. We used validated means of collecting patient-reported outcomes, such as the BPI, SF-12 scale, and FIQOL questionnaire. The length of the follow-up period is almost 3 years, which makes this one of the longer studies reporting on hemorrhoidal dearterialization in the literature. As reported in several other studies, most recurrences occur within the first postoperative year, so it is safe to assume that 3-year follow-up is an adequate measure of success for this technique.

In conclusion, this study suggests that hemorrhoidal dearterialization with suture mucopexy is as good as hemorrhoidectomy in the longer term, both in terms of actual recurrence of internal hemorrhoids and in terms of patient satisfaction. It may be more appropriate for grade III internal hemorrhoids, but may successfully be used in grade IV disease as well. In addition, dearterialization is a safe procedure, which not only provides less postoperative pain in the short term, but also enjoys a low occurrence of chronic complications.

Conflict of interest None.

References

1. Morinaga K, Hasuda K, Ikeda T (1995) A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. Am J Gastroenterol 90:610–613
2. Konsten J, Baeten CG (2000) Hemorrhoidectomy vs. Lord's method: 17-year follow-up of a prospective, randomized trial. Dis Colon Rectum 43:503–506
3. Qarabaki MA, Mukhashavria GA, Mukhashavria GG, Giorgadze NG (2014) Circular vs. three-quadrant hemorrhoidectomy for end-stage hemorrhoids: short- and long-term outcomes of a prospective randomized trial. J Gastrointest Surg 18:808–815
4. Denoya PI, Fakhoury M, Chang K, Fakhoury J, Bergamaschi R (2013) Dearterialization with mucopexy versus haemorrhoidectomy for grade III or IV haemorrhoids: short-term results of a double-blind randomized controlled trial. Colorectal Dis 15:1281–1288
5. Corman ML (2013) Corman's colon and rectal surgery. In: Editor (ed) Book corman's colon and rectal surgery, 6 edn. City: Lippincott Williams & Wilkins, p 1564
6. Ratto C, Giordano P, Donisi L, Parello A, Litta F, Doglietto GB (2011) Transanal haemorrhoidal dearterialization (THD) for selected fourth-degree haemorrhoids. Tech Coloproctol 15:191–197
7. Ferguson JA, Heaton JR (1959) Closed hemorrhoidectomy. Dis Colon Rectum 2:176–179
8. Keller S, Bann CM, Dodd SL, Schein J, Mendoza TR, Cleeland CS (2004) Validity of the brief pain inventory for use in documenting the outcomes of patients with noncancer pain. Clin J Pain 20:309–318
9. Tan G, Jensen MP, Thornby JI, Shanti BF (2004) Validation of the brief pain inventory for chronic nonmalignant pain. J Pain 5:133–137
10. Daut RL, Cleeland CS, Flanery RC (1983) Development of the Wisconsin Brief Pain Questionnaire to assess pain in cancer and other diseases. Pain 17:197–210
11. Rockwood TH, Church JM, Fleshman JW et al (2000) Fecal Incontinence Quality of Life Scale: quality of life instrument for patients with fecal incontinence. Dis Colon Rectum 43:9–16; discussion 16-17
12. Ware JE Jr (2000) SF-36 health survey update. Spine (Phila Pa 1976) 25:3130–3139
13. Zampieri N, Castellani R, Andreoli R, Geccherle A (2012) Long-term results and quality of life in patients treated with hemorrhoidectomy using two different techniques: ligasure versus transanal hemorrhoidal dearterialization. Am J Surg 204:684–688
14. Elmer SE, Nygren JO, Lenander CE (2013) A randomized trial of transanal hemorrhoidal dearterialization with anopexy compared with open hemorrhoidectomy in the treatment of hemorrhoids. Dis Colon Rectum 56:484–490
15. Infantino A, Altomare DF, Bottini C et al (2012) Prospective randomized multicentre study comparing stapler haemorrhoidopexy with Doppler-guided transanal haemorrhoid dearterialization for third-degree haemorrhoids. Colorectal Dis 14:205–211
16. Avital S, Inbar R, Karin E, Greenberg R (2012) Five-year follow-up of Doppler-guided hemorrhoidal artery ligation. Tech Coloproctol 16:61–65
17. Faucheron JL, Poncet G, Voirin D, Badic B, Gangner Y (2011) Doppler-guided hemorrhoidal artery ligation and rectoanal repair (HAL-RAR) for the treatment of grade IV hemorrhoids: long-term results in 100 consecutive patients. Dis Colon Rectum 54:226–231
18. De Nardi P, Capretti G, Corsaro A, Staudacher C (2014) A prospective, randomized trial comparing the short- and long-term results of doppler-guided transanal hemorrhoid dearterialization with mucopexy versus excision hemorrhoidectomy for grade III hemorrhoids. Dis Colon Rectum 57:348–353

2014

Authors: **Ratto** C., **Parello** A., **Veronese** E., **Cudazzo** E., **D'Agostino** E., **Pagano** C., **Cavazzoni** E., **Brugnano** L. & **Litta** F.

Source: Colorectal Disease 2015 Jan;17(1):O10-9

Available for Open Online Access

Title: **Doppler-guided transanal haemorrhoidal dearterialization for haemorrhoids: results from a multicentre trial**

AIM:

This multicentre study, based on the largest patient population ever published, aims to evaluate the efficacy of a Doppler guided THD (THD® Doppler) in the treatment of symptomatic haemorrhoids and to identify predictive failure factors for an effective mid-term outcome.

METHODS:

803 patients affected by grade II (137, 17.1%), III (548, 68.2%) and IV (118, 14.7%) symptomatic haemorrhoidal disease underwent THD® Doppler, with a rectal mucopexy in patients with haemorrhoidal prolapse. The disease was assessed through a specifically designed symptom questionnaire and scoring system. A uni- and multivariate analysis of the potential predictive factors of failure was performed.

RESULTS:

The morbidity rate was 18.0%, and it was represented mainly by pain or tenesmus (106 patients, 13.0%). Acute bleeding requiring surgical haemostasis occurred in 7 patients (0.9%). No serious or life-threatening complication occurred. After a mean follow-up period of 11.1 ± 9.2 months, the overall success rate was 90.7% (728 patients), with a recurrence of haemorrhoidal prolapse, bleeding, and both symptoms in 51 (6.3%), 19 (2.4%), 5 (0.6%) patients, respectively. Sixteen out of 47 re-operated patients underwent a conventional haemorrhoidectomy. All the symptoms were significantly improved in each domain of the score ($p<0.0001$). At multivariate analysis the absence of morbidity and performing a distal Doppler-guided dearterialization were associated to a better outcome.

CONCLUSION:

THD® Doppler is a safe and effective therapy of haemorrhoidal disease. If this technique is to be employed, an accurate distal Doppler-guided dearterialization and a tailored mucopexy are mandatory to contain and reduce the symptoms.

Original article

doi:10.1111/codi.12779

Doppler-guided transanal haemorrhoidal dearterialization for haemorrhoids: results from a multicentre trial

C. Ratto*, A. Parello*, E. Veronese†, E. Cudazzo‡, E. D'Agostino§, C. Pagano¶, E. Cavazzoni, L. Brugnano†† and F. Litta***

*Proctology Unit, Department of Surgical Sciences, Catholic University, Rome, Italy, †Ospedale Fracastoro, San Bonifacio, San Bonifacio, Verona, Italy, ‡Ospedale Civile di Guastalla, Guastalla, Reggio Emilia, Italy, §Presidio Ospedaliero San Sebastiano di Frascati, Frascati, Rome, Italy, ¶A. O. Melegnano – P.O. di Vizzolo Predabissi, Vizzolo Predabissi, Milan, Italy, **Department of Surgery, University of Perugia, Perugia, Italy and ††Ospedale Civile di Locri, Locri, Reggio Calabria, Italy

Received 11 April 2014; accepted 20 August 2014; Accepted Article online 12 September 2014

Abstract

Aim This multicentre study, based on the largest patient population ever published, aims to evaluate the efficacy of Doppler-guided transanal haemorrhoidal dearterialization (THD Doppler) in the treatment of symptomatic haemorrhoids and to identify the factors predicting failure for an effective mid-term outcome.

Method Eight hundred and three patients affected by Grade II (137, 17.1%), III (548, 68.2%) and IV (118, 14.7%) symptomatic haemorrhoidal disease underwent THD Doppler, with a rectal mucopexy in patients with haemorrhoidal prolapse. The disease was assessed through a specifically designed symptom questionnaire and scoring system. A uni- and multivariate analyses of the potential predictive factors for failure were performed.

Results The morbidity rate was 18.0%, represented mainly by pain or tenesmus (106 patients, 13.0%). Acute bleeding requiring surgical haemostasis occurred in seven patients (0.9%). No serious or life-threatening complications occurred. After a mean follow-up period of 11.1 ± 9.2 months, the overall success rate was 90.7% (728 patients), with a recurrence of haemorrhoidal prolapse, bleeding, and both symptoms in 51 (6.3%), 19 (2.4%) and 5 (0.6%) patients, respectively. Sixteen out of 47 patients undergoing re-operation had a conventional haemorrhoidectomy. All the symptoms were significantly improved in each domain of the score ($P < 0.0001$). At multivariate analysis the absence of morbidity and performance of a distal Doppler-guided dearterialization were associated with a better outcome.

Conclusion THD Doppler is a safe and effective therapy for haemorrhoidal disease. If this technique is to be employed, an accurate distal Doppler-guided dearterialization and a tailored mucopexy are mandatory to contain and reduce the symptoms.

Keywords Haemorrhoids, haemorrhoidal disease, rectal bleeding, prolapse, transanal haemorrhoidal dearterialization, multivariate

What does this paper add to the literature?
To our knowledge this is the largest series ever published on the topic of Doppler-guided transanal haemorrhoidal dearterialization. This paper describes the changes in the technique that there have been over the years, and their impact on the results in short- and long-term follow-up. A detailed multivariate analysis of the potential predictive factors of failure is provided.

Introduction

Haemorrhoidal disease represents the most common condition presenting to proctology units, with its prevalence ranging from 5% to about 35% in Western populations [1,2].

Over the past two decades traditional excisional procedures, such as Milligan–Morgan haemorrhoidectomy, have been questioned, mainly because of the risk of postoperative pain and complications [3]. In 1995 Morinaga *et al.* [4] described Doppler-guided transanal ligation of haemorrhoidal arteries to reduce the arterial hyperflow to haemorrhoids. More recently, a new technique was introduced, Doppler-guided transanal haemorrhoidal dearterialization (THD Doppler). By means of specifically designed proctoscopes it also allows the performance of a rectal mucopexy to reduce the prolapse [5]. Several studies have shown the safety and efficacy of THD for symptomatic haemorrhoidal

Correspondence to: Carlo Ratto, Department of Surgical Sciences, Catholic University, Largo A. Gemelli, 8, 00168, Rome, Italy.
E-mail: carloratto@tiscali.it

disease [6–9], in fourth-degree haemorrhoids [10] and in an emergency setting [11]. Therefore, the UK National Institute for Health and Care Excellence (NICE) has recently provided a clinical guideline, which considers haemorrhoidal artery ligation as 'an efficacious alternative to conventional haemorrhoidectomy or stapled haemorrhoidopexy', without 'major safety concerns' [12].

Based on the largest patient population ever published, this multicentre observational study aims to: evaluate the efficacy of THD Doppler in the treatment of symptomatic haemorrhoidal disease, with a detailed description of early and late morbidity; and identify the factors predictive of failure for mid-term follow-up (FU).

Method

A total of 803 patients (502 men, mean age 49.4 ± 13.0 years, range 18–87) affected by symptomatic haemorrhoids who failed a conservative approach (diet modifications and pharmacological therapy) were treated primarily with the THD Doppler procedure at seven Italian colorectal units from June 2005 to October 2011 (Table 1). The leading centre (Rome) coordinated the study, and a prospective database was collected by each participating centre. Institutional review board approval was obtained in all departments and all patients gave written informed consent.

Table 1 Baseline demographic and clinical features.

	No. of patients (%)
Sex	
Male	502 (62.5)
Female	301 (37.5)
Age (years)*	49.4 (13.0) (range 18–87)
Haemorrhoid grade†	
I	0
II	137 (17.1)
III	548 (68.2)
IV	118 (14.7)
Recurrent disease	
Yes	82 (10.2)
No	721 (89.8)
Previous surgical treatment	
Stapled haemorrhoidopexy	32 (39.0)
Haemorrhoidectomy	29 (35.4)
THD	10 (12.2)
Rubber band ligation	9 (11.0)
Cryotherapy	2 (2.4)
Total	82 (100)

THD, transanal haemorrhoidal dearterialization.
*Values are mean (SD).
†Goligher classification [13].

Preoperatively, all patients underwent full clinical and physical examination, including digital rectal examination and anoscopy; the severity of the haemorrhoidal disease was graded according to the Goligher classification [13]. Associated conditions (skin tags, anal fissure, anal fistula) were scrupulously identified. Overall, 137 (17.1%), 548 (68.2%) and 118 (14.7%) cases were classified as Grade II, III and IV haemorrhoids, respectively (Fig. 1). In 82 out of 803 patients (10.2%) the disease was recurrent; Table 1 reports previous surgical procedures in these cases.

A symptom questionnaire and scoring system, specifically designed for patients affected by haemorrhoidal disease, was also administered to all subjects [14]. This questionnaire, although not yet validated, scores the frequencies of five different parameters which characterize haemorrhoidal disease (from 0 to 4, with 0 being no symptom and 4 daily presence of the symptom): bleeding, prolapse, manual reduction, impact on quality of life, discomfort/pain. A final score of 0 indicates the total absence of symptoms, while a score of 20 represents the worst condition. A screening colonoscopy was performed before the operation, if necessary; patients affected by colorectal cancer or other neoplasms were excluded.

Equipment

The THD Doppler device (THD S.p.A., Correggio, Italy) consists of a proctoscope equipped with a Doppler probe on the lateral profile of the device and a light source. During the study period the device evolved twice (July 2007 and September 2008), so that three different devices were used to treat patients (Fig. 2).

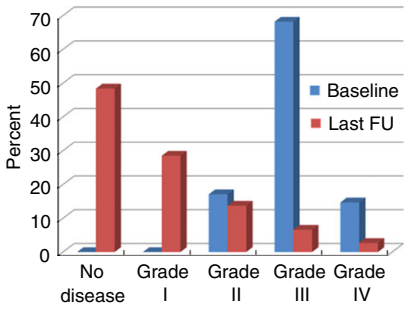


Figure 1 Proportion of patients classified according to the Goligher classification [13] at baseline and at the last follow-up evaluation.

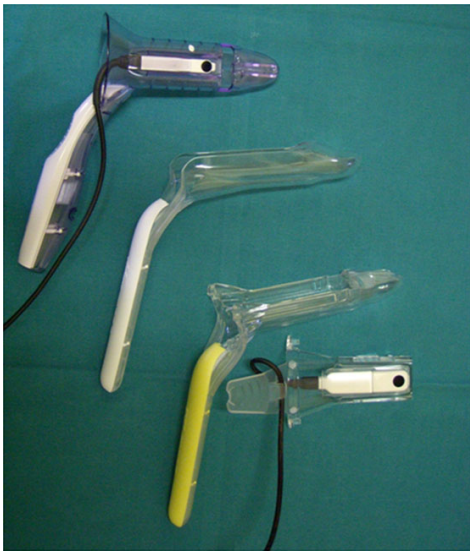


Figure 2 Proctoscopes used in the transanal haemorrhoidal dearterialization (THD) procedure over time. From top left to bottom right: traditional THD proctoscope (the 'first device'); THD Surgy® (the 'second device'), used since July 2007 together with the first device to make the mucopexy; THD Slide® (the 'current device'), in used since September 2008.

Surgical technique

On the day of the surgery, two enemas were given as bowel preparation. No antibiotic prophylaxis was given. All patients were treated under general or spinal anaesthesia.

A detailed description of the surgical technique has already been published [15]. With the patient in the lithotomy position, the proctoscope was fully introduced transanally to reach the lower rectum. Under Doppler guidance, six arterial signals were found at 6–7 cm from the anal verge, mostly at 1, 3, 5, 7, 9, 11 o'clock of the rectal circumference. The traditional approach to make the 'dearterialization' involves the transfixion of rectal mucosa and submucosa with a 'Z-stitch' to entrap the artery; this dearterialization modality is here defined as 'high ligation'. In patients affected by haemorrhoidal prolapse, mucopexy was performed after the artery ligation with the same suture used for the dearterialization, making a series of passages in increments of about 0.5 cm. Finally, the suture was tied to fix the mucopexy. Since 2009, dearterialization has been modified by introducing 'distal Doppler-guided dearterialization' (DDD) [5,8]. After the identification of the main arterial trunks at 6–7 cm from the anal verge, the proctoscope was moved distally and, when the best Doppler signal was obtained (usually within the most distal 2 cm of rectum, above the anorectal junction), a small 'marker point' was placed on the mucosa using electrocautery. In patients who needed the dearterialization alone, a Z-shaped stitch was placed to entrap the artery, and the knot tied. In patients with prolapsing haemorrhoids needing a mucopexy, after placement of the 'marker point' the proctoscope was fully re-introduced and the mucopexy started at 6–7 cm from the anal verge and continued distally (including the 'marker point' which was surrounded by two Z-shaped suture passages). The last mucopexy suture was placed at the apex of the internal haemorrhoidal pile (which was never included within the mucopexy suture), and the knot tied (Fig. 3). When six sutures were performed the mucopexy was defined as

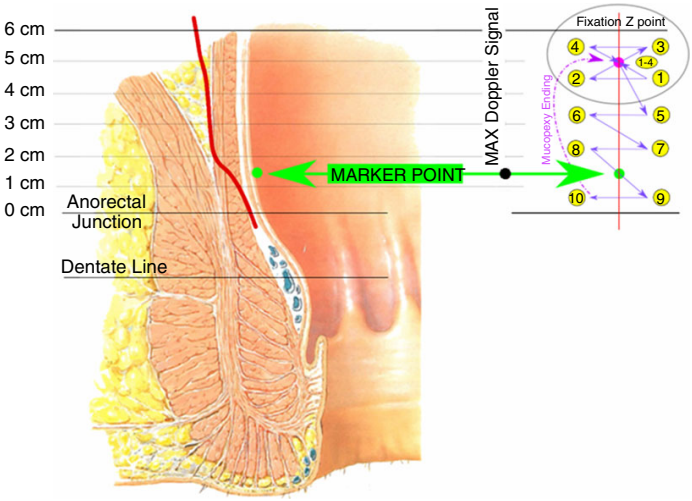


Figure 3 Schema of THD Doppler procedure including dearterialization and mucopexy.

'total'; on the contrary, if fewer than six sutures were adopted it was defined as 'partial'.

Follow-up

During the postoperative period, patients were advised to avoid straining and physical effort, while a fibre- and fluid-rich diet was prescribed. Stool softeners, analgesics and anti-inflammatory drugs were given for three postoperative days, and thereafter only if necessary; no antibiotics were administered.

Routine FU visits were scheduled at 2 weeks, 1 month and 3 months and then a year after the operation. In this study, the FU visit with the longer period of observation (at least 3 months) was defined as 'last FU'. Postoperative symptoms occurring in the first 24 h (early morbidity) and then within 30 days (late morbidity) were all noted. The required medical or surgical therapies adopted were also registered. At the last FU visit, the symptom questionnaire was re-administered (and compared with the preoperative data), and patients were submitted to anoscopy. Failure was defined as the presence of recurrent bleeding or recurrent haemorrhoidal prolapse needing a medical or surgical therapy, so an 'intention-to-treat' analysis was carried out.

Statistical analysis

The following baseline variables were evaluated as factors predictive of failure: age, gender, haemorrhoid grade, recurrent disease, type of THD procedure performed, morbidity, need for therapy, FU period, use of first or second device, use of 'high ligation'. Continuous data were analysed as means (with SD and range) and compared using the paired samples *t*-test; categorical data were analysed as frequencies and percentages and compared using the chi-square test test or the marginal homogeneity test as necessary. To assess factors potentially predictive of failure univariate and multivariate logistic regression models were applied. A $P < 0.05$ was considered statistically significant. Analyses were carried out with SPSS® version 17.0 software for Windows® (SPSS, Chicago, Illinois, USA).

Results

Average surgery time was 34.3 ± 5.9 (range 24–47) minutes, and postoperative stay was 0.6 ± 0.53 days. The THD Doppler procedure consisted of a dearterialization without a mucopexy, a dearterialization plus a partial mucopexy, and dearterialization plus a total mucopexy in 112 (13.9%), 52 (6.5%) and 639 (79.6%) patients, respectively. Another concomitant surgical procedure was carried out in 199 out of 803 patients (24.8%); skin tag removal (66 patients, 8.2%) was the most frequent associated procedure. In 53 patients (6.6%) with anal fissure, an internal lateral sphincterotomy was performed before starting the THD Doppler procedure (Table 2). Concerning the type of device used, 67 patients (8.3%) were treated with the first device, 77 (9.6%) with the second one, and 659 (82.1%) with the final one. In 523 out of 803 patients (65.1%), dearterialization was performed according to the 'high ligation' modality, while 280 (34.9%) underwent the 'DDD'.

One intra-operative complication occurred in four cases (0.5%): two transient submucosal haematomas, one tearing of the rectal mucosa and one case of bleeding; these events were always easily managed by placing a haemostatic suture (Table 2).

There was no mortality. Early morbidity (within 24 h) consisted mainly of pain or tenesmus, which occurred in 96 patients (12.0%) and required medical therapy; however, the rate of prescription of analgesics or nonsteroidal anti-inflammatory drugs (NSAIDs) was higher. Catheterization was necessary in 69 patients (8.6%) with urinary retention. Only one case of early bleeding requiring surgical haemostasis was registered (Table 2). The 30-day morbidity rate was 18.0%, and it was represented mainly by pain or tenesmus (104 patients, 13.0%). Acute bleeding occurred in 18 patients (2.2%): it stopped spontaneously in four cases, in seven patients (0.9%) a rectal washout was performed with bleeding resolution without further treatments and surgical haemostasis was needed in the remaining seven patients (0.9%) (Table 2). Four cases (0.5%) of haemorrhoidal thrombosis were reported. Three patients (0.4%) suffered from an anal abscess which was drained in two cases; only one case of postoperative anal fissure was reported (Table 2).

Last follow-up evaluation

The mean FU period was 11.1 ± 9.2 months (median 7, range 3–57). No patients were lost to FU. At the last FU evaluation, recurrence of haemorrhoidal prolapse, of bleeding and of both haemorrhoidal prolapse and bleeding requiring a medical or surgical therapy was seen, respectively, in 51 (6.3%), in 19 (2.4%) and 5 (0.6%) patients. Therefore, the overall failure rate was 9.3% (75 patients) (Table 2). Conversely, on an 'intention-to-treat' basis, the success rate was 90.7%. However, about a third of recurrent patients (28 patients, 37.3%) underwent a conservative treatment consisting of diet and drugs. Consequently, the overall

Table 2 Perioperative and last follow-up results.

	No. of patients (%)
Perioperative results	
Type of THD procedure	
Dearterialization	112 (13.9)
Dearterialization + partial mucopexy	52 (6.5)
Dearterialization + total mucopexy	639 (79.6)
Concomitant surgical procedure	
Skin tag removal	66 (8.2)
Internal lateral sphincterotomy	53 (6.6)
Single pile removal	42 (5.2)
Anorectal polyp excision	24 (3.0)
Fistulotomy	2 (0.3)
Other	12 (1.5)
Total	199 (24.8)
Mortality	0
Intra-operative complications	
Transient submucosal hematoma	2 (0.3)
Rectal mucosa tearing	1 (0.1)
Bleeding	1 (0.1)
Total	4 (0.5)
Early (≤ 24 h) morbidity	
Pain/tenesmus	96 (12.0)
Urinary retention	69 (8.6)
Bleeding	1 (0.1)
Total	166 (20.7)
Required therapy for early morbidity	
Analgesics	188 (23.4)
Catheterization	69 (8.6)
Other drugs	53 (6.6)
NSAIDs	27 (3.4)
Surgical haemostasis	1 (0.1)
Total	338 (42.1)
Late (≤ 30 days) morbidity	
Pain/tenesmus	104 (13.0)
Bleeding	18 (2.2)
Urinary retention	7 (0.9)
Haemorrhoidal thrombosis	4 (0.5)
Constipation	3 (0.4)
Anal abscess/infection	3 (0.4)
Anal fissure	1 (0.1)
Other	4 (0.5)
Total	144 (18.0)
Required therapy for late morbidity	
Analgesics	116 (14.4)
NSAIDs	37 (4.6)
Other drugs	28 (3.5)
Catheterization	7 (0.9)
Surgical haemostasis	7 (0.9)
Rectal washout	7 (0.9)
Anal abscess drainage	2 (0.3)
Fissurectomy	1 (0.1)
Other	1 (0.1)
Total	206 (25.7)
Last follow-up results	
Failure	
Haemorrhoidal prolapse	51 (6.3)
Recurrent bleeding	19 (2.4)
Haemorrhoidal prolapse and bleeding	5 (0.6)
Total	75 (9.3)
Required therapy for failure	
Drugs	28 (3.5)
Repeat-THD	18 (2.2)
Haemorrhoidectomy	16 (2.0)
Rubber band ligation	12 (1.5)
Other	1 (0.1)
Total	75 (9.3)
Condition or symptom referred	
Skin tags	67 (8.3)
Chronic rectal pain/discomfort	3 (0.4)
Post-defecation soiling	3 (0.4)
Anal fistula	1 (0.1)
Anal fissure	1 (0.1)
Recurrent haemorrhoidal thrombosis	1 (0.1)
Other	11 (1.4)
Total	87 (10.8)
Required therapy for referred symptom	
Skin tag removal	41 (5.1)
Analgesics	3 (0.4)
Biofeedback	2 (0.3)
Fistulectomy	1 (0.1)
Haemorrhoidal thrombosis incision	1 (0.1)
NSAIDs	1 (0.1)
Other	4 (0.5)
Total	53 (6.6)

THD, transanal haemorrhoidal dearterialization; NSAID, non-steroidal anti-inflammatory drug.

re-operation rate was 5.6% (47/803 patients). Among the re-operated patients, 18 underwent the THD Doppler procedure again, 16 patients a conventional haemorrhoidectomy and 12 patients a rubber band ligation (Table 2). No statistical difference emerged when a subgroup analysis was carried out. The success rate was, respectively, 92.7, 90.3 and 89.8% in Grade II, III and IV haemorrhoids; it was respectively 88.4, 92.3 and 90.9% in patients who underwent dearterialization alone, dearterialization plus partial mucopexy, and dearterialization plus total mucopexy. A detailed analysis of the failure rate by degree of disease and symptoms is provided in Table 3. Residual skin tags were the most frequent conditions detected or referred at the last FU physical examination (67 patients, 8.3%); three patients

Table 3 Failure rate by degree of disease and symptoms reported.

Failure type	Haemorrhoid grade, * no. of patients (%)				
	II	III	IV	Overall	$P^{\dagger}$
Failure: bleeding	2 (1.5)	16 (2.9)	1 (0.9)	19 (2.4)	0.302
Failure: prolapse	7 (5.1)	33 (6.0)	11 (9.3)	51 (6.3)	0.332
Failure: bleeding + prolapse	1 (0.7)	4 (0.7)	0	5 (0.6)	0.648
Overall failure	10 (7.3)	53 (9.6)	12 (10.2)	75 (9.3)	0.657

*Goligher classification [13].
†Chi-square test.

(0.4%) complained of chronic rectal pain or discomfort, while a further three patients (0.4%) referred to postdefaecation soiling (two of them underwent biofeedback therapy); one anal fistula was detected in one patient (0.1%) submitted to a fistulectomy; one patient (0.1%) affected by recurrent haemorrhoidal thrombosis was submitted to an incision of thrombosed piles. A detailed description of the results of the last FU visits is given in Table 2.

At the last FU physical evaluation, the haemorrhoid grades changed, showing a significant 'downstaging' of the disease compared with the baseline condition ($P < 0.0001$) (Table 4, Fig. 1). Each symptom changed significantly ($P < 0.0001$), so that each score parameter and the total score (from 13.1 at the baseline to 1.5 at the last FU, $P < 0.0001$) significantly decreased (Table 4).

Twelve months' follow-up

Two hundred and ninety-eight patients (180 men, mean age 48.6 ± 13.1 years, range 20–86) were evaluated after a minimum FU of 12 months (mean 20.7 ± 8.5; median 18; range 12–57). Recurrence of haemorrhoidal prolapse, bleeding and both prolapse and bleeding requiring a medical or surgical therapy was seen in 26 (8.7%), 10 (3.4%) and 3 patients (1.0%), respectively.

Factors predictive of failure

At univariate analysis, age < 40 years, absence of morbidity within 30 days and a FU period shorter than 12 months were all variables significantly protecting from failure; a THD procedure performed using the first or second device or with a 'high ligation' were factors significantly associated with a higher failure rate. The haemorrhoid grade and recurrent disease were not significantly associated with failure (Table 5).

At multivariate analysis, absence of morbidity within 30 days was the only protective factor that did not lose its significance (OR 0.396, CI 95% 0.158–0.992, $P = 0.048$); patients who underwent a 'high ligation' had a failure risk about three times greater than that of patients treated by DDD (OR 2.846, CI 95% 1.240–6.532, $P = 0.014$) (Table 5).

Discussion

Despite the high prevalence of haemorrhoidal disease, to date no surgical technique can be considered the 'gold-standard' of treatment [16]. The most innovative approaches are stapled haemorrhoidopexy [17] and Doppler-guided dearterialization [mostly performed by either THD Doppler or Doppler-guided haemorrhoidal artery ligation (DG-HAL)]; both are considered valid alternatives to conventional excision [5,18,19]. However, recurrence is the most concerning issue. A large meta-analysis by Jayaraman *et al.* [20] showed that stapled haemorrhoidopexy was associated with a higher risk of symptom recurrence and prolapse compared with haemorrhoidectomy; these two procedures were comparable in terms of pain, urgency and pruritus ani.

In a recent systematic review the pooled recurrence rate of Doppler-guided dearterialization was 17.5%, with a surprisingly wide range of 3–60% [21]. However, in our opinion, an accurate literature review reveals that, to date, it is not trivial to produce a robust systematic review of the success rate of Doppler-guided dearterialization due to: (i) differences in the adopted device (DG-HAL or THD Doppler), (ii) techniques (dearterialization alone or with mucopexy), (iii) length of FU, and (iv) the definition of 'success' or 'recurrence'.

Also, Tiernan *et al.* [22] suggested the need for 'a standardized definition' of recurrence. In this study 'failure' was defined as the presence of recurrent bleeding or prolapse needing medical or surgical therapy: the overall success rate was 90.7%, with no significant differences between haemorrhoid grade (Tables 2 and 3). Other series showed similar good results for advanced grades of haemorrhoids [7,10,23]. In a randomized trial, patients affected by Grade III and IV haemorrhoids were assigned to THD Doppler or stapled haemorrhoidopexy; both techniques were equally effective at short-term FU, but it was concluded that THD should be the preferred option because of less postoperative pain [7].

Table 4 Clinical symptoms at baseline and at the last follow-up (FU).

	Bleeding, no. (%)		Prolapse, no. (%)		Manual reduction, no. (%)		Discomfort/pain, no. (%)		Impact on QoL, no. (%)	
Frequency	Baseline	Last FU*	Baseline	Last FU*	Baseline	Last FU*	Baseline	Last FU*	Baseline	Last FU*
Never	24 (3.0)	619 (77.1)	4 (0.5)	638 (79.5)	99 (12.3)	721 (89.8)	53 (6.6)	598 (74.5)	3 (0.4)	570 (71.0)
At least once/year	78 (9.7)	151 (18.8)	84 (10.5)	88 (11.0)	99 (12.3)	54 (6.7)	110 (13.7)	140 (17.4)	19 (2.4)	176 (21.9)
At least once/month	240 (29.9)	27 (3.4)	160 (19.9)	56 (7.0)	130 (16.2)	21 (2.6)	184 (22.9)	53 (6.6)	209 (26.0)	45 (5.6)
At least once/week	335 (41.7)	6 (0.7)	357 (44.5)	17 (2.1)	331 (41.2)	6 (0.7)	319 (39.7)	10 (1.2)	415 (51.7)	9 (1.1)
Every day	126 (15.7)	0	198 (24.7)	4 (0.5)	144 (17.9)	1 (0.1)	137 (17.1)	2 (0.2)	157 (19.6)	2 (0.2)

	Baseline	Last FU†
Total score	13.1	1.5

Haemorrhoid grade‡	Baseline	Last FU§
No disease	0	389 (48.4)
I	0	229 (28.5)
II	137 (17.1)	110 (13.7)
III	548 (68.2)	53 (6.6)
IV	118 (14.7)	22 (2.7)

*$P < 0.0001$ (marginal homogeneity test).
†$P < 0.0001$ (paired samples t-test).
‡Goligher classification [13].
§$P < 0.0001$ (marginal homogeneity test).

Table 5 Predictive factors for failure in univariate and multivariate analysis.

Factor	Univariate analysis Relative risk (95% CI)	*P*-value	Multivariate analysis Relative risk (95% CI)	*P*-value
Age < 40 years	0.932 (0.879–0.988)	0.007	0.987 (0.963–1.012)	0.308
Male gender	0.806 (0.522–1.244)	0.330		
Haemorrhoid grade	1.057 (0.546–2.047)	0.869		
Recurrent disease	0.662 (0.364–1.203)	0.181		
Type of THD procedure	1.198 (0.417–3.441)	0.737		
No morbidity within 30 days	0.542 (0.328–0.894)	0.018	0.396 (0.158–0.992)	0.048
Need for therapy within 30 days	0.852 (0.499–1.456)	0.560		
Follow-up < 12 months	0.541 (0.352–0.831)	0.005	1.021 (0.980–1.063)	0.322
Device: first device	2.222 (1.021–4.837)	0.044	0.779 (0.247–2.455)	0.670
Device: second device	2.269 (1.231–5.613)	0.012	1.228 (0.492–3.065)	0.660
High ligation	3.091 (1.702–5.614)	0.000	2.846 (1.240–6.532)	0.014

THD, transanal haemorrhoidal dearterialization.

In the present study, at last FU the most frequent findings were residual skin tags, needing excision in about two-thirds of cases because of pruritus ani or discomfort (Table 2). However, a 'skin tag-pexy' is not a target for the THD Doppler procedure; that should be made clear to patients in order to avoid false expectations.

In this series, the overall morbidity rate was 18.0%, mainly represented by pain or tenesmus (13.0%) (Table 2). This should be related to the fact that about 85% of patients were subjected to mucopexy, which inevitably creates oedema and/or inflammation of the rectal mucosa/submucosa layers. Administration of NSAIDs and analgesics can easily control pain and tenesmus. Similarly, Theodoropoulos *et al.* [24] found that these symptoms were more pronounced in patients undergoing DG-HAL plus haemorrhoidopexy or recto-anal repair. Data from this study are encouraging with regard to postoperative pain, confirming that THD Doppler resulted in less postoperative pain than stapled haemorrhoidopexy [7,9] or haemorrhoidectomy [25].

It is well known that stapled haemorrhoidopexy can be associated with some serious and life-threatening complications or disabling long-term conditions [26,27]. In this study, no serious event occurred. At last FU visit, only three patients (0.4%) complained of chronic rectal pain, while three (0.4%) reported postdefaecation soiling (Table 2). The low incidence of these conditions is probably due to the absorbable nature of the suture: nerves or the smooth muscle layer are not trapped by the suture indefinitely and no anatomical changes are created in the rectum. Moreover, during the procedure, the needle penetrated the rectal wall at a maximum depth of 6 mm, avoiding perforation of the entire rectal wall; for this reason, perirectal sepsis after THD Doppler was not reported.

Generally, postoperative bleeding is one of the most feared complications after surgery for haemorrhoids. Only one case of early postoperative bleeding (within 24 h) was registered in this study, while the remaining 18 cases (2.2%) occurred within 30 days, but surgical haemostasis was needed only in seven patients (0.9%). These percentages are similar, or actually a little better, than other reports, from which emerged a pooled rate of 5% for postoperative bleeding [21].

A uni- and multivariate analysis performed in this study on potential predictive factors of failure found that the haemorrhoidal grade was not statistically significant. This finding probably demonstrates that a tailored mucopexy is mandatory for successful treatment of patients with prolapse. Other studies seem to confirm this interpretation. Pol *et al.* [28] treated 244 patients with DG-HAL without mucopexy or recto-anal repair; patients with Grade III and IV haemorrhoids had a higher risk of recurrence at multivariate analysis. On the contrary, an Italian multicentre study [6] in which mucopexy was added to dearterialization to treat patients with grades II and III haemorrhoids, showed that haemorrhoid grade was not predictive of failure. In the present study, only the absence of morbidity and use of 'high ligation' were statistically predictive of failure at multivariate analysis; other confounding variables (age, length of FU and type of device) lost significance at univariate analysis (Table 5).

As previously described, the THD Doppler procedure has evolved over time; initially, the dearterialization was performed at 6–7 cm from the anal verge (high ligation). Recent studies have shown that haemorrhoidal arteries at 4–6 cm from the anorectal junction are located outside the rectal wall, while at 2 cm from the anorectal junction they are almost always detected in the submucosa [29,30]. Therefore the technique has been modified to obtain a more effective

dearterialization, introducing the DDD [5,8]. In this context it is not surprising that at multivariate analysis patients who underwent 'high ligation' showed a three times higher risk of failure (Table 5).

Analysis of patients with a minimum FU of 12 months gave a success rate of 86.9%; this percentage was slightly lower than the 92.9% observed in patients with a FU shorter than 12 months. This difference could be explained by the consideration that a greater proportion of patients with a 12-months minimum FU underwent the operation with the old devices and 'high ligation'. As stated above, these two variables were the only significant independent factors predictive of failure. On the other hand, a longer FU period increased the recurrence rates, but only very slightly. For this reason, a FU shorter than 12 months was significant only at univariate analysis and it has lost its significance at multivariate analysis, when the two confounding variables (type of device and modality of artery ligation) were considered.

Conclusions

THD Doppler is a valid therapeutic option in patients affected by haemorrhoidal disease, irrespective of the grade of their disease. An accurate distal Doppler-guided dearterialization and a tailored mucopexy are mandatory to control symptoms. This procedure is associated with a low morbidity rate. However, it is necessary to be very careful to avoid complications, as this could affect the long-term outcome.

Author contributions

Carlo Ratto: conception and design, extraction of data, review of the Literature. Angelo Parello, Ezio Veronese, Eugenio Cudazzo, Elio D'Agostino, Claudio Pagano, Emanuel Cavazzoni and Luigi Brugnano: design, extraction of data, review of the Literature. Francesco Litta: design, extraction of data, review of the Literature, writing of manuscript.

Conflicts of interest

No funding was received for research and/or publication. The authors do not have any financial interests that might benefit from the publication of the submitted manuscript.

References

1 Johanson JF, Sonnenberg A. The prevalence of hemorrhoids and chronic constipation. An epidemiologic study. *Gastroenterology* 1990; **98:** 380–6.
2 Loder PB, Kamm MA, Nicholls RJ, Phillips RK. Haemorrhoids: pathology, pathophysiology and aetiology. *Br J Surg* 1994; **81:** 946–54.
3 Shanmugam V, Thaha MA, Rabindranath KS, Campbell KL, Steele RJ, Loudon MA. Rubber band ligation versus excisional haemorrhoidectomy for haemorrhoids. *Cochrane Database Syst Rev* 2005; **3:** CD005034.
4 Morinaga K, Hasuda K, Ikeda T. A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. *Am J Gastroenterol* 1995; **90:** 610–3.
5 Ratto C. THD doppler procedure for hemorrhoids: the surgical technique. *Tech Coloproctol* 2014; **18:** 291–8.
6 Infantino A, Bellomo R, Dal Monte PP *et al.* Transanal haemorrhoidal artery echodoppler ligation and anopexy (THD) is effective for II and III degree haemorrhoids: a prospective multicentric study. *Colorectal Dis* 2010; **12:** 804–9.
7 Festen S, Van Hoogstraten MJ, Van Geloven AA, Gerhards MF. Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results. *Int J Colorectal Dis* 2009; **24:** 1401–5.
8 Ratto C, Donisi L, Parello A, Litta F, Zaccone G, De Simone V. 'Distal doppler-guided dearterialization' is highly effective in treating haemorrhoids by transanal haemorrhoidal dearterialization. *Colorectal Dis* 2012; **14:** e786–9.
9 Sajid MS, Parampalli U, Whitehouse P, Sains P, McFall MR, Baig MK. A systematic review comparing transanal haemorrhoidal de-arterialisation to stapled haemorrhoidopexy in the management of haemorrhoidal disease. *Tech Coloproctol* 2012; **16:** 1–8.
10 Ratto C, Giordano P, Donisi L, Parello A, Litta F, Doglietto GB. Transanal haemorrhoidal dearterialization (THD) for selected fourth-degree haemorrhoids. *Tech Coloproctol* 2011; **15:** 191–7.
11 Cavazzoni E, Bugiantella W, Graziosi L *et al.* Emergency transanal haemorrhoidal Doppler guided dearterialization for acute and persistent haemorrhoidal bleeding. *Colorectal Dis* 2013; **15:** e89–92.
12 National Institute for Health and Clinical Excellence. *Interventional Procedure Guidance 342: Haemorrhoidal Artery Ligation.* http://www.nice.org.uk/nicemedia/live/12236/48673/48673.pdf (accessed August 10, 2013).
13 Goligher JC, Leacock AG, Brossy JJ. The surgical anatomy of the anal canal. *Br J Surg* 1955; **43:** 51–61.
14 Giordano P, Nastro P, Davies A, Gravante G. Prospective evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: three-year outcomes. *Tech Coloproctol* 2011; **15:** 67–73.
15 Ratto C, Donisi L, Parello A, Litta F, Doglietto GB. Evaluation of transanal hemorrhoidal dearterialization as a minimally invasive therapeutic approach to hemorrhoids. *Dis Colon Rectum* 2010; **53:** 803–11.
16 Kaidar-Person O, Person B, Wexner SD. Hemorrhoidal disease: a comprehensive review. *J Am Coll Surg* 2007; **204:** 102–17.

17 Burch J, Epstein D, Sari AB *et al.* Stapled haemorrhoidopexy for the treatment of haemorrhoids: a systematic review. *Colorectal Dis* 2009; **11:** 233–43.
18 Scheyer M, Antonietti E, Rollinger G, Mall H, Arnold S. Doppler-guided hemorrhoidal artery ligation. *Am J Surg* 2006; **191:** 89–93.
19 Rivadeneira DE, Steele SR, Ternent C, Chalasani S, Buie WD, Rafferty JL. Standards practice task force of the American society of colon rectal surgeons. Practice parameters for the treatment of hemorrhoids (revised 2010). *Dis Colon Rectum* 2011; **54:** 1059–64.
20 Jayaraman S, Colquhoun PH, Malthaner RA. Stapled versus conventional surgery for hemorrhoids. *Cochrane Database Syst Rev* 2006; **4:** CD005393.
21 Pucher PH, Sodergren MH, Lord AC, Darzi A, Ziprin P. Clinical outcome following doppler-guided haemorrhoidal artery ligation: a systematic review. *Colorectal Dis* 2013; **15:** e284–94.
22 Tiernan JP, Hind D, Brown SR. Evaluating the efficacy of treatments for haemorrhoids: time for a standardised definition of recurrence? *Colorectal Dis* 2013; **15:** 1449–50.
23 Walega P, Krokowicz P, Romaniszyn M *et al.* Doppler guided haemorrhoidal arterial ligation with recto-anal-repair (RAR) for the treatment of advanced haemorrhoidal disease. *Colorectal Dis* 2010; **12:** e326–9.
24 Theodoropoulos GE, Sevrisarianos N, Papaconstantinou J *et al.* Doppler-guided haemorrhoidal artery ligation, recto-anal repair, sutured haemorrhoidopexy and minimal mucocutaneous excision for grades III-IV haemorrhoids: a multicenter prospective study of safety and efficacy. *Colorectal Dis* 2010; **12:** 125–34.
25 Denoya PI, Fakhoury M, Chang K, Fakhoury J, Bergamaschi R. Dearterialization with mucopexy vs haemorrhoidectomy for grade III or IV haemorrhoids: short-term results of a double-blind randomized controlled trial. *Colorectal Dis* 2013; **15:** 1281–8.
26 Pescatori M, Gagliardi G. Postoperative complications after procedure for prolapsed hemorrhoids (PPH) and stapled transanal rectal resection (STARR) procedures. *Tech Coloproctol* 2008; **12:** 7–19.
27 Faucheron JL, Voirin D, Abba J. Rectal perforation with life-threatening peritonitis following stapled haemorrhoidopexy. *Br J Surg* 2012; **99:** 746–53.
28 Pol RA, van der Zwet WC, Hoornenborg D *et al.* Results of 244 consecutive patients with hemorrhoids treated with doppler-guided hemorrhoidal artery ligation. *Dig Surg* 2010; **27:** 279–84.
29 Schuurman JP, Go PM, Bleys RL. Anatomical branches of the superior rectal artery in the distal rectum. *Colorectal Dis* 2009; **11:** 967–71.
30 Ratto C, Parello A, Donisi L, Litta F, Zaccone G, Doglietto GB. Assessment of haemorrhoidal artery network using colour duplex imaging and clinical implications. *Br J Surg* 2012; **99:** 112–8.

2014

Authors: **Tempel** M.B., **Pearson** E.G, **Page** M., **Pollock** D. et al.

Source: Tech Coloproctol (2014) 18:607-610

https://www.ncbi.nlm.nih.gov/pubmed/24352923

Title: **Survey of patient satisfaction after Doppler-guided transanal hemorrhoidal dearterialization performed in ambulatory settings**

BACKGROUND:

Transanal hemorrhoidal dearterialization (THD) is a recently developed procedure to minimize postoperative pain from hemorrhoidectomy. This technique utilizes Doppler signals to aid ligation of hemorrhoidal arteries followed by mucopexy of redundant mucosa if needed. The aim of the present study was to assess patient satisfaction after THD.

METHODS:

This is a retrospective cohort study of patients who underwent THD at three different sites from April 2007 through October 2010. All procedures were performed in ambulatory settings according to protocol. Telephone surveys were conducted after a minimum of 1-month follow-up to assess patients' satisfaction on a scale of 1-10. Patients were asked whether the procedure had alleviated their symptoms. Patients were asked to recall duration of pain and time from surgery to return to work.

RESULTS:

Between April 2007 and October 2010, 216 patients with grade III-IV hemorrhoids underwent THD. There were 165 males and 61 females. Average age was 52.2 ± 14.2 years. All patients were discharged the same day after meeting ambulatory surgery center discharge criteria. Postoperative difficulty urinating occurred in 37 (17 %) patients, and six of them required temporary urinary catheterization. Transitory postoperative bleeding was reported by 38 (18 %) patients. Transitory incontinence to stool and flatus occurred in 18 (9 %) and 16 patients (8 %), respectively. Pelvic muscle spasms occurred in 21 (10 %) patients. Median follow-up was 23 months (range 1-42 months) with 143 (66 %) having at least 9 months between procedure and interview. Mean patient satisfaction was 8.5 ± 0.7 (on a scale of 1-10 with 10 being the best), and 91.5 % of patients felt the procedure had "helped" them. Average number of days with discomfort was 6.7 ± 2.1. Patients returned to work after an average of 10.3 ± 3.2 days. Our study is limited by lack of long-term follow-up and by retrospective complication assessment.

CONCLUSIONS:

Patient satisfaction with THD performed in ambulatory settings is high. Our data support performance of this procedure in an ambulatory setting.

2014

Authors: **Ratto** C.

Source: Tech Coloproctol. 2014 Mar;18(3):291-8.

Available for Full Open Online Access

Title: **THD Doppler procedure for hemorrhoids: the surgical technique**

Transanal hemorrhoidal dearterialization (THD) is an effective treatment for hemorrhoidal disease. The ligation of hemorrhoidal arteries (called ''dearterialization'') can provide a significant reduction of the arterial overflow to the hemorrhoidal piles. Plication of the redundant rectal mucosa/submucosa (called ''mucopexy'') can provide a repositioning of prolapsing tissue to the anatomical site. In this paper, the surgical technique and perioperative patient management are illustrated. Follow- ing adequate clinical assessment, patients undergo THD under general or spinal anesthesia, in either the lithotomy or the prone position. In all patients, distal Doppler-guided dearterialization is performed, providing the selective ligation of hemorrhoidal arteries identified by Doppler. In patients with hemorrhoidal/muco-hemorrhoidal prolapse, the mucopexy is performed with a continuous suture including the redundant and prolapsing mucosa and sub- mucosa. The description of the surgical procedure is complemented by an accompanying video (see supplementary material). In long-term follow-up, there is resolution of symptoms in the vast majority of patients. The most common complication is transient tenesmus, which sometimes can result in rectal discomfort or pain. Rectal bleeding occurs in a very limited number of patients. Neither fecal incontinence nor chronic pain should occur.

Anorectal physiology parameters should be unaltered, and anal sphincters should not be injured by following this procedure. When accurately performed and for the correct indications, THD is a safe procedure and one of the most effective treatments for hemorrhoidal disease.

Tech Coloproctol
DOI 10.1007/s10151-013-1062-3

HOW I DO IT

THD Doppler procedure for hemorrhoids: the surgical technique

C. Ratto

Received: 10 July 2013 / Accepted: 6 August 2013

Abstract Transanal hemorrhoidal dearterialization (THD) is an effective treatment for hemorrhoidal disease. The ligation of hemorrhoidal arteries (called "dearterialization") can provide a significant reduction of the arterial overflow to the hemorrhoidal piles. Plication of the redundant rectal mucosa/submucosa (called "mucopexy") can provide a repositioning of prolapsing tissue to the anatomical site. In this paper, the surgical technique and perioperative patient management are illustrated. Following adequate clinical assessment, patients undergo THD under general or spinal anesthesia, in either the lithotomy or the prone position. In all patients, distal Doppler-guided dearterialization is performed, providing the selective ligation of hemorrhoidal arteries identified by Doppler. In patients with hemorrhoidal/muco-hemorrhoidal prolapse, the mucopexy is performed with a continuous suture including the redundant and prolapsing mucosa and submucosa. The description of the surgical procedure is complemented by an accompanying video (see supplementary material). In long-term follow-up, there is resolution of symptoms in the vast majority of patients. The most common complication is transient tenesmus, which sometimes can result in rectal discomfort or pain. Rectal bleeding occurs in a very limited number of patients. Neither fecal incontinence nor chronic pain should occur. Anorectal physiology parameters should be unaltered, and anal sphincters should not be injured by following this procedure. When accurately performed and for the correct indications, THD is a safe procedure and one of the most effective treatments for hemorrhoidal disease.

Keywords Hemorrhoids · Dearterialization · Mucopexy · Hemorrhoidal artery · Prolapse · Recurrence · Complication

Introduction

Recent findings concerning the pathophysiology of the hemorrhoidal disease [1–4], and the development of new technologies for surgical treatment [5], have favored a rapid spread of an innovative approach, the ligation of hemorrhoidal arteries, with or without pexy of prolapsing rectal mucosa/submucosa. A number of procedures have been devised using Doppler guidance and different surgical devices. Recent reviews [6, 7] have evaluated these techniques grouping them together, generating some confusion between different procedures. This paper provides an overview of the technical aspects and perioperative management of one of the most widely used techniques, transanal hemorrhoidal dearterialization (THD). This surgical procedure is primarily oriented toward the management of the main symptoms of hemorrhoidal disease (i.e., bleeding, prolapse, and pain), intervening on its pathophysiological processes. THD is based on two technical steps: (1) the targeted ligation of hemorrhoidal arteries (called "dearterialization"), using a very sensitive continuous Doppler probe able to identify the maximal flow; (2) the plication and lifting of redundant and prolapsing rectal mucosa/submucosa (called "mucopexy").

Electronic supplementary material The online version of this article (doi:10.1007/s10151-013-1062-3) contains supplementary material, which is available to authorized users.

C. Ratto (✉)
Department of Surgical Sciences, Catholic University,
Largo A. Gemelli, 8, 00168 Rome, Italy
e-mail: carloratto@tiscali.it

Published online: 12 September 2013

Patient assessment

An accurate assessment of patient's history is mandatory, particularly concerning symptoms related to hemorrhoidal disease. Then, both anorectal examination and anoscopy are carried out to evaluate hemorrhoidal engorgement, spontaneous bleeding, and eventual prolapse of piles and rectal mucosa/submucosa, both at rest and during straining. In particular, reducibility of hemorrhoidal prolapse should be assessed. Anal skin tags should also be noted and distinguished from real hemorrhoidal prolapse. Other anal and/or rectal diseases and functional disorders must be diagnosed/excluded. In particular, patients complaining of symptoms of obstructed defecation should be further investigated. Finally, endoscopic assessment of the colon and rectum should be performed according to the guidelines for colorectal cancer screening.

Indications

Transanal hemorrhoidal dearterialization should be reserved for patients presenting active hemorrhoidal disease despite lifestyle/diet interventions, drug therapy, and minor office procedures such as rubber band ligation or sclerotherapy. Indications should be established on the basis of the patient's symptoms and physical findings. If the main complaint is bleeding, this can be addressed by dearterialization alone, ligating of the hemorrhoidal arteries along the low rectal circumference. Usually, at least 6 arteries are found and ligated using the THD Doppler device. In case of bleeding associated with hemorrhoidal or mucosal and hemorrhoidal prolapse, mucopexy should be added to the dearterialization. In fact, mucopexy can be regarded as an "on-demand" step of THD, depending also on the location and severity of mucosal prolapse (in terms of its length). It is mandatory that the prolapsing hemorrhoidal piles and rectal mucosa should be reducible, so that they will reach their respective anatomical sites. Therefore, fibrosed piles cannot be treated with THD. When the prolapse involves the whole rectal circumference, 6 separate mucopexy sutures may be placed. Alternatively, if there is only limited circumferential involvement, a smaller number of running sutures should be used. Patients, who complain of mucosal and hemorrhoidal prolapse or hemorrhoidal prolapse alone, usually have a history of bleeding, which disappeared in the later phase of hemorrhoidal disease in accordance with the pathophysiological evolution of the disease. These patients should undergo both dearterialization and mucopexy following the same criteria mentioned above. Mucopexy can be adapted to different lengths of mucosal prolapse, making longer or shorter running sutures. However, attention must be paid to misdiagnosed internal rectal intussusception, which is not amenable to mucopexy used for the hemorrhoidal prolapse. According to the Goligher's classification, 1st degree or initial 2nd degree hemorrhoids, unresponsive to conservative treatment or minimal surgery, may be addressed by dearterialization alone. More advanced 2nd degree, 3rd degree, and 4th degree (except in the case of fixed, fibrotic piles) should undergo dearterialization and mucopexy.

Patients with skin tags should be advised that these are not real hemorrhoids, but the consequence of previous engorgement and dislodgement of hemorrhoidal cushions toward the perianal skin. Since THD does not provide any specific treatment for skin tags, only surgical excision can be a reliable treatment when indicated or desired.

Patients with hemorrhoids who suffer from inflammatory bowel disease deserve a special mention. There is a lack of studies specifically addressing patients with Crohn's disease or ulcerative colitis operated on with THD. However, providing that no severely active inflammation is demonstrated on the rectal mucosa, this method may be suitable in patients with hemorrhoids resistant to conservative treatments. The same concept applies to hemorrhoidal disease in patients with chronic radiation proctitis.

Preparation for surgery

This is a matter of the surgeon's preference as there are no absolute guidelines in hemorrhoidal surgery. The same is true also for the THD procedure. Because it is performed within the lower rectum, one or two enema(s) should be prescribed. The Author does not consider antibiotic prophylaxis as mandatory as in his experience no infections have been observed following this operation.

Anesthesia

Transanal hemorrhoidal dearterialization can be performed under both general and locoregional anesthesia. Propofol-remifentanil anesthesia, with the placement of a laryngeal mask, combines general anesthesia, complete control of vital parameters, and quick reversion and discharge from the hospital. Spinal anesthesia may be limited to the most caudal metameric nerve roots avoiding any prolonged stay in bed. Unfortunately, spinal anesthesia is usually associated with a higher risk of urinary retention, especially following hemorrhoid surgery. More limited locoregional anesthesia (i.e., posterior perianal block) does not ensure a complete intraoperative analgesia due to the visceral pain elicited by surgical ligation, suturing for plication, and tying knots on the rectal mucosa.

Intraoperative management

The patient can be placed in either the lithotomy or the prone position, based on the surgeon's preference. However, it should be taken into consideration that the lithotomy position allows a more realistic position of the prolapsing hemorrhoids and rectal mucosa. An accurate intraoperative monitoring of blood pressure could be helpful. In particular, systolic pressure higher than 100–110 mmHg allows auscultation of a Doppler signal necessary for the identification of the hemorrhoidal arteries.

Equipment

Transanal hemorrhoidal dearterialization is performed using a specific device produced by THD S.p.A., Correggio, Italy. It consists of a proctoscope equipped with a Doppler probe and a light source (Fig. 1). The Doppler probe utilizes a double crystal, which allows a more precise focusing of the ultrasound waves and capturing of large-diameter arteries located in the superficial layers of the rectal wall. Sufficient space is provided around two crystals for their adequate vibration. The Doppler probe is mounted on an oblique support, oriented toward the operative window, so that the artery identified by the Doppler signal lies within the operative window and can be selectively ligated.

The latest proctoscope model (THD Slide®, THD S.p.A., Correggio, Italy) has a sliding part comprising the operating window and the Doppler probe, so that the operator can move them proximally and distally without repositioning the proctoscope. The section of the proctoscope is elliptical, with an external maximum diameter of 32–34 mm and an internal diameter of 20–34 mm.

The recommended suture is 2–0 absorbable polyglycolic acid with a 5/8-in. needle. This is mounted on a specially designed needle holder, providing a mark on the tip where the needle should be held. With this configuration, the needle holder tip can be inserted into the pivot, and the needle rotates to transfix the rectal mucosa in a standard fashion. The depth of the transfixed stitches can be easily and safely calibrated up to a maximum depth of 6.5 mm, which includes only mucosa and submucosa avoiding penetration through the full thickness of the rectal wall and therefore lowering the risk of perirectal fistula and abscess. A knot-pusher is also provided in case is needed.

Fig. 1 Surgical instruments specifically designed for the THD procedure

Distal Doppler-guided dearterialization (DDD)

Surgical anatomy of the hemorrhoidal arteries

Aim of hemorrhoidal dearterialization is to significantly reduce the arterial overflow in the hemorrhoidal tissue, characteristic of patients with hemorrhoidal disease. The anatomical and physiological characteristics of hemorrhoids have not been fully elucidated. Microscopically, hemorrhoidal tissue is composed of sinusoids, i.e., vascular structures without a muscular wall [8]. Direct arteriovenous communications have been demonstrated histologically and radiologically, and some authors have noted a resemblance to erectile tissue [9]. Traditionally, with the patient in the lithotomy position, hemorrhoids frequently appear to be localized to the left lateral, right posterolateral, and right anterolateral areas of the anal canal. However, this configuration is demonstrated in less than 20 % of patients [10]. In reality, a wider network of arterial and venous vessels has been described [11]. Schuurman et al. [1] studied 10 non-fixed human cadavers in order to assess the arterial vasculature of the rectum and arterial supply to the hemorrhoids. Selective injections of different colors were used. The authors found that, about 2–3 cm above the dentate line, thin tortuous arteries (a mean number of 8, all branches of the superior hemorrhoidal artery) were seen lying in the submucosa, reaching into the hemorrhoidal tissue. Smaller branches from these arteries formed a plexus in the corpus cavernosum recti area.

In our recent study [12], the majority of arteries in the upper part of the lower third of the rectum (4–6 cm from the anorectal junction) were located outside the rectal wall. In contrast, within 2 cm from the anorectal junction, hemorrhoidal arteries were detected in the submucosa in 98 % of the 6 sectors of the rectal circumference (96.6 and 100 % of sectors at 2 and 1 cm above the anorectal junction, respectively). Therefore, in their course through the lower third of the rectum, the hemorrhoidal arteries traverse the muscularis propria of the rectum and become more superficial. These features can be easily confirmed during Doppler-guided surgical procedures. The different Doppler signals are dependent on the position of the artery (perirectal, perforating the rectal muscle, or submucosal), the distance from the Doppler probe, and the direction of

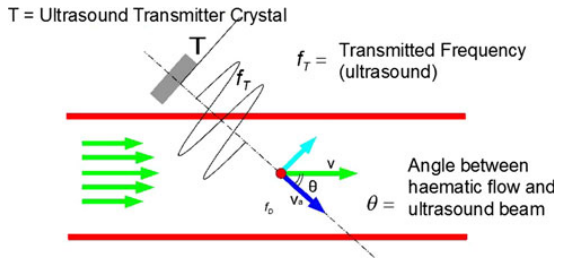


Fig. 2 Schema justifying different Doppler signals occurring during THD as related to arterial blood flow. According to this physical law, the intensity of the Doppler signal is the inverse of the cosine of the angle between the ultrasound waves and blood flow. The more perpendicular the blood flow to the ultrasound waves (i.e., artery into the perirectal tissue or submucosa) the higher the Doppler signal; the more parallel the flow (i.e., artery perforating the rectal muscle) the lower the signal

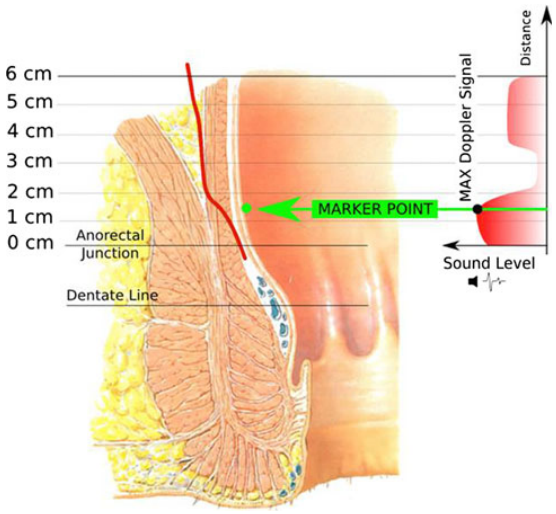


Fig. 3 Schema of the anatomical course of a hemorrhoidal artery and different levels of Doppler signal related to the position of the artery

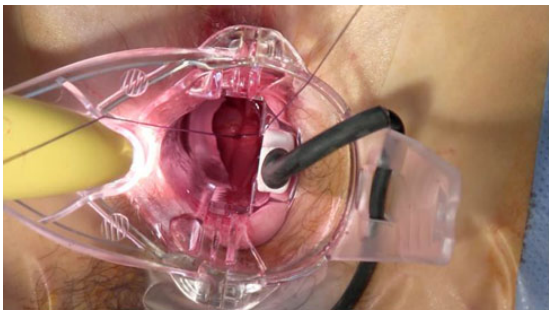


Fig. 4 Suture of a hemorrhoidal artery during DDD procedure

blood flow in relation to the ultrasound waves emitted by the probe. In fact, the intensity of the Doppler signal is the inverse of the cosine of the angle between the ultrasound waves and blood flow. As a consequence, the more perpendicular the blood flow to the ultrasound waves (i.e., artery into the perirectal tissue or submucosa) the higher the Doppler signal. On the other hand, the more parallel the flow (i.e., artery traversing the rectal muscle) the lower the signal (Fig. 2). The proximity of the artery to the probe when the artery is submucosal makes the Doppler signal higher than that perceived at the proximal sites.

Technique

Following gel lubrication, the proctoscope is inserted through the anal canal reaching the low rectum, about 6–7 cm from the anal verge. The surgeon can decide to start the operation at any point of the rectal circumference and proceed in a clockwise or anticlockwise direction. The Doppler system is then turned on. The Doppler signal corresponding to all 6 main trunks of the hemorrhoidal arteries, which are usually located at 1, 3, 5, 7, 9, and 11 o'clock of the low rectal circumference, is sought by slowly rotating and/or tilting the proctoscope. However, searching with the Doppler probe makes possible correct identification of those arteries not located at the usual odd hours positions. The proctoscope is pulled slowly back to follow the artery distally up to hemorrhoidal apex, and the best Doppler signal is searched for. According to the above-mentioned features from our previous study [12], the Doppler signal is quite clear at the proximal site (corresponding to the proximal part of the lower rectum, where, however, arteries could lie in the perirectal fat), attenuated or absent at the intermediate site (where the artery is perforating the rectal muscle), and again clear at the distal site (within the most distal 2 cm of lower rectum, where the artery lies in the rectal submucosa, just above the internal hemorrhoidal piles, Fig. 3). As a consequence of anatomical and acoustic findings, the best place to find the hemorrhoidal arteries should be the most distal part of the rectum: This is the fundamental principle of distal Doppler-guided dearterialization (DDD) [13]. After identification of the best place for artery ligation, the Doppler system is turned off.

If the patient is a candidate for dearterialization alone (i.e., the patient only has bleeding without prolapse), the artery, once identified, can be directly ligated with a "Z-stitch" at the site of the best Doppler signal (Fig. 4). When the patient needs to undergo dearterialization and mucopexy (due to hemorrhoidal or muco-hemorrhoidal prolapse), the rectal mucosa can be marked with electrocautery ("marker point") at the site of the best Doppler

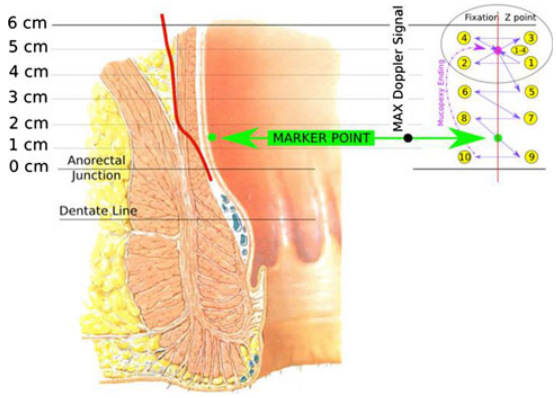


Fig. 5 Schema of mucopexy fixation point and continuous suture

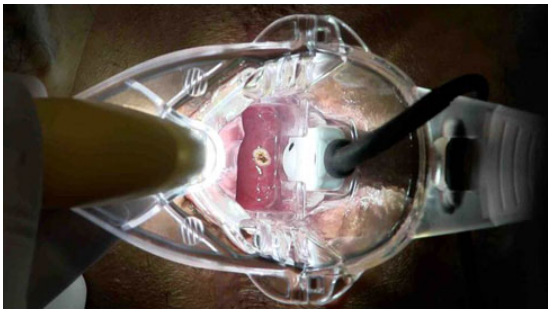


Fig. 6 "Marker point" on the distal rectal mucosa to identify the best Doppler signal obtained from the submucosal hemorrhoidal artery

signal (Figs. 5, 6) to indicate where the artery will be ligated. Then, a mucopexy follows (see below).

Mucopexy (MP)

Pathological anatomy of hemorrhoidal prolapse

Normally, the hemorrhoidal cushions are loosely attached to the circular muscle through the elastic rectal submucosa, which keeps the piles in the anal canal at rest. During defecation, rolling of the hemorrhoids inside the lumen occurs, favored by the internal anal sphincter relaxation. The fecal bolus has a shearing effect on the cushions and facilitates their prolapse [14–16]. On the other hand, the elasticity of the rectal submucosa keeps the piles inside the rectum. In patients with hemorrhoidal disease, due to altered defecation and other predisposing factors [17], the rectal submucosa progressively loses its elasticity, determining hemorrhoidal prolapse [15, 16, 18]. The progressive disruption of both the connective tissue stroma (Park's ligaments) and anchoring system (Treitz's muscle) plays a major role. Severity of prolapse is related to persistence of pathogenic factors, engorgement of piles, and progressive loss of the elasticity of the rectal submucosa.

Transanal hemorrhoidal dearterialization with mucopexy provides plication of the rectal submucosa affected by the loss of elasticity. It is reduced stably into the rectal ampulla, recovering its anatomical position. Furthermore, the scarring process induced by the mucopexy attaches the plicated mucosa and submucosa to the underlying rectal muscle.

Technique

Following the identification of the hemorrhoidal artery, the proctoscope is again pushed fully inside the distal rectum, and a "Z-stitch" is made as a proximal "fixation point" of MP. The circular device pivot can be used to do this. The proximal end of MP is not standard, depending on the length of prolapsing mucosa and submucosa. Then, the knot is tied (Fig. 7). Thereafter, the main proctoscope remains in place, and only its sliding part is moved back, exposing the rectal mucosa so that MP can be performed under direct vision. MP is carried out with a continuous

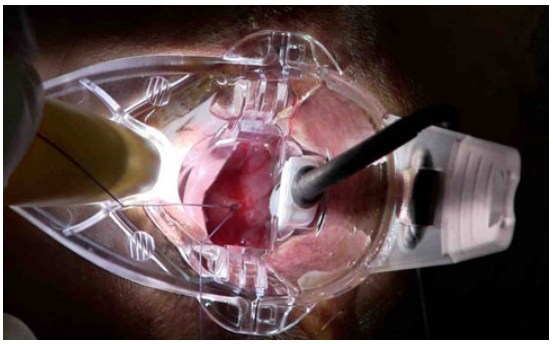


Fig. 7 Fixation Z point at the proximal edge of the mucopexy continuous suture

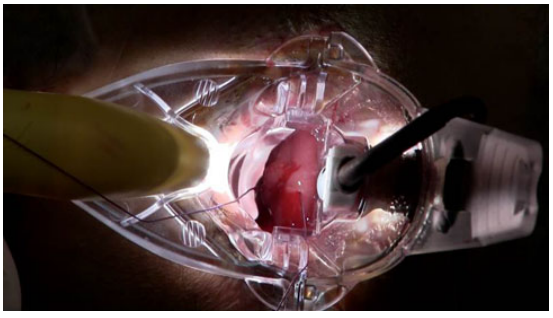


Fig. 8 Mucopexy continuous suture

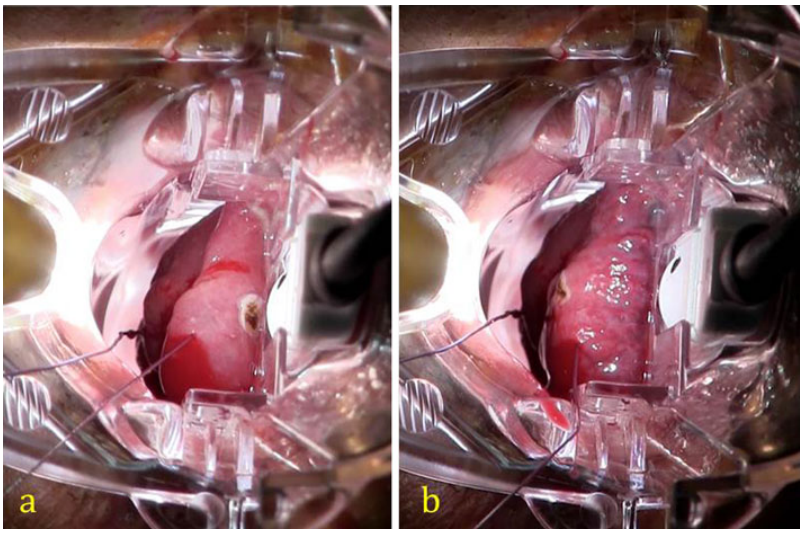


Fig. 9 Passages of the mucopexy continuous suture above (**a**) and below (**b**) the marker point to entrap the hemorrhoidal artery

suture, including the redundant and prolapsing mucosa and submucosa, in a proximal-to-distal direction, along a longitudinal axis (Figs. 5, 8). The recommended distance between each suture is approximately 0.5 cm, which is optimal in order to avoid sutures that are too tight (a shorter distance has a lesser plicating effect as well as increased risk of tissue ischemia) or too loose (a longer distance with consequent formation of wide enfolding of rectal mucosa/submucosa and increased risk of early postoperative rupture of the running suture). While performing MP, when the "marker point" is visualized, the surgeon takes care to make a passage of the running suture above and another below the "marker point," in order to entrap the hemorrhoidal artery within the running suture and accomplish the dearterialization according to the DDD principle (Fig. 9). Each vertical row should be spaced from the adjacent one in order to guarantee enough blood outflow from the hemorrhoids via the venous plexus. In fact, a circumferential obliteration of rectal tissue might create a significant obstacle for the blood and consequently an increased risk of postoperative thrombosis. The MP running suture is stopped at the proximal apex of the internal hemorrhoid, avoiding its inclusion in the mucopexy. When performed this way, the THD method can effectively be considered a hemorrhoid-sparing procedure. Finally, the suture is gently tied (Fig. 10).

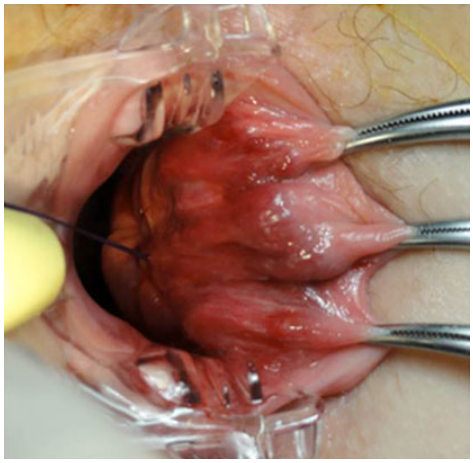


Fig. 10 Mucopexy suture is secured without including the hemorrhoid

Postoperative management

A diet rich in fluids (oral intake of at least 2 l of water per day) and fiber is established, eventually supplemented by oral assumption of stool softeners. Use of laxatives is advisable. In fact, especially in patients who underwent MP, not only constipation but also diarrhea and increased frequency of bowel movements could cause an early disruption of the rectal sutures and, then, possible bleeding from the mucopexy suture(s) and early recurrence of prolapse. Scrupulous adherence to a dietary protocol is usually recommended during the first 2–3 postoperative months, and the patient is encouraged to continue a high residue diet after this time period. Patients with either chronic diarrhea or irritable bowel syndrome should be put on a very carefully controlled diet and pre-/probiotics. On the other hand, those with either chronic inflammatory bowel disease or chronic radiation proctitis must continue the specific therapy as prescribed; a sudden worsening of their condition should be diagnosed early and treated.

Postoperative care should be strongly directed toward the control of pain and tenesmus. The source of these symptoms is the surgical site (not the hemorrhoidal cushions) and is related to the plication of the rectal mucosa/submucosa. This can cause an inflammatory response (with edema and inflammatory reaction) associated with relative ischemia of those tissues, which causes both pain and tenesmus. As a consequence of the inflammatory process, MP patients can have a mucous, sometimes bloody, anal discharge for a few days. When both piles and the sensitive mucosa of the anal pecten are spared during MP (as described above), these are not the source of pain and tenesmus, unless a hemorrhoidal thrombosis has developed. The severity of pain and tenesmus could be dependent not only on the surgical procedure but also on the patient's tolerance level to pain; in that case, their management of these symptoms should be specially tailored. Patients who undergo dearterialization alone usually suffer minor pain and/or rectal discomfort, lasting from a few hours to a few days. In these patients, anti-inflammatory drugs and/or analgesics can be prescribed "as needed." Patients who had MP more frequently report tenesmus and pain. In these patients, non-steroidal anti-inflammatory drugs (NSAIDs) should be given around the clock for at least 3 days, and other analgesics when requested. With these measures, in the author's experience, both edema and related symptoms are reduced. Usually, patients can discontinue this postoperative regimen after a few days, and only a minority of them needs it for more than 7 days.

Urinary retention develops in about 10 % of patients, especially those who undergo MP and males. To prevent this, restriction of excessive intravenous infusion of fluids is advisable. Treatment should consist only in temporary bladder catheterization.

Tenesmus can be accompanied by a transient sensation of urge to defecate. This is usually transient, with resolution within 7–10 days, and does not give rise to any form of persistent urgency, soiling, or fecal incontinence.

Follow-up

The follow-up includes 4 different time points. At the first visit, 7–10 days after the procedure, a digital anorectal examination is never carried out, but only an external inspection to avoid the risk of pulling on the stitches. At this time, particular attention is also paid to normalizing defecation with diet and laxatives. Usually, bleeding is no longer present. In a minority of patients after MP, some bloody mucus is referred, due to the early postoperative inflammatory process. Inflammation can also determine mild fever along the first 2–3 postoperative days, usually self-limited and responding to anti-inflammatory drugs. Tenesmus can be referred after MP at this time and gradually improves. Only minority of patients still require analgesics. The second follow-up visit is made after 1 month. The patient's anorectum is digitally explored and assessed. Rectal pain, discomfort, and tenesmus should no longer be present. Persistence of these symptoms should be investigated. In case of some hemorrhoidal prolapse is preset or reported, this is suspicious of suture disruption, usually secondary to defecatory dysfunction. Also intermittent, self-limited episodes of bleeding can be indicative to MP disruption. Anal continence should be fully normal. At the 3 month follow-up visit, the patient is also evaluated with anoscopy. At that time, when the procedure is successful, all symptoms are resolved. Volume and appearance of hemorrhoidal cushions are that of patients without hemorrhoidal disease. Persistent or new bleeding or prolapse will require a closer follow-up. Thereafter, patients are contacted by telephone and examined 1 year after surgery. A long-term annual follow-up may be established. If any symptom related to a possible recurrence of hemorrhoidal disease is reported, the patient undergoes digital examination and anoscopy.

Complications and management

The most common complication is tenesmus, which sometimes can turn into rectal discomfort or pain. It can be managed with analgesics and anti-inflammatory drugs as described above. However, these symptoms rapidly disappear. Rectal bleeding can occur in a very limited number of patients, usually within 2 weeks after the operation. It can be caused by trauma of the rectal mucosa involved in the surgical procedure (especially MP) during prolonged straining, passage of hard stool, or diarrhea. In fact, excessive suture traction can be generated and can lead to breakage. Moreover, the relative tissue ischemia at the level of the MP suture line can result in a limited necrosis of the mucosa/submucosa and consequent bleeding. In both cases, the removal of clots by saline solution lavage (performed with a soft catheter) can usually stop the bleeding. If bleeding continues and increases in frequency and intensity, it is necessary to perform an endoscopic or surgical hemostasis (cauterization, endoclip, and suture).

In the author's experience, THD, performed according to the principles outlined above, is never followed by fecal incontinence and chronic pain. Indeed, anorectal physiology parameters should be unaltered, and anal sphincters should not be injured by this procedure [19].

Recurrences and their management

In case of recurrence, the treatment decision making is guided by the symptoms. Recurrence of rectal bleeding can

occur in cases where the dearterialization was not successful in one or more rectal sectors. Severity of bleeding is usually less than in the initial presentation and can be easily managed with medical therapy, rubber band ligation, or new dearterialization under Doppler guidance.

In the majority of cases of recurrent prolapse, the cause seems to be the disruption of MP suture(s) with difficult defecation early in the postoperative period or later due to chronic straining. To prevent this occurrence, an optimal diet and fiber supplements are necessary in case of constipation, or prompt treatment for IBS and IBD symptoms. Patients with recurrent prolapse can be managed conservatively if the prolapse is minimal. Re-do MP is technically possible although other strategies such as excisional hemorrhoidectomy can also be adopted.

Conclusions

Transanal hemorrhoidal dearterialization is a valid therapeutic option in patients with hemorrhoidal disease. It can provide effective control of symptoms in the vast majority of patients. Accuracy in both dearterialization (using the "DDD" procedure) and mucopexy (repositioning the prolapsing rectal mucosa and submucosa, completely sparing the piles) seems the key to therapeutic success. However, patients must be informed about postoperative management. The limited number and severity of complications makes THD very safe. Finally, THD can be used in case of recurrent disease.

Conflict of interest The author was speaker at a number of congresses/training courses about the THD Doppler procedure.

References

1. Schuurman JP, Go PM, Bleys RL (2009) Anatomical branches of the superior rectal artery in the distal rectum. Colorectal Dis 11:967–971
2. Aigner F, Bodner G, Gruber H et al (2006) The vascular nature of hemorrhoids. J Gastrointest Surg 10:1044–1050
3. Aigner F, Gruber H, Conrad F et al (2009) Revised morphology and hemodynamics of the anorectal vascular plexus: impact on the course of hemorrhoidal disease. Int J Colorectal Dis 24:105–113
4. Aigner F, Bonatti H, Peer S et al (2010) Vascular considerations for stapled haemorrhoidopexy. Colorectal Dis 12:452–458
5. Ratto C, Donisi L, Parello A, Litta F, Doglietto GB (2010) Evaluation of transanal hemorrhoidal dearterialization as a minimally invasive therapeutic approach to hemorrhoids. Dis Colon Rectum 53:803–811
6. Giordano P, Overton J, Madeddu F, Zaman S, Gravante G (2009) Transanal hemorrhoidal dearterialization: a systematic review. Dis Colon Rectum 52:1665–1671
7. Pucher PH, Sodergren MH, Lord AC, Darzi A, Ziprin P (2013) Clinical outcome following Doppler-guided haemorrhoidal artery ligation: a systematic review. Colorectal Dis 15:e284–e294
8. Lucha PA (2009) Pathophysiology of hemorrhoidal disease. In: Khubchandani I, Paonessa N, Azimuddin K (eds) Surgical treatment of hemorrhoids. Springer, London, pp 15–17
9. Loder PB, Kamm MA, Nicholls RJ, Philips RK (1994) Haemorrhoids: pathology, pathophysiology and aetiology. Br J Surg 81:946–954
10. Thomson WH (1981) The anatomy and nature of piles. In: Kaufman HD (ed) The haemorrhoid syndrome. Abacus Press, Tunbridge Wells, pp 15–33
11. Shafik A (2009) Surgical anatomy of hemorrhoids. In: Khubchandani I, Paonessa N, Azimuddin K (eds) Surgical treatment of hemorrhoids. Springer, London, pp 7–13
12. Ratto C, Parello A, Donisi L, Litta F, Zaccone G, Doglietto GB (2012) Assessment of haemorrhoidal artery network using colour duplex imaging and clinical implications. Br J Surg 99:112–118
13. Ratto C, Donisi L, Parello A, Litta F, Zaccone G, De Simone V (2012) Distal Doppler-guided dearterialization' is highly effective in treating haemorrhoids by transanal haemorrhoidal dearterialization. Colorectal Dis 14:e786–e789
14. Tagart RE (1974) Haemorrhoids and palpable ano-rectal lesions. Practitioner 212:221–238
15. Haas PA, Fox TA Jr, Haas GP (1984) The pathogenesis of hemorrhoids. Dis Colon Rectum 27:442–450
16. Keighley MR, Williams NS (2008) Haemorrhoidal disease. In: Keighley MR, Williams NS (eds) Surgery of the anus, rectum and colon, 3rd edn. Elsevier, Saunders, pp 321–381
17. Jackson CC, Robertson E (1965) Etiologic aspects of hemorrhoidal disease. Dis Colon Rectum 8:185–189
18. Gass OC, Adams J (1950) Hemorrhoids: etiology and pathology. Am J Surg 29:40–43
19. Ratto C, Parello A, Donisi L, Litta F, Doglietto GB (2011) Anorectal physiology is not changed following transanal haemorrhoidal dearterialization for haemorrhoidal disease: clinical, manometric and endosonographic features. Colorectal Dis 13:e243–e245

2013

Authors: **Elmér** E., **Nygren** J. O., **Lenander** C. E.

Source: Diseases of the Colon & Rectum, Volume 56: 4 (2013)
https://www.ncbi.nlm.nih.gov/pubmed/23478616

Title: **A Randomized Trial of Transanal Hemorrhoidal Dearterialization With Anopexy Compared With Open Hemorrhoidectomy in the Treatment of Hemorrhoids**

BACKGROUND:

Doppler guidance in hemorrhoidal surgery has become more frequent during the past decade. The method is mainly studied in nonrandomized trials. Data from randomized controlled trials are lacking.

OBJECTIVES:

The aim of this study was to compare early and midterm results of transanal hemorrhoidal dearterialization with anopexy to open hemorrhoidectomy.

DESIGN, SETTINGS, PATIENTS, AND INTERVENTIONS:

Forty patients with grade 2 to 3 hemorrhoids were randomly assigned to transanal hemorrhoidal dearterialization with anopexy (group A, n = 20) or open hemorrhoidectomy (group B, n = 20). A diary was used during the first 2 postoperative weeks. A self-reported symptom questionnaire was answered, and a clinical examination was performed preoperatively, after 2 to 4 months, and after 1 year.

MAIN OUTCOME MEASURE:

The main outcome measure was postoperative pain.

RESULTS:

Postoperative peak pain was lower in group A during the first week than in group B ($p < 0.05$), whereas no difference in overall pain was noted. More patients expressed normal well-being in group A ($p = 0.045$). Pain, bleeding, and the need for manual reduction of the hemorrhoids were all improved in both groups after 1 year ($p < 0.05$). Soiling had decreased after both methods at early follow-up. After 1 year, soiling was significantly decreased only after open hemorrhoidectomy. The grade of hemorrhoids was significantly reduced after 1 year for both methods, but there was a trend to more patients with remaining grade 2 hemorrhoids in group A ($p = 0.06$).

LIMITATIONS:

There was no blinding, the sample size was small, and follow-up was for only 1 year. The questionnaire was not validated.

CONCLUSION:

The difference in postoperative pain between transanal hemorrhoidal dearterialization with anopexy and open hemorrhoidectomy may be less than expected based on previous literature.

2012

Authors: **Cavazzoni** E., **Bugiantella** W., **Graziosi** L. et al.

Source: Colorectal Disease 2013 Feb; 15(2):e89-92
https://www.ncbi.nlm.nih.gov/pubmed/23045996

Title: Emergency transanal haemorrhoidal Doppler guided dearterialization for acute and persistent haemorrhoidal bleeding

AIM:

The effectiveness of Doppler guided transanal haemorrhoidal dearterialization (THD) for arresting persistent haemorrhoidal bleeding in patients admitted as an emergency was studied.

METHOD:

Eleven patients with severe anal bleeding underwent emergency THD as definitive treatment for haemorrhoids. In the majority of patients antiplatelet or anticoagulant therapy was ongoing and severe anaemia was present in six patients.

RESULTS:

The mean operative time was 39.7 min. Six to nine feeding arteries were ligated. Intra-operative blood loss was nil. Bleeding was well controlled in all patients. No blood transfusion was required. Mean pain score per verbal numeric scale was 3.6 and 1.4 on day 1 and day 3 respectively. The mean time to resumption of normal activities was 8 days. No major complications were experienced. Six months follow-up demonstrated good control of haemorrhoidal disease.

CONCLUSION:

THD is effective in controlling acute haemorrhoidal bleeding with a low incidence of postoperative complications.

2012

Authors: **Zampieri** N., **Castellani** R., **Andreoli** R., **Geccherie** A.

Source: Am J Surg. 2012 Nov;204(5):684-8

http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-67202012000400016&lng=en&nrm=iso&tlng=en

Title: **Long-term results and quality of life in patients treated with hemorrhoidectomy using two different techniques: Ligasure versus transanal hemorrhoidal dearterialization**

BACKGROUND:

Hemorrhoids are the most frequent anal pathology. We evaluated the results of 2 techniques at 1 year after surgery.

METHODS:

The clinical charts and data of patients who underwent hemorrhoidectomy between January 2008 and June 2010 were considered and analyzed. Patients underwent surgery with 2 techniques: transanal hemorrhoidal dearterialization (THD) hemorrhoidectomy or LigaSure-vessel sealing system (Valleylab, Boulder, CO). Patients were chosen randomly to receive one technique or the other. The primary objectives were quality of life, quality of defecation, and regression of symptoms.

RESULTS:

Forty-six patients treated with THD and 68 patients treated with Ligasure were enrolled in the study. No significant differences were observed in the rate of postoperative surgical complications or readmissions. Short- and medium-term (1-6 mo) results showed that THD patients had a higher rate of pain resolution compared with Ligasure patients ($P < .05$). Functionally, all patients treated with Ligasure showed more postoperative constipation despite administration of laxatives than patients treated with THD.

CONCLUSIONS:

THD is an effective technique and is associated with the best short-term clinical and surgical outcomes if compared with Ligasure.

2011

Authors: **Ratto** C., **Parrello** A., **Donisi** L., **Litta** F., **Zaccone** G., **Doglietto** G.B.

Source: Br J Surg. 2012 Jan;99(1):112-8. doi: 10.1002/bjs.7700

Available for Open Online Access on Wiley Online Library (www.bjs.co.uk)

Title: **Assessment of haemorrhoidal artery network using colour duplex imaging and clinical implications**

BACKGROUND:

Dearterialization should reduce arterial overflow to haemorrhoids. The purpose of this study was to assess the topography of haemorrhoidal arteries.

METHODS:

Fifty patients with haemorrhoidal disease were studied. Using endorectal ultrasonography, six sectors were identified within the lower rectal circumference. Starting from the highest level (6 cm above the anorectal junction), the same procedure was repeated every 1 cm until the lowest level was reached (1 cm above the anorectal junction). Colour duplex imaging examinations identified haemorrhoidal arteries related to the rectal wall layers, and the arterial depth was calculated.

RESULTS:

Haemorrhoidal arteries were detected in 64.3, 66.0, 66.0, 98.3, 99.3 and 99.7 per cent of the sectors 6, 5, 4, 3, 2 and 1 cm above the anorectal junction respectively ($P < 0.001$). Most of the haemorrhoidal arteries were external to the rectal wall at 6 and 5 cm (97.9 and 90.9 per cent), intramuscular at 4 cm (55.0 per cent) and within the submucosa at 3, 2 and 1 cm above the anorectal junction (67.1, 96.6 and 100 per cent) ($P< 0.001$). The mean arterial depth decreased significantly from 8.3 mm at 6 cm to 1.9 mm at 1 cm above the anorectal junction ($P<0.001$).

CONCLUSION:

This study demonstrated that the vast majority of haemorrhoidal arteries lie within the rectal submucosa at the lowest 2 cm above the anorectal junction. This should therefore be the best site for performing haemorrhoidal dearterialization.

Original article

Assessment of haemorrhoidal artery network using colour duplex imaging and clinical implications

C. Ratto, A. Parello, L. Donisi, F. Litta, G. Zaccone and G. B. Doglietto

Department of Surgical Sciences, Catholic University, Largo A. Gemelli, 8, 00168, Rome, Italy
Correspondence to: Dr C. Ratto (e-mail: carloratto@tiscali.it)

Background: **Dearterialization should reduce arterial overflow to haemorrhoids. The purpose of this study was to assess the topography of haemorrhoidal arteries.**

Methods: **Fifty patients with haemorrhoidal disease were studied. Using endorectal ultrasonography, six sectors were identified within the lower rectal circumference. Starting from the highest level (6 cm above the anorectal junction), the same procedure was repeated every 1 cm until the lowest level was reached (1 cm above the anorectal junction). Colour duplex imaging examinations identified haemorrhoidal arteries related to the rectal wall layers, and the arterial depth was calculated.**

Results: **Haemorrhoidal arteries were detected in 64·3, 66·0, 66·0, 98·3, 99·3 and 99·7 per cent of the sectors 6, 5, 4, 3, 2 and 1 cm above the anorectal junction respectively ($P < 0·001$). Most of the haemorrhoidal arteries were external to the rectal wall at 6 and 5 cm (97·9 and 90·9 per cent), intramuscular at 4 cm (55·0 per cent), and within the submucosa at 3, 2 and 1 cm above the anorectal junction (67·1, 96·6 and 100 per cent) ($P < 0·001$). The mean arterial depth decreased significantly from 8·3 mm at 6 cm to 1·9 mm at 1 cm above the anorectal junction ($P < 0·001$).**

Conclusion: **This study demonstrated that the vast majority of haemorrhoidal arteries lie within the rectal submucosa at the lowest 2 cm above the anorectal junction. This should therefore be the best site for performing haemorrhoidal dearterialization.**

Presented in part to the Annual Meeting of the American Society of Colon and Rectal Surgeons, Minneapolis, Minnesota, USA, May 2010, and published in abstract form as *Dis Colon Rectum* 2010; **53**: 578

Paper accepted 4 August 2011

Published online in Wiley Online Library (www.bjs.co.uk). **DOI:** 10.1002/bjs.7700

Introduction

The anatomical and physiological characteristics of haemorrhoids have not been elucidated fully. Microscopically, haemorrhoidal piles are sinusoids (vascular structures without a muscular wall)[1]. Direct arteriovenous communications have been demonstrated histologically and radiologically, and some authors have noted a resemblance to erectile tissue[2]. Traditionally, haemorrhoidal piles frequently appear to be localized to the left lateral, right posterolateral and right anterolateral sites in the anal canal circumference with the patient in the lithotomy position; however, this configuration is demonstrated in less than 20 per cent of patients[3]. In reality, a wider network of arterial and venous vessels has been described[4], although the distribution and relationship to rectal and anal layers is unclear.

Recently, haemorrhoidal disease (HD) has often been treated using non-excisional procedures. Some surgical techniques address the reduction of arterial inflow to haemorrhoids.

Transanal haemorrhoidal dearterialization (THD) and Doppler-guided haemorrhoidal artery ligation (DG-HAL) are the main surgical procedures with this aim, and use specifically designed devices for arterial ligation in the lower rectum guided by a Doppler signal[5]. Stapled haemorrhoidopexy (SH) divides the haemorrhoidal arteries in the suture line[6].

Assessment of the optimal site for these surgical approaches should improve the clinical efficacy. The purpose of this study was to localize precisely the arteries running into the rectum and directed to haemorrhoids.

Methods

The local institutional review board approved this study. Patients with HD were enrolled prospectively. Each patient signed an informed consent form regarding the procedures

and purpose of the study. All patients had anal bleeding with or without haemorrhoidal prolapse. Before inclusion in the study, an accurate diagnostic assessment, including patient history, physical examination, anoproctoscopic and colonoscopic findings, if indicated, confirmed HD. Patients with chronic bowel inflammatory disease, anal fissures, anal fistulas or abscesses, and a history of pelvic surgery and/or radiotherapy were excluded.

The enrolled patients underwent endoanal–endorectal ultrasonography (ERUS) and colour duplex imaging performed by a single operator. An ultrasound system (ProFocus Green™; BK Medical, Herlev, Denmark) fitted with endoanal–endorectal probes (models 2052 and 8848; BK Medical) was used. Before ultrasound examinations, the patients were prepared with two enemas to flush the rectum. During ERUS, the proximal edge of the puborectalis sling was identified to localize the anorectal junction (ARJ). The ARJ was regarded as the best reference point during anorectal ultrasonography. The anal dentate line cannot be identified using ultrasound techniques, and in patients with HD the anal pecten can frequently be displaced. The lower rectal circumference was subdivided into six sectors (left anterolateral, left lateral, left posterolateral, right posterolateral, right lateral and right anterolateral) (*Fig. 1*). From the upper limit (6 cm above the ARJ), the same procedure was repeated every 1 cm until the lower limit was reached (1 cm above the ARJ) (*Fig. 1*). A total of 300 sectors were studied for each of the six rectal levels.

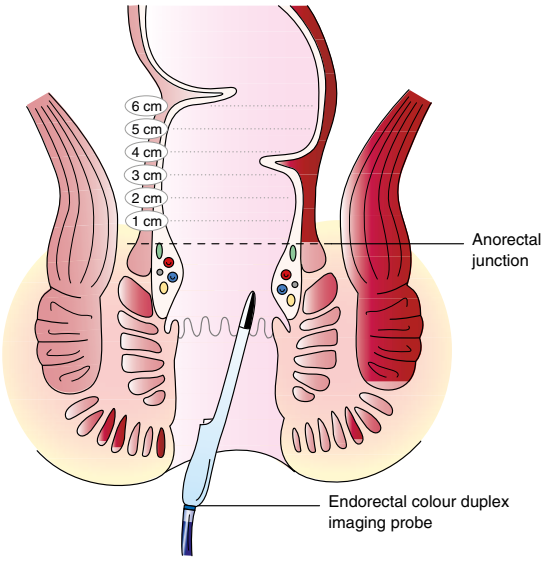


Fig. 1 Topographic schematic diagram showing different levels of the colour duplex imaging examination

Using combined colour duplex imaging, the courses of arteries that reached haemorrhoidal piles were followed carefully. All perirectal arteries that were not directed to haemorrhoids (vaginal, prostatic, and seminal vesicle arteries) were excluded from the study.

Arteries were classified according to their location in the rectal wall: running within the submucosa, between the submucosa and the rectal muscle, within the rectal muscle, between the rectal muscle and the perirectal fat, or outside the rectal wall. The distance between the centre of the arterial lumen and the ultrasound probe surface (defined as 'arterial depth') was calculated.

Close contact was maintained with the rectal mucosa, but care was taken to avoid applying excessive pressure to the rectal wall with the ultrasound probe to minimize any distortion of the ultrasonographic and Doppler signals owing to arterial occlusion or compression. For each sector investigated, at least one picture was obtained for review after the examination.

Statistical analysis

The mean(s.d.) value was calculated for each recorded parameter. One-way ANOVA was used to compare means. The Bonferroni method was used for multiple comparisons, when appropriate. $P < 0{\cdot}050$ was considered statistically significant.

Results

Fifty patients (36 men, 14 women) with a mean(s.d.) age of 47·1(13·1) years were studied. Five patients (10 per cent) had grade II, 41 (82 per cent) had grade III and four (8 per cent) had grade IV haemorrhoids.

Significantly fewer sectors in the upper part of the low rectum had an arterial supply directed to the haemorrhoids than in the lower part (64·3, 66·0 and 66·0 per cent at 6, 5 and 4 cm above the ARJ respectively *versus* 98·3, 99·3 and 99·7 per cent at 3, 2 and 1 cm respectively; $P < 0{\cdot}001$). *Fig. 2* shows colour duplex imaging samples of different artery locations in relation to the rectal wall layers. The distribution of haemorrhoidal arteries in relation to rectal layers and distance from the ARJ is shown in *Table 1*. In the majority of the upper sectors (97·9 per cent at 6 cm and 90·9 per cent at 5 cm from the ARJ), haemorrhoidal arteries were located in the perirectal fat, and only occasionally within the bowel wall. At 4 cm above the ARJ, a greater number of sectors had arteries located in the rectal muscle. At 3 cm, the arteries were shown to run into the

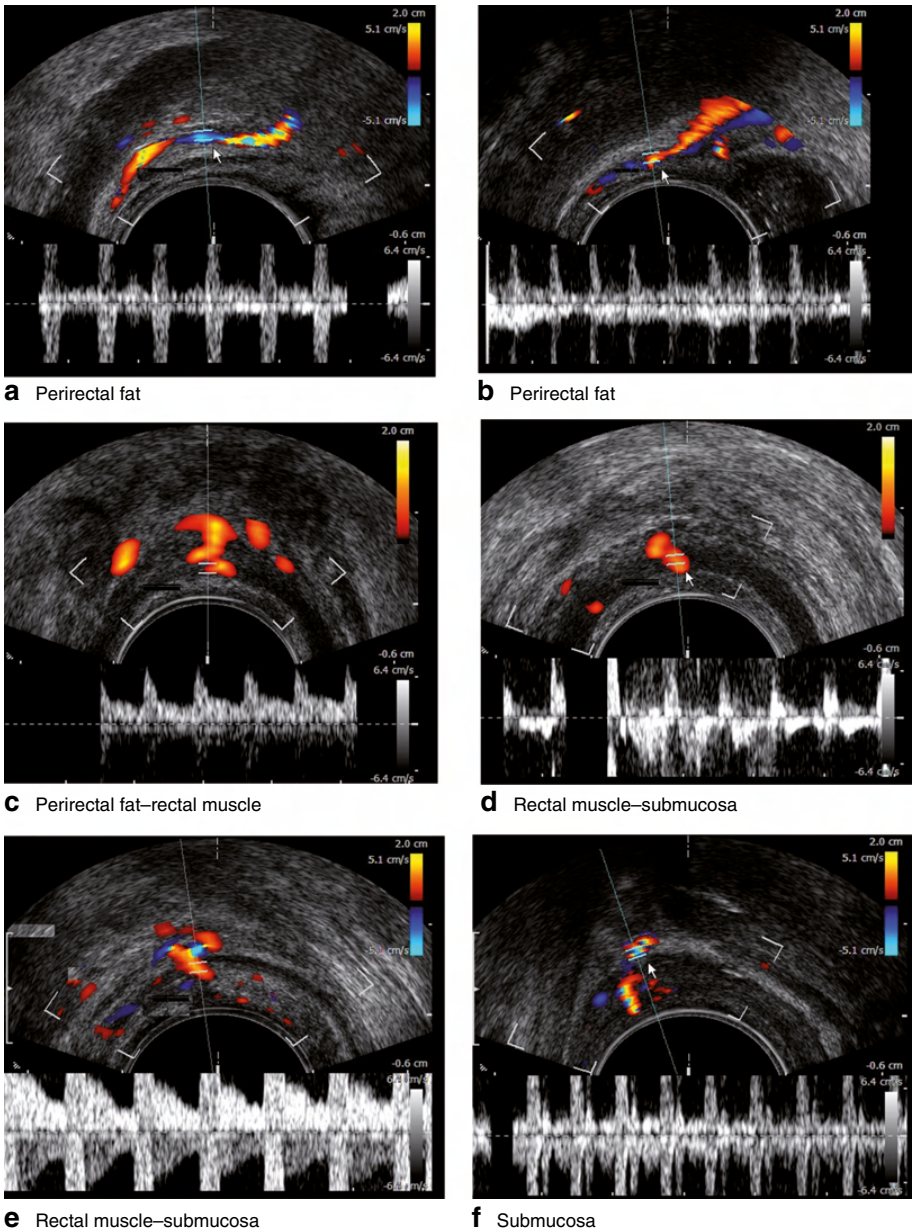


Fig. 2 Colour duplex imaging examples of different locations of arteries in relation to the rectal wall: **a,b** perirectal fat; **c** perirectal fat–rectal muscle; **d,e** rectal muscle–submucosa; **e** submucosa

submucosa in the majority of sectors, whereas at 2 and 1 cm above the ARJ almost all of the arteries had a submucosal location (in 96·6 and 100 per cent of sectors respectively); the differences were statistically significant ($P < 0·001$).

No haemorrhoidal arteries were detected in the left and right anterolateral sectors at 6, 5 and 4 cm above the ARJ, whereas such arteries were identified in the other sectors. At the lower three levels (3, 2 and 1 cm above the

Table 1 Distribution of detectable haemorrhoidal arteries in relation to rectal sectors and wall layers

	No. of rectal sectors						
	Distance from anorectal junction						
Haemorrhoidal artery location	6 cm	5 cm	4 cm	3 cm	2 cm	1 cm	*P**
Perirectal fat	189 (97·9)	180 (90·9)	84 (42·4)	8 (2·7)	0 (0)	0 (0)	< 0·001
Perirectal fat–rectal muscle	0 (0)	5 (2·5)	48 (24·2)	9 (3·1)	0 (0)	0 (0)	< 0·001
Rectal muscle	4 (2·1)	9 (4·5)	34 (17·2)	23 (7·8)	5 (1·7)	0 (0)	< 0·001
Rectal muscle–submucosa	0 (0)	3 (1·5)	27 (13·6)	57 (19·3)	5 (1·7)	0 (0)	< 0·001
Submucosa	0 (0)	1 (0·5)	5 (2·5)	198 (67·1)	288 (96·6)	299 (100)	< 0·001

Values in parentheses are percentages. *One-way ANOVA and Bonferroni tests.

Table 2 Rectal sectors with detectable haemorrhoidal arteries in relation to distance from anorectal junction

	Distance from anorectal junction					
Rectal sector	6 cm	5 cm	4 cm	3 cm	2 cm	1 cm
Left anterolateral	0 (0)	0 (0)	0 (0)	47 (94)	50 (100)	50 (100)
Left lateral	47 (94)	49 (98)	49 (98)	50 (100)	50 (100)	50 (100)
Left posterolateral	49 (98)	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)
Right posterolateral	48 (96)	49 (98)	49 (98)	49 (98)	49 (98)	49 (98)
Right lateral	49 (98)	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)
Right anterolateral	0 (0)	0 (0)	0 (0)	49 (98)	49 (98)	50 (100)

Values in parentheses are percentages.

Table 3 Arterial depth in relation to level of rectal circumference

	Distance from anorectal junction						
	6 cm	5 cm	4 cm	3 cm	2 cm	1 cm	*P**
Arterial depth (mm)	8·3(1·5)	6·6(1·4)	5·1(1·2)	3·3(0·9)	2·4(0·6)	1·9(0·4)	< 0·001

Values are mean(s.d.). *One-way ANOVA and Bonferroni tests.

Table 4 Arterial depth in relation to level of rectal circumference and sector

	Arterial depth (mm)						
	Distance from anorectal junction						
Rectal sector	6 cm	5 cm	4 cm	3 cm	2 cm	1 cm	*P**
Left anterolateral	—	—	—	2·6(0·7)	2·2(0·6)	1·9(0·5)	< 0·001
Left lateral	8·0(1·7)	6·1(1·4)	4·6(0·9)	3·4(0·7)	2·4(0·6)	1·9(0·4)	< 0·001
Left posterolateral	8·5(1·4)	7·0(1·4)	5·3(1·3)	3·5(0·9)	2·4(0·6)	1·9(0·4)	< 0·001
Right posterolateral	8·3(1·5)	6·7(1·5)	5·2(1·2)	3·6(0·8)	2·5(0·5)	2·0(0·4)	< 0·001
Right lateral	8·3(1·5)	6·7(1·3)	5·2(1·2)	3·6(1·0)	2·6(0·8)	1·9(0·4)	< 0·001
Right anterolateral	—	—	—	2·9(0·8)	2·2(0·5)	1·8(0·4)	< 0·001
*P**	0·674	0·022	0·020	< 0·001	0·005	0·865	—

Values are mean(s.d.). *One-way ANOVA and Bonferroni tests.

ARJ), haemorrhoidal arteries were identified in nearly all circumferential sectors (*Table 2*). The mean haemorrhoidal arterial depth was significantly lower in more distal sectors than in more proximal sectors; a statistical comparison between each level showed all differences to be significant ($P < 0·001$) (*Table 3*). This was a consistent finding in each rectal sector (*Table 4*). When mean arterial depths at each rectal level were compared, the differences between sectors

were not statistically different at 6 cm above ($P = 0{\cdot}674$) or 1 cm below ($P = 0{\cdot}865$) the ARJ, whereas differences between sectors were statistically significant at 5, 4, 3 and 2 cm above the ARJ ($P = 0{\cdot}022$, $P = 0{\cdot}020$, $P < 0{\cdot}001$ and $P = 0{\cdot}005$ respectively).

Discussion

The pathogenesis of HD is unclear, but is probably multifactorial. A number of elements have been claimed to be causative or predisposing factors. Disruption of supportive tissue surrounding haemorrhoids is considered to be an important factor in haemorrhoidal prolapse[7] and a number of inflammatory mediators have also been cited[8,9]. A hypertonic internal anal sphincter has frequently been associated with HD and is regarded as a possible cause of haemorrhoidal symptoms[10]. Haemorrhoidal vascularization appears to play a central role in the pathophysiology of HD.

Hyperplasia of the arteriovenous network within the anorectal submucosa (corpus cavernosum recti, CCR) results in increased vascular pressure. Blood overflow to the CCR should also cause increased intravascular pressure, and is thus a significant predisposing factor for HD[11]. Aigner and colleagues[12] confirmed the relationship between arterial overflow and HD. Using a transperineal Doppler probe to investigate haemorrhoidal arteries, they found a significantly higher arterial calibre and flow velocity in patients with HD compared with controls. They then hypothesized that the coordinated filling and drainage of the anorectal vascular plexus is regulated by the intrinsic vascular sphincter mechanism, and that the morphological and functional failure of this vascular system may contribute to the development of HD[13].

A comprehensive understanding of anorectal vascularization should contribute to outlining the pathophysiology of HD. A recent study by Schuurman and co-workers[14] highlighted how vascularization of the CCR is provided almost exclusively by branches of the superior rectal artery (SRA), a terminal branch of the inferior mesenteric artery. A previous study by Shafik and Mostafa[15] indicated that the lower half of the rectum is vascularized by the terminal branches of the SRA (two or three main branches), with plexiform patterns at the ends. The middle rectal artery has been reported in only 50 per cent of cadaver specimens[15], and the functional role of this artery seems negligible in light of these anatomical inconsistencies. DiDio and colleagues[16] also studied the middle rectal artery in 30 cadavers; it was present in 56·7 per cent of specimens, bilaterally (36·7 per cent) or unilaterally (20·0 per cent). The middle rectal artery arose from the internal pudendal artery in 40 per cent of specimens, the inferior gluteal artery in 26·7 per cent, and the internal iliac artery in 16·8 per cent. The consistent findings of the above studies appear to demonstrate that the SRA branches play a predominant role in CCR vascularization. Therefore, it is particularly important to define the topography of these vessels within the rectal–perirectal area. Aigner *et al.*[17] analysed five macroscopic preparations of human pelvis; they described the division of the SRA into left and right branches, then into three to five terminal branches penetrating the rectal wall in the middle and lower rectum. On examining microscopic preparations from 27 fetuses, they identified two to four terminal vessels penetrating the rectal wall and reaching the submucosa, especially in the posterolateral position (71 per cent of specimens)[17].

In the present study, the majority of arterial branches at the three highest levels (6, 5 and 4 cm from the ARJ) were located outside the rectal wall in the right lateral, right posterolateral, left posterolateral and left lateral sectors, where these vessels arise. In contrast, no haemorrhoidal arteries were detected in several sectors in the higher three levels; in particular, none was found in the right and left anterolateral sectors. These findings suggest that the arterial pulses detected by Doppler ultrasonography in the anterior highest three levels of the low rectum during surgical procedures using this technology can be regarded as being generated by vessels that are not directed to haemorrhoids. In contrast, in the lower 2 cm, haemorrhoidal arteries were detected in 98 per cent of sectors; specifically, at 2 and 1 cm from the ARJ, arteries were identified in the submucosa in 96·6 per cent and 100 per cent of sectors respectively. These features can be confirmed easily during Doppler-guided surgical procedures. Investigation of the position of the arteries in relation to rectal layers and levels showed that the mean arterial depth decreased significantly from the highest to the lowest level, reaching the shallowest depth at the most distal 2 cm of the rectum where nearly all of the arteries were in the submucosa; this feature was invariably found regardless of the circumferential sector investigated.

Both anatomical and physiological evidence obtained from the literature and the present study has implications for the various therapeutic approaches that are currently available. In this regard, the most innovative surgical techniques are SH (also known as Longo's technique) and Doppler-guided ligation of haemorrhoidal arteries, including THD and DG-HAL techniques. The goal of the first method is to treat haemorrhoidal prolapse by resecting the rectal mucosa approximately 3–4 cm above the dentate line[18]; however, the level of anastomosis is frequently unpredictable as it is affected by the traction applied to the previously performed rectal purse-string. In fact, it has been established that, even though SH is performed according

to well established technical guidelines, the intended location of the staple line is too difficult to standardize, as demonstrated by the wide range of anatomicopathological results reported by Ohana and co-workers[19]. Based on these data and the present findings, only a suture located within the distal 2 cm of the low rectum plays a role in the control of arterial overflow in patients treated with SH. However, even if SH and Doppler-guided ligation of haemorrhoidal arteries were applied, some doubts about Longo's procedure remain with respect to the circumferential suture performed with the specifically designed stapling device. This type of suture cannot ensure selective ligation of haemorrhoidal arteries as it can also involve both major and minor arterial vessels. Moreover, the circumferential suture could generate an unpredictable risk of venous outflow blockage, thus damaging the drainage system, as described previously[13].

The correlation between SH and rectal vascularization was highlighted in another study in which a perineal Doppler probe was used in patients who underwent SH for HD and a group of healthy subjects[20]. Baseline measurements differed significantly between patient and control groups. Postoperative follow-up showed no significant alterations in physiological parameters. Patients with a higher rate of recurrence of HD had higher baseline arterial flow velocity values. The study showed that SH did not reduce arterial inflow in the vessels feeding the anorectal vascular plexus. The present data may explain the reasons for the failure to reduce vascular overflow. In that study[20], the anastomosis was performed 3·5–4 cm above the dentate line, a level at which most terminal arterial branches are not in the submucosa. Indeed, a meta-analysis of large-scale studies of patients undergoing SH demonstrated that these patients are more likely to develop recurrent HD with prolapse and bleeding at any time than those having conventional haemorrhoidectomy[21,22].

The goal of THD and DG-HAL is significantly to reduce arterial overflow to haemorrhoidal piles by dearterialization, that is Doppler-guided ligation of the haemorrhoidal arteries in the upper part of the low rectum. The results of these operations seem promising[23–31]. In particular, most studies have shown that recurrent bleeding is limited to a minority of patients (5–20 per cent after THD; 1–21 per cent after DG-HAL)[23–31].

However, traditional dearterialization might fail to include the haemorrhoidal arteries in some sites owing to their deep location (within the muscularis propria or in perirectal fat), particularly on the anterior side of the rectum. The reported frequency of recurrent bleeding in patients undergoing dearterialization alone using the 'high arterial ligation' technique (31 per cent)[26] supports this view. When mucopexy is included in THD or DG-HAL procedures, the possibility of excluding arteries may be lower as the running suture (even one that begins in the upper part of the low rectum to perform high ligation of haemorrhoidal arteries) is usually continued by transfixing the mucosa and submucosa to the ARJ, thus involving arterial branches directed to the haemorrhoidal piles.

By selectively ligating the haemorrhoidal arteries using a very precise Doppler system[26], the THD technique can accurately identify the location of arterial vessels in the submucosa of the low rectum, thus achieving a significant reduction in arterial overflow to haemorrhoids. Based on the present findings, dearterialization should be more effective if performed 1 and 2 cm from the ARJ, where almost all of the arteries are localized in the submucosa, with a mean depth of 1·9–2·4 mm. In contrast, arterial ligation 3 cm from the ARJ may not be effective in certain sectors. At this level, 67·1 per cent of the vessels identified were located in the submucosa. Above this level, a smaller percentage of submucosal arteries was found, possibly making dearterialization less accurate at higher levels.

This study provides new insight into the functional anatomy of haemorrhoids, with a direct impact on pathophysiology and treatment. The location of almost all the branches of the SRA in the submucosa provides a clear target for surgical treatments that recognize vascular overflow as a fundamental factor in the aetiology of HD. Optimizing dearterialization is essential for improving clinical outcome. In this regard, Doppler imaging plays a pivotal role during the surgical procedure by providing precise identification, then guided ligation of arteries. Clinical trials are required to confirm the therapeutic implications of these findings.

Acknowledgements

The authors declare no conflict of interest.

References

1 Lucha PA. Pathophysiology of hemorroidal disease. In *Surgical Treatment of Hemorrhoids*, Khubchandani I, Paonessa N, Azimuddin K (eds). Springer: London, 2009; 15–17.
2 Loder PB, Kamm MA, Nicholls RJ, Philips RK. Haemorrhoids: pathology, pathophysiology and aetiology. *Br J Surg* 1994; **81**: 946–954.
3 Thomson WH. The anatomy and nature of piles. In *The Haemorrhoid Syndrome*, Kaufman HD (ed.). Abacus Press: Tunbridge Wells, 1981; 15–33.
4 Shafik A. Surgical anatomy of hemorrhoids. In *Surgical Treatment of Hemorrhoids*, Khubchandani I, Paonessa N, Azimuddin K (eds). Springer: London, 2009; 7–13.

5 Giordano P, Overton J, Madeddu F, Zaman S, Gravante G. Transanal hemorrhoidal dearterialization: a systematic review. *Dis Colon Rectum* 2009; **52**: 1665–1671.

6 Sultan S, Rabahi N, Etienney I, Atienza P. Stapled haemorrhoidopexy: 6 years' experience of a referral centre. *Colorectal Dis* 2010; **12**: 921–926.

7 Shafik A. The pathogenesis of hemorrhoids and their treatment by anorectal bandotomy. *J Clin Gastroenterol* 1984; **6**: 129–137.

8 Klink C, Binnebösel M, Kämmer D, Willis S, Prescher A, Klinge U *et al*. Haemorrhoids are related to changes of cell function in mucosa and submucosa. *Int J Colorectal Dis* 2009; **24**: 1389–1394.

9 Taweevisit M, Wisadeopas N, Phumsuk U, Thorner PS. Increased mast cell density in haemorrhoid venous blood vessels suggests a role in pathogenesis. *Singapore Med J* 2008; **49**: 977–979.

10 Vyslouzil K, Zboril P, Skalický P, Vomackova K. Effect of hemorrhoidectomy on anorectal physiology. *Int J Colorectal Dis* 2010; **25**: 259–265.

11 Stelzner F, Staubesand J, Machleidt H. [The corpus cavernosum recti – basis of internal hemorrhoids.] *Langenbecks Arch Klin Chir Ver Dtsch Z Chir* 1962; **299**: 302–312.

12 Aigner F, Bodner G, Gruber H, Conrad F, Fritsch H, Margreiter R *et al*. The vascular nature of hemorrhoids. *J Gastrointest Surg* 2006; **10**: 1044–1050.

13 Aigner F, Gruber H, Conrad F, Eder J, Wedel T, Zelger B *et al*. Revised morphology and hemodynamics of the anorectal vascular plexus: impact on the course of hemorrhoidal disease. *Int J Colorectal Dis* 2009; **24**: 105–113.

14 Schuurman JP, Go PM, Bleys RL. Anatomical branches of the superior rectal artery in the distal rectum. *Colorectal Dis* 2009; **11**: 967–971.

15 Shafik A, Mostafa H. Study of the arterial pattern of the rectum and its clinical application. *Acta Anat (Basel)* 1996; **157**: 80–86.

16 DiDio LJ, Diaz-Franco C, Schemainda R, Bezerra AJ. Morphology of the middle rectal arteries. A study of 30 cadaveric dissections. *Surg Radiol Anat* 1986; **8**: 229–236.

17 Aigner F, Bodner G, Conrad F, Mbaka G, Kreczy A, Fritsch H. The superior rectal artery and its branching pattern with regard to its clinical influence on ligation techniques for internal hemorrhoids. *Am J Surg* 2004; **187**: 102–108.

18 Corman ML, Gravié JF, Hager T, Loudon MA, Mascagni D, Nyström PO *et al*. Stapled haemorrhoidopexy: a consensus position paper by an international working party – indications, contra-indications and technique. *Colorectal Dis* 2003; **5**: 304–310.

19 Ohana G, Myslovaty B, Ariche A, Dreznik Z, Koren R, Rath-Wolfson L. Mid-term results of stapled hemorrhoidopexy for third- and fourth-degree hemorrhoids – correlation with the histological features of the resected tissue. *World J Surg* 2007; **31**: 1336–1342.

20 Aigner F, Bonatti H, Peer S, Conrad F, Fritsch H, Margreiter R *et al*. Vascular considerations for stapled haemorrhoidopexy. *Colorectal Dis* 2010; **12**: 452–458.

21 Jayaraman S, Colquhoun PH, Malthaner RA. Stapled *versus* conventional surgery for hemorrhoids. *Cochrane Database Syst Rev* 2006; (4)CD005393.

22 Shao WJ. Systematic review and meta-analysis of randomized controlled trials comparing stapled haemorrhoidopexy with conventional haemorrhoidectomy. *Br J Surg* 2008; **95**: 147–160.

23 Cantero R, Balibrea JM, Ferrigni C, Sanz M, García Pérez JC, Pérez R *et al*. [Doppler-guided transanal haemorrhoidal dearterialisation. An alternative treatment for haemorrhoids.] *Cir Esp* 2008; **83**: 252–255.

24 Infantino A, Bellomo R, Dal Monte PP, Salafia C, Tagariello C, Tonizzo CA *et al*. Transanal haemorrhoidal artery echodoppler ligation and anopexy (THD) is effective for II and III degree haemorrhoids: a prospective multicentric study. *Colorectal Dis* 2010; **12**: 804–809.

25 Festen S, van Hoogstraten MJ, van Geloven AA, Gerhards MF. Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results. *Int J Colorectal Dis*. 2009; **24**: 1401–1405.

26 Ratto C, Donisi L, Parello A, Litta F, Doglietto GB. Evaluation of transanal hemorrhoidal dearterialization as a minimally invasive therapeutic approach to hemorrhoids. *Dis Colon Rectum* 2010; **53**: 803–811.

27 Arnold S, Antonietti E, Rollinger G, Scheyer M. [Doppler ultrasound assisted hemorrhoid artery ligation. A new therapy in symptomatic hemorrhoids.] *Chirurg* 2002; **73**: 269–273.

28 Scheyer M, Antonietti E, Rollinger G, Mall H, Arnold S. Doppler-guided hemorrhoidal artery ligation. *Am J Surg* 2006; **191**: 89–93.

29 Greenberg R, Karin E, Avital S, Skornick Y, Werbin N. First 100 cases with Doppler-guided hemorrhoidal artery ligation. *Dis Colon Rectum* 2006; **49**: 485–489.

30 Wallis de Vries BM, van der Beek ES, de Wijkerslooth LR, van der Zwet WC, van der Hoeven JA, Eeftinck Schattenkerk M *et al*. Treatment of grade 2 and 3 hemorrhoids with Doppler-guided hemorrhoidal artery ligation. *Dig Surg* 2007; **24**: 436–440.

31 Wałega P, Scheyer M, Kenig J, Herman RM, Arnold S, Nowak M *et al*. Two-center experience in the treatment of hemorrhoidal disease using Doppler-guided hemorrhoidal artery ligation: functional results after 1-year follow-up. *Surg Endosc* 2008; **22**: 2379–2383.

2011

Authors: **Faucheron** JL., **Poncet** G., **Voirin** D., **Badic** B., **Gangner** Y.

Source: Dis Colon Rectum. 2011 Feb;54(2):226-31

https://www.ncbi.nlm.nih.gov/pubmed/21228673

Title: **Doppler-guided hemorrhoidal artery ligation and rectoanal repair (HAL-RAR) for the treatment of grade IV hemorrhoids: long-term results in 100 consecutive patients**

BACKGROUND:

Doppler-guided hemorrhoidal artery ligation is a minimally invasive technique for the treatment of symptomatic hemorrhoids that has been applied successfully for grade II and III hemorrhoids but is less effective for grade IV hemorrhoids. Development of a special proctoscope enabled the combination of hemorrhoidal artery ligation with transanal rectoanal repair (mucopexy), which serves to lift and then secure the protruding hemorrhoids in place.

OBJECTIVE:

The purpose of this study was to describe our experience with this combined procedure in the treatment of grade IV hemorrhoids.

DESIGN:

Prospective observational study.

SETTING:

Outpatient colorectal surgery unit.

PATIENTS:

Consecutive patients with grade IV hemorrhoids treated from April 2006 to December 2008.

INTERVENTION:

Hemorrhoidal artery ligation-rectoanal repair.

MAIN OUTCOME MEASURES:

Operating time, number of ligations, number of mucopexies and associated procedures, and postoperative symptoms were recorded. Pain was graded on a visual analog scale. Follow-up was at 2, 6, and 12 months after surgery, and then annually.

RESULTS:

A total of 100 consecutive patients (64 women, 36 men) with grade IV hemorrhoids were included. Preoperative symptoms were bleeding in 80 and pain in 71 patients; 19 patients had undergone previous surgical treatment for the disease. The mean operative time was 35 (range, 17-60) minutes, with a mean of 9 (range, 4-14)

tions placed per patient. Eighty-four patients were discharged on the day of the operation. Nine patients developed early postoperative complications: pain in 6, bleeding in 4, dyschezia in 1, and thrombosis of residual hemorrhoids in 3. Late complications occurred in 4 patients and were managed conservatively. Recurrence was observed in 9 patients (9%), with a mean follow-up of 34 (range, 14-42) months.

LIMITATIONS:

The 2 main weaknesses of the study were the lack of very long-term follow-up and the absence of a comparison with hemorrhoidectomy or hemorrhoidopexy.

CONCLUSION:

Doppler-guided hemorrhoidal artery ligation with rectoanal repair is safe, easy to perform, and should be considered as an effective option for the treatment of grade IV hemorrhoids.

2010

Authors: **Ratto** C., **Donisi** L., **Parello** A., **Litta** F., **Doglietto** G.B.

Source: Dis. Colon Rectum. 2010; 53 (5): 803-811
https://www.ncbi.nlm.nih.gov/pubmed/20389215

Title: **Evaluation of Transanal Hemorrhoidal Dearterialization as a Minimally Invasive Therapeutic Approach to Hemorrhoids**

PURPOSE:

Transanal hemorrhoidal dearterialization (THD) is an innovative technique to treat hemorrhoids using a specially designed proctoscope for Doppler-guided transanal ligation of hemorrhoidal arteries. We analyzed results of experience at a single-institution with this THD device.

METHODS:

Overall, 170 patients were submitted to THD during the period July 2005 through October 2008. The operation consisted of hemorrhoidal dearterialization (of 6 arteries) in all patients, with major mucosal/submucosal pexy in 56 patients (32.9%). The first consecutive 11 patients (6.4%) were treated under general/spinal anesthesia, the remaining 159 (93.6%) by sedation with propofol, supported by analgesia with remifentanil. Following THD surgery, patients were regularly evaluated at 2 weeks, 1 and 3 months, and once a year after operation.

RESULTS:

The mean age of the 170 patients was 47.3 ± 13.0 years; 102 (60%) were men. Hemorrhoidal disease was grade II in 13 (7.6%); grade III in 141 (82.7%), and grade IV in 16 (9.6%). Postoperative bleeding requiring surgical hemostasis occurred in 2 cases (1.2%). Mean follow-up was 11.5 ± 12 (range, 1-41) months. Hemorrhoidal thrombosis occurred in 4 patients (2.3%), chronic pain and fecal incontinence in none. Hemorrhoidal prolapse was reported at follow-up by 50 patients (29.5%), but prolapse was confirmed only in 18 (10.5%) and was mild; some patients reporting prolapse were found to have skin tags. Overall, long-term control of bleeding was obtained in 159 patients (93.5%) and control of prolapse in 152 (89.5%). Recurrence of hemorrhoidal disease requiring surgery was found in 7 patients (4.1%).

CONCLUSIONS:

THD appears to be a very effective minimally invasive option to treat hemorrhoids and can be performed in a day-surgery setting. Future controlled trials comparing THD with other procedures will show the real potential of THD and define adequate indications for this approach.

2009

Authors: **Festen** S., **Van Hoogstraten** MJ., **Van Geloven** AAW., **Gerhards** MF.

Source: Int J Colorectal Dis. 2009 Dec;24(12):1401-5

https://www.ncbi.nlm.nih.gov/pubmed/19798507

Title: Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results

PURPOSE:

Haemorrhoidal disease is a frequently occurring entity in the western world. The Procedure for prolapse and haemorrhoids (PPH) and transanal haemorrhoidal dearterialisation (THD) are the most important surgical treatments that respect normal anal anatomy. This is the first randomized trial that compares both techniques in the treatment of grade III and IV haemorrhoids.

METHODS:

Patients with grade III or IV haemorrhoids were randomized between PPH and THD. Patients were seen after 1 week, 3 weeks and 6 weeks postoperatively. Primary endpoint was resolved symptoms 6 weeks postoperatively. Secondary endpoints were pain, measured with a visual analogue scale (VAS) after 1 day, 1 week and 3 weeks, and complications.

RESULTS:

Eighteen patients were allocated to PPH versus 23 to THD. Success rates after 6 weeks were 83% in the PPH group versus 78% in the THD group. VAS scores were significantly lower after 1 day and 1 week in the THD group, but equalled out after 3 weeks. Twelve percent of the patients after PPH and 4% after THD needed an urgent readmission to treat an acute bleeding. Overall complication rates did not differ significantly.

CONCLUSION:

Both PPH and THD are safe treatments for grade III and IV haemorrhoids with acceptable complication rates and good short-term results. THD might be the preferred treatment because it carries the similar complication rate and short-term results, but results in less postoperative pain when compared with PPH. Moreover, it is a less invasive, more easily learned and less costly procedure.

2009

Authors: **Schuurman** JP., **Go** PMNYH., **Bleys** RLAW.

Source: Colorectal Disease 2009, 11: 967-971

https://www.ncbi.nlm.nih.gov/pubmed/19175645

Title: **Anatomical branches of the superior rectal artery in the distal rectum**

OBJECTIVE:

The aim of this experimental study was to study the arterial supply of the corpus cavernosum recti in the inner wall of the distal rectum in relation to haemorrhoidal ligation therapy.

METHOD:

In 10 nonfixed human cadavers, the arterial vasculature of the rectum was studied using the Araldite casting method. Subsequently, the specimens were treated with methylbenzonate in order to obtain semi-transparent specimens in which the corpus cavernosum recti could be studied.

RESULTS:

Specimens were obtained permitting study of the arterial vasculature of the rectum and corpus cavernosum recti at all levels. The superior rectal artery was found to sypply the corpus cavernosum recti which consisted of a variable number of equally spaced twisting arteries.

CONCLUSION:

The distal rectum is supplied by the superior rectal artery. The supplying arteries of the corpus cavernosum recti are not confined to the strict locations described in the literature. This finding is of importance in surgical treatment of haemorrhoidal disease.

2011

Authors: **Giordano** P., **Nastro** P., **Davies** A., **Gravante** G.

Source: Techniques in Coloproctology. Published Online 12 February 2011

Available for Open Online Access

Title: Prospective evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: three-year outcomes

INTRODUCTION:

The aim of the study was to compare short- and medium-term outcomes of transanal Haemorrhoidal dearterialisation (THD) versus stapled haemorrhoidopexy (SH) for the treatment of second- and third-degree haemorrhoids.

METHODS:

Patients with second- or third-degree haemorrhoids who failed conservative treatment were randomly allocated to THD or SH. Preoperative and postoperative symptoms, postoperative pain, time until return to normal activities, complications, patient satisfaction and recurrence rates were all assessed prospectively. Patients were followed up at 2, 8 months and when the study was completed.

RESULTS:

Twenty-eight patients (43% third degree) underwent THD and 24 (38% third degree) underwent SH. There were no significant differences in terms of postoperative pain, expected pain and analgesia requirements, but more THD patients returned to work within 4 days ($P < 0.05$). One THD patient developed a sub-mucosal haematoma after surgery, one SH patient occlusion of the rectal lumen and two rectal bleeding. At 8-month follow-up (range 33-48 months), all short-term complications resolved. Patient satisfaction ("excellent/good outcome", THD 89 vs. SH 87%) and recurrence rate (THD 14 vs. SH 13%) were similar in the two groups.

CONCLUSIONS:

Short-term results although similar seem to suggest SH may result in increased morbidity while return to work is quicker after THD. Medium-term results demonstrate that THD and SH have similar effectiveness.

Tech Coloproctol (2011) 15:67–73
DOI 10.1007/s10151-010-0667-z

ORIGINAL ARTICLE

Prospective evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: three-year outcomes

P. Giordano · P. Nastro · A. Davies · G. Gravante

Received: 29 October 2010 / Accepted: 13 December 2010 / Published online: 12 February 2011

Abstract
Introduction The aim of the study was to compare short- and medium-term outcomes of transanal haemorrhoidal dearterialisation (THD) versus stapled haemorrhoidopexy (SH) for the treatment of second- and third-degree haemorrhoids.
Methods Patients with second- or third-degree haemorrhoids who failed conservative treatment were randomly allocated to THD or SH. Preoperative and postoperative symptoms, postoperative pain, time until return to normal activities, complications, patient satisfaction and recurrence rates were all assessed prospectively. Patients were followed up at 2, 8 months and when the study was completed.
Results Twenty-eight patients (43% third degree) underwent THD and 24 (38% third degree) underwent SH. There were no significant differences in terms of postoperative pain, expected pain and analgesia requirements, but more THD patients returned to work within 4 days ($P < 0.05$). One THD patient developed a sub-mucosal haematoma after surgery, one SH patient occlusion of the rectal lumen and two rectal bleeding. At 8-month follow-up, two SH patients complained of faecal urgency. At 38-month follow-up (range 33–48 months), all short-term complications resolved. Patient satisfaction ("excellent/good outcome", THD 89 vs. SH 87%) and recurrence rate (THD 14 vs. SH 13%) were similar in the two groups.
Conclusions Short-term results although similar seem to suggest SH may result in increased morbidity while return to work is quicker after THD. Medium-term results demonstrate that THD and SH have similar effectiveness.

Keywords Haemorrhoids · Stapled haemorrhoidopexy · Procedure for prolapse and haemorrhoids · Transanal haemorrhoidal dearterialisation

Introduction

Conventional haemorrhoidectomy (CH) is the most widely used surgical procedure for the treatment of symptomatic haemorrhoids and is still considered by many surgeons as the gold-standard technique. It is very effective, relatively safe and economic, but also notoriously painful and potentially affects the mechanism of anal continence [1]. Over the years, alternative minimally invasive techniques have been developed including stapled haemorrhoidopexy (SH), also known as procedure for prolapse and haemorrhoids (PPH), and transanal haemorrhoidal dearterialisation (THD) also known as Doppler-guided haemorrhoidal artery ligation (DGHAL). SH consists of a transanal stapled circumferential rectal mucosectomy. The procedure aims to lift up the mucosa and restore the normal anatomy and physiology of the diseased haemorrhoidal tissue. Results show that the procedure is less painful and facilitates an earlier return to normal activities than to CH [2–5]. However, data also suggest a higher recurrence rate [6] and a small risk of serious complications [7–12]. THD is a technique that closes, under Doppler guidance, the distal branches of the superior rectal artery (SRA), thereby

Paper presented as a poster at the Association of Surgeons of Great Britain and Ireland 2009, Association of Coloproctology of Great Britain and Ireland 2009 and the European Society of Coloproctology 2009.

P. Giordano (✉) · P. Nastro · A. Davies · G. Gravante
Department of Colorectal Surgery, Whipps Cross University Hospital, Whipps Cross Road, London E11 1NR, UK
e-mail: pasquale.giordano@whippsx.nhs.uk

reducing the blood flow to the haemorrhoidal plexus [13]. The closure of the vessels is achieved with a dedicated proctoscope that incorporates a Doppler probe. Early data suggest a favourable comparison with CH in terms of postoperative pain and return to normal activities. Relapse rates seem similar [14], but long-term results are scarce [15, 16].

This prospective trial aims to compare short- and medium-term results of these two new treatment modalities for haemorrhoids.

Materials and methods

All patients with symptomatic second- and third-degree haemorrhoidal disease that failed a conservative treatment were offered surgical intervention in the form of THD or SH. Patients were given an explanation of the details of both procedures and were invited to participate to the study. Although there was no formal randomisation, those that agreed to participate were casually allocated to either procedure without any specific criteria for selecting one method over the other. The surgical procedure was decided blindly by the operating surgeon on the day of surgery just before examining the patient under anaesthesia and without being aware of the patient's symptoms.

All patients with fourth-degree haemorrhoids and those with a large external component were excluded and offered CH. Furthermore, patients with complicated haemorrhoidal disease, other concomitant anal conditions, under anticoagulation therapy, with coagulation disorders or those who opted for one of the two procedures thereby refusing random allocation were also excluded.

Surgical procedure and technique

All operations were performed as a day-case procedure under general anaesthesia by the senior author (PG) or under his direct supervision by another member of the team specifically trained in the procedure. All patients were prescribed a phosphate enema prior to surgery. Both SH and THD procedures were carried out with the patient in the lithotomy position. THD was performed using a specifically designed proctoscope (THD PS02, THD Lab^{TM}, Correggio, Italy), which incorporates a side-sensing Doppler probe and a window beyond this for suture placement. The Doppler ultrasound transducer was used to identify the haemorrhoidal arteries at about 4 cm above the dentate line. Once identified, the haemorrhoidal arteries were transfixed and ligated using 2/0 absorbable Vicryl^{TM} sutures in a figure-of-eight stitch. In addition to that, a mucosopexy was performed at the same time using the same stitch starting from the level of the ligation and proceeding distally towards the dentate line, incorporating the mucosa and submucosa. The suture was stopped at about 5 mm from the dentate line taking care not to catch the anal mucosa in order to avoid postoperative pain.

Stapled haemorrhoidopexy was performed according to the technique described by Longo [12] using a 2/0 polypropylene purse-string suture applied 4 cm above the dentate line including mucosa and submucosa. The dedicated circular stapling device (PPH 03, Ethicon Endo-Surgery^{TM}, Ohio, USA) was then used for mucosectomy and anopexy. The excised specimen of the SH group was inspected and sent for histological examination. Finally, an absorbable gelatine sponge dressing was placed in the anal canal of all patients.

Anaesthesia and operative time were recorded in a computerised log. Patients were discharged with rectal 2% lignocaine gel, oral diclofenac (50 mg tid) and co-dydramol (paracetamol 1000 mg–dihydrocodeine 60 mg qid) to be used as required for 10 days. Patients also received regular laxatives for 2 weeks (Hyspagula sachet po bid and Lactulose 10 ml po bid).

Assessment and postoperative follow-up

All data were prospectively collected. Data included patients' demographics and relevant history. The degree of severity of haemorrhoidal symptoms was scored for each patient using a specifically designed questionnaire assessing 5 different parameters, each scoring from 0 to 4 with 0 corresponding to no symptoms at all and 4 to the presence of the symptoms on a daily basis or with every bowel movement (Table 1). A total score of 0 corresponded to the complete absence of haemorrhoidal symptoms, while a total score of 20 corresponded to the worst possible degree of symptoms (Table 1). Postoperative pain was assessed using a standardised visual analogue score 0–10 (0 = no pain, 10 = the worse possible pain) with patients asked to record the most severe episode. Patients were also asked to record in a similar manner the expected pain from −5 to +5 VAS, with −5 corresponding to the actual pain being much better than expected, 0 as expected and +5 much worse than expected.

Patients were reviewed in the outpatient clinic at 8 weeks and 8 months and reassessed with a telephone interview at 3 years. During the interview, the questionnaire on symptoms was completed again and unless patients were completely asymptomatic they were recalled and evaluated in the outpatient clinic. Patient satisfaction was assessed at 3 years with 4 categories: excellent, good, fair and poor.

Table 1 Symptom questionnaire

	Never	At least once per year	At least once per months	At least once per week	With every bowel movement
Bleeding	0	1	2	3	4
Prolapse	0	1	2	3	4
Manual reduction	0	1	2	3	4
Discomfort/pain	0	1	2	3	4
Impact on	Not at all	Minimal	Moderate	Severe	Very severe
QoL	0	1	2	3	4

QoL quality of life

Statistical analysis

All collected data were entered into an Excel database (Microsoft Corporation, Redmond-Washington, USA) and analysed with the Statistical Package for the Social Sciences Windows version 13.0 (SPSS, Chicago, Illinois, USA). Descriptive statistics for quantitative continuous variables were the mean and standard deviation after confirmation of normal distribution, otherwise median and range. Descriptive statistics for qualitative categorical variables were performed using frequencies. Comparison of groups (SH vs. THD) was performed with Student's *t*-test for continuous parametric, the Mann–Whitney test for continuous non-parametric and the chi-square test or Fisher's exact test for categorical variables (Fisher's if counts were inferior to 5). A P value of <0.05 was considered statistically significant.

Results

Between September 2004 and December 2005, 64 consecutive patients were evaluated. Twelve patients were excluded from this group (Fig. 1), leaving 52 patients for analysis. Demographic and preoperative clinical data are summarised in Table 2. THD and SH groups were homogeneous for age, sex, previous haemorrhoidal surgery, degree of prolapse and preoperative symptom score. All patients had previously received at least one injection of sclerotherapy, 7 had undergone haemorrhoidal banding.

Early results

Early postoperative results are summarised in Table 3. No differences were observed for the operative time. There was a trend towards less pain in the THD group although this did not reach statistical significance. All patients but one in both groups were discharged on the same day they had surgery. There was a significant difference between the groups in terms of return to work that favoured the THD group (Table 3).

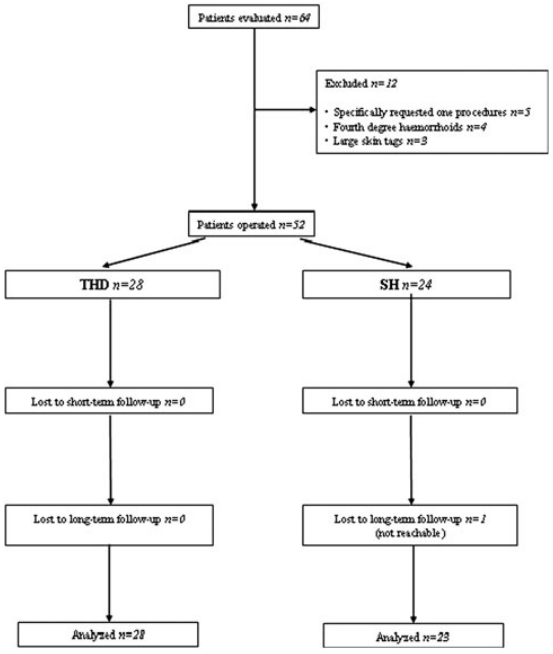


Fig. 1 Flow diagram of patients at each stage of treatment *THD* transanal haemorrhoidal dearterialisation, *SH* stapled haemorrhoidopexy

No significant differences were observed for the rate of postoperative surgical complications or readmissions (Tables 3, 4). In 2 THD patients, the tip of the needle snapped off during ligation and was not retrieved. This did not cause any symptoms and both patients had a successful outcome. Another patient in the THD group experienced urinary retention. He had to be catheterised overnight and was discharged the following day. One patient in the SH group developed complete occlusion of the rectal lumen following firing of the stapler. The complication was successfully managed endoscopically, and the patient was discharged home 2 days later. Again, even in this case, the haemorrhoidal symptoms resolved successfully after surgery [17]. In the SH group, 2 patients with postoperative bleeding had to be readmitted and managed conservatively.

Table 2 Demographic data

	THD ($n = 28$; 54%)	SH ($n = 24$; 46%)	*P*
Age (years)	54 (23–73)	48 (35–78)	NS
Sex (males/females)	20 M/8F	16 M/8F	NS
Previous CH	1 (4%)	0 (0%)	NS
Haemorrhoidal degree			
Second degree	16 (57%)	15 (62%)	NS
Third degree	12 (43%)	9 (38%)	NS
Preoperative scoring system	13.6 (8–20)	13.3 (9–18)	NS

M males, *F* females, *CH* conventional haemorrhoidectomy, *THD* transanal haemorrhoidal dearterialisation, *SH* stapled haemorrhoidopexy

Table 3 Early postoperative results

	THD ($n = 28$; 54%)	SH ($n = 24$; 46%)	*P*
Operating time (min)	30 (20–45)	33 (18–100)	NS
Postoperative pain (VAS)	2 (0–9)	3.5 (1–10)	NS
Postoperative versus expected pain	−2 (−5, 1)	−3 (−5, 2)	NS
Delayed discharge	1 (4%)	1 (4%)	NS
Time required to return to normal activities (days)	3.2 (1–11)	6.3 (4–14)	<0.01
Patients with return to work or normal activities at postoperative day 4	25 (89%)	12 (50%)	<0.05
Readmissions	0 (0%)	3 (12%)	NS

THD transanal haemorrhoidal dearterialisation, *SH* stapled haemorrhoidopexy

None of them required blood transfusions. Another patient in the SH group also required readmission on the second postoperative day because of severe pain (Tables 3, 4).

Three-year results

The overall median follow-up was 38 months (range 33–48 months). Only one patient in the SH group was not contactable at this time. This patient was asymptomatic when seen at 8 months.

Table 4 Postoperative complications

	THD ($n = 28$; 54%)	SH ($n = 24$; 46%)	*P*
Faecal incontinence	0 (0%)	0 (0%)	NS
Transient faecal urgency	0 (0%)	2 (8%)	NS
Submucosal haematoma	1 (4%)	0 (0%)	NS
Technical problems	2 (7%)	0 (0%)	NS
Postoperative bleeding	0 (0%)	2 (8%)	NS
Rectal stenosis	0 (0%)	1 (4%)	NS
Urinary retention	1 (4%)	0 (0%)	NS
Severe postoperative pain	0 (0%)	1 (4%)	NS
Total complications	4 (14%)	6 (25%)	NS

THD transanal haemorrhoidal dearterialisation, *SH* stapled haemorrhoidopexy

Medium-term results are shown in Table 5. There was no significant difference in recurrence between the groups (14 vs. 13%). Five patients (3 THDs and 2 SHs) had prolapsed haemorrhoids and successfully proceeded to CH. Two patients, one in each group, suffering from haemorrhoidal bleeding were happy to avoid further intervention (Table 5). Two other patients suffered of occasional pruritus but had no evidence of haemorrhoidal disease on clinical evaluation.

There was no significant difference in the postoperative symptom scores between THD and SH (Table 5; P = NS). Both techniques significantly reduced the scores when compared to the preoperative values ($P < 0.0001$). As both groups had also similar preoperative scores (Table 2), it appeared that THD and SH were associated with a similar degree of improvement.

No differences were observed between the groups as regards patient satisfaction. Satisfaction was excellent or good in 89% ($n = 25$) of patients in the THD group and 87% ($n = 20$) in the SH group (P = NS). Those patients that rated their satisfaction as excellent were completely asymptomatic at the time of the interview (Table 5).

Discussion

The ideal surgical option for the treatment of symptomatic haemorrhoids is a technique able to provide long-term

Table 5 Medium-term postoperative results

	THD ($n = 28$; 55%)	SH ($n = 23$; 45%)	P
Postoperative scoring system	1.1 (0–7)	1.6 (0–12)	NS
Total recurrences	4 (14%)	3 (13%)	NS
Haemorrhoidal prolapsed	3 (11%)	2 (9%)	NS
Frequent bleeding	1 (4%)	1 (4%)	NS
Satisfaction rate			
Excellent	19 (68%)	15 (65%)	NS
Good	5 (18%)	3 (13%)	NS
Fair	2 (7%)	2 (9%)	NS
Poor	2 (7%)	3 (13%)	NS

THD transanal haemorrhoidal dearterialisation, *SH* stapled haemorrhoidopexy

relief of symptoms which is, at the same time, economical, safe, easy to perform and well tolerated by patients. The fact that multiple operations exist implies that no method is universally accepted as superior to the others. The operative approach is often tailored to the individual patient.

While there is now considerable literature on SH, the data regarding THD is still limited and mostly taken from case series, not comparative studies [15]. Furthermore, THD has progressively evolved over the years, and the technique used in this study differs substantially from the original haemorrhoidal artery ligation [13] since the plication of the rectal mucosa has become an integral part of the operation. As a consequence, the postoperative changes in the anatomy of the haemorrhoidal plexus following THD and SH are very similar, except that THD does not involve the excision of any tissue.

THD and SH aim to correct the physiology of the haemorrhoidal plexus by restoring normal anatomy. This may be achieved through a reduction in the arterial in-flow (dearterialisation) or an elimination of the mucosal prolapse (mucosopexy). The rationale behind mucosopexy is not just to reduce haemorrhoidal prolapse but also to improve long-term outcomes. Indeed, since it has been suggested that mucosal sliding may impair venous drainage [18], mucosopexy could perhaps improve venous drainage from the haemorrhoidal plexus, thus reducing the recurrence rate. Furthermore, repositioning the haemorrhoidal cushions rather than excising them also has the advantage of restoring the physiological role of these structures in the mechanism of anal continence. It has been demonstrated that the cushions contribute to approximately 15–20% of the resting anal pressure [19] and perhaps more importantly they serve as a plug ensuring complete closure of the anal canal.

With THD, dearterialisation relies on the accurate localisation and transfixion of the terminal branches of the SRA. A plication of the rectal mucosa is also performed in the mucosopexy. With SH, the dearterialisation and mucosopexy are obtained with the excision of a ring of the rectal wall that transects the terminal branches of the SRA and lifts up the mucosa at the same time. In spite of using these methods for correcting the causes of the haemorrhoidal disease, Aigner et al. [20] recently questioned the effectiveness of SH in achieving the dearterialisation, showing no postinterventional changes in either arterial calibre or arterial blood flow. These findings suggest that mucosopexy may play a more important role in SH for the treatment of haemorrhoidal disease. The same author also demonstrated that transmural branches of the SRA enter the rectal wall very distally, below the ligation line of THD and the staple line of SH. These vessels might be responsible for the recurrences observed after THD and SH [20]. However, a mucosopexy almost down to the dentate line like the one used in our THD patients should also be able to deal with these most distal branches.

Numerous studies clearly demonstrated the short-term advantages of SH compared to CH especially in terms of postoperative pain and quicker recovery [3, 4, 21]. On the contrary, only one trial compared THD to CH and showed that THD requires less postoperative analgesia [14]. SH and THD are both performed above the sensitive anoderm and therefore should cause less postoperative pain than to CH. Our results confirm that both SH and THD produce minimal postoperative pain with no significant differences among the techniques. Furthermore, we observed a definite advantage of THD: patients returned to work earlier. It is possible that this occurred because patients in the THD group experienced less postoperative discomfort that was however not demonstrated due to the relatively small number of patients included in the study. Indeed, it has been reported that when TDH is compared to SH, postoperative pain following THD is lower during the first week [22].

The rare but definite risk of major complications after SH has been clearly documented [7], but no reports of major complications following THD are currently available [15]. We believe that the risk of major complications following SH is mainly related to the "blind" excision of the rectal wall. Since THD is a non-excisional technique, the possibility of major problems should be virtually

eliminated. In our study, the tip of the needle snapped off during the ligation in 2 THD patients. The problem was related to a defect in the batch of needles used. Indeed, this was the only time this unusual problem was encountered by the senior author of this study in more than 400 procedures performed over a 7-year period. In the SH group, postoperative pain, bleeding and one case of rectal lumen closure after firing of the stapler accounted for the increased rates of both delayed discharges and readmissions.

A recent meta-analysis of long-term outcomes of SH vs. CH demonstrated a significantly higher overall rate of prolapse recurrence in the SH group [6]. The difference was even more significant for results in patients with third- and fourth-degree haemorrhoids. Other outcome measures including bleeding and patients satisfaction were similar in the 2 groups. The only prospective trial available comparing THD to CH reported a recurrence rate of 20% for THD and 16% for CH [14], but this study included patients with all degrees of prolapsed and the THD technique used in this study did not include a mucosopexy. A recent review of all published data on THD included almost 2000 patients and reported an overall recurrence rate of 9% for prolapse and 7.8% for bleeding [15]. When those studies with a follow-up of 1 year or more were analysed, the prolapse was present in 10.8% of patients (46/427) and bleeding in 9.7% (49/507). Individual studies reporting long-term results of THD for third-degree haemorrhoids have shown recurrence rates of 12–13.5% [16, 23]. The impact of the rectal plication on recurrence rates following THD has also been reported [24]. In a recently published prospective trial, Khafagy et al. [25] randomised 45 patients with haemorrhoids to SH, CH and DGHAL. The degree of haemorrhoids included is not clear since the authors first stated that third- and fourth-degree haemorrhoids were included but then that patients with non-reducible haemorrhoids were excluded. This study demonstrated pain to be significantly worse following CH. While there was no significant difference between the groups regarding improvement of symptoms such as bleeding and pain, prolapse completely resolved following CH while it improved in only 67 and 60% of patients following SH and DGHAL, respectively. The length of follow-up was not stated. In another prospective trial comparing THD with mucosopexy to SH for grades III and IV haemorrhoids, 78 and 83% ($P = 0.648$) of patients had complete resolution of symptoms at 6 weeks follow-up [20]. In this study, persistent prolapse appeared to be more common following THD (11 vs. 22%). However, more patients with fourth-degree haemorrhoids were randomised to the THD group, which may have influenced the results [26].

The results of our study confirmed recurrence rates of 14 and 13%, respectively, for THD and SH at three-year follow-up, well within the range of those reported in the literature. Based on these findings, the advocates of haemorrhoidectomy might point to the higher recurrence rates of less aggressive surgery compared to CH. However, it is important to bear in mind that the early postoperative benefits of SH and THD could easily overcome the higher incidence rate of late symptoms and make these procedures much more appealing to patients.

We acknowledge that the study has a number of limitations. Equivalence of most outcomes may reflect sample size, and there is potential for surgeon-related bias in relation to choice of procedure for each patient. Nevertheless, it is the first to assess directly these two procedures and provide a decent length of follow-up. These results show that THD and SH have similar effectiveness for the treatment of second- and third-degree haemorrhoids although THD may yield certain advantages in terms of risk of potentially serious complications, postoperative pain and time off work. Given its medium-term results comparable to SH in terms of recurrence rates and patient satisfaction, we suggest that THD could be considered a valid alternative first-line surgical option for the treatment of second- and third-degree haemorrhoids, although larger randomised studies are needed to better establish the definitive role of this technique.

Conflict of interest The senior author Pasquale Giordano is a trainer in the THD technique. The authors Piero Nastro, Andrew Davies and Gianpiero Gravante have no conflicts of interest or financial ties to disclose.

References

1. Lunniss PJ, Gladman MA, Hetzer FH, Williams NS, Scott SM (2004) Risk factors in acquired faecal incontinence. J R Soc Med 97:111–116
2. Ortiz H, Marzo J, Armendariz P (2002) Randomized clinical trial of stapled haemorrhoidopexy versus conventional diathermy haemorrhoidectomy. Br J Surg 89:1376–1381
3. Shao WJ, Li GC, Zhang ZH, Yang BL, Sun GD, Chen YQ (2008) Systematic review and meta-analysis of randomized controlled trials comparing stapled haemorrhoidopexy with conventional haemorrhoidectomy. Br J Surg 95:147–160
4. Nisar PJ, Acheson AG, Neal KR, Scholefield JH (2004) Stapled hemorrhoidopexy compared with conventional hemorrhoidectomy: systematic review of randomized, controlled trials. Dis Colon Rectum 47:1837–1845
5. Pramateftakis MG (2010) The role of hemorrhoidopexy in the management of 3rd degree hemorrhoids. Tech Coloproctol 14(Suppl 1):S5–S7
6. Giordano P, Gravante G, Sorge R, Ovens L, Nastro P (2009) Long-term outcomes of stapled hemorrhoidopexy vs

conventional hemorrhoidectomy: a meta-analysis of randomized controlled trials. Arch Surg 144:266–272
7. Pescatori M, Gagliardi G (2008) Postoperative complications after procedure for prolapsed hemorrhoids (PPH) and stapled transanal rectal resection (STARR) procedures. Tech Coloproct 12:7–19
8. Molloy RG, Kingsmore D (2000) Life threatening pelvic sepsis after stapled haemorrhoidectomy. Lancet 355:810
9. Serventi A, Rassu PC, Giaminardi E, Vitali GC, Brigli G (2010) Fecaloma in an iatrogenic diverticulum: an unusual complication of the procedure for prolapsed hemorrhoids (PPH). Tech Coloproctol 14:371–372
10. Büyükaşik O, Hasdemir OA, Cöl C (2009) Rectal lumen obliteration from stapled hemorrhoidopexy: can it be prevented? Tech Coloproctol 13:333–335
11. Khubchandani I, Fealk MH, Reed JF III (2009) Is there a post-PPH syndrome? Tech Coloproctol 13:141–144
12. Lacerda-Filho A, Assunção GM, de Oliveira TA (2009) Neuropathic pain after stapled hemorrhoidopexy. Tech Coloproctol 13:255–256
13. Morinaga K, Hasuda K, Ikeda T (1995) A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. Am J Gastroenterol 90:610–613
14. Bursics A, Morvay K, Kupcsulik P, Flautner L (2004) Comparison of early and 1-year follow-up results of conventional hemorrhoidectomy and hemorrhoid artery ligation: a randomized study. Int J Colorectal Dis 19:176–180
15. Giordano P, Overton J, Madeddu F, Zaman S, Gravante G (2009) Transanal hemorrhoidal dearterialization: a systematic review. Dis Colon Rectum 52:1665–1671
16. Faucheron JL, Gangner Y (2008) Doppler-guided hemorrhoidal artery ligation for the treatment of symptomatic hemorrhoids: early and three-year follow-up results in 100 consecutive patients. Dis Colon Rectum 51:945–949
17. Longo A (1998) Treatment of haemorrhoidal disease by reduction of mucosa and haemorrhoidal prolapse with a circular suturing device: a new procedure. In: Monduzzi Editore (Ed.), 6th World congress of endoscopic surgery, Bologna, pp 777–784
18. Thomson WH (1975) The nature of haemorrhoids. Br J Surg 62:542–552
19. Lestar B, Penninckx F, Kerremans R (1989) The composition of anal basal pressure. An in vivo and in vitro study in man. Int J Colorectal Dis 4:118–122
20. Aigner F, Bodner G, Conrad F, Mbaka G, Kreczy A, Fritsch H (2004) The superior rectal artery and its branching pattern with regard to its clinical influence on ligation techniques for internal hemorrhoids. Am J Surg 187:102–108
21. Tjandra JJ, Chan MK (2007) Systematic review on the procedure for prolapse and hemorrhoids (stapled hemorrhoidopexy). Dis Colon Rectum 50:878–892
22. Festen S, van Hoogstraten MJ, van Geloven AA, Gerhards MF (2009) Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomised trial on postoperative complication and short-term results. Int J Colorectal Dis 24:1401–1405
23. Scheyer M, Antonietti E, Rollinger G, Mall H, Arnold S (2006) Doppler-guided hemorrhoidal artery ligation. Am J Surg 191:89–93
24. Dal Monte PP, Tagariello C, Sarago M et al (2007) Transanal haemorrhoidal dearterialisation: nonexcisional surgery for the treatment of haemorrhoidal disease. Tech Coloproctol 11:333–338
25. Khafagy W, El Nakeeb A, Fouda E et al (2009) Conventional haemorrhoidectomy, stapled haemorrhoidectomy, Doppler guided haemorrhoidectomy artery ligation; post operative pain and anorectal manometric assessment. Hepatogastroenterology 56:1010–1015
26. Teo JY, Kam MH, Eu KW (2010) Letter to the editor on the article "Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results". Int J Colorectal Dis 25:1385

2009

Authors: **Giordano** P., M.D., F.R.C.S.(Edinb.), F.R.C.S.(Engl.)1., **Overton** J., B.Sc.2., **Madeddu** F., M.D.1., **Zaman** S., M.D.1., **Gravante** G, M.D.1.

Source: Dis Colon Rectum. 2009 Sep;52(9):1665-71

https://www.ncbi.nlm.nih.gov/pubmed/19690499

Title: **Transanal Hemorrhoidal Dearterialization: A Systematic Review**

PURPOSE:

Transanal hemorrhoidal dearterialization consists of a Doppler-guided ligation of the distal branches of the rectal arteries. The aim of this review is to assess the current evidence on dearterialization, establish the safety and efficacy of the technique, define its indications, and identify its possible advantages and limitations.

METHODS:

All published studies on dearterialization without language restrictions were reviewed systematically. Primary outcome measures were postoperative pain and hemorrhoidal recurrences.

RESULTS:

Seventeen articles including a total of 1,996 patients were analyzed. In general, the quality of the studies was low. Operating time ranged between 5 and 50 minutes. Hospital stay was one day for most patients, whereas the return to normal activities was between two and three days in most cases. Postoperative pain was present in 18.5% of patients. Three patients experienced significant postoperative hemorrhages. There were no other major complications. The overall recurrence rate was 9.0% for prolapse, 7.8% for bleeding, and 4.7% for pain at defecation. The recurrence rate at one year or more was 10.8% for prolapse, 9.7% for bleeding, and 8.7% for pain at defecation. When reported as a function of the hemorrhoidal grade, the recurrence rate was higher for fourth-degree hemorrhoids (range, 11.1–59.3%).

CONCLUSION:

Transanal hemorrhoidal dearterialization appears to be a potential treatment option for second-degree and third-degree hemorrhoids. Clinical trials and longer follow-up comparing it with other procedures used to treat hemorrhoids are needed to establish a possible role for this technique.

2009

Authors: **Giordano** P., MD, FRCSED, FRCS., **Gravante** G., MD., **Segre** R., PHD., **Ovens** L., MBCHB, MRCS., **Nastro** P., MD, MRCS.

Source: Arch Surg. 2009; 144 (3): 266-272

Available for Open Online Access - https://jamanetwork.com/journals/jamasurgery/fullarticle/404710

Title: Long-term Outcomes of Stapled Hemorrhoidopexy vs Conventional Hemorrhoidectomy – A Meta analysis of Radomized Controlled Trials

---

OBJECTIVE:

To asses the long-term results of stapled hemorrhoidectomy (SH) compared with conventional hemorrhoidectomy (CH) and to define the role of SH in the tratment of hemorrhoids.

DATA SOURCES:

Published randomized controlled trials of CH vs SH with a minimum clinical follow-up of 12 months were searched and selected in the MEDLINE, EMBASE, and Cochrane Library database using the keywords hemorrhoid, stapl, and anopexy, without language restrictions.

STUDY SELECTION:

Potentially relevant studies were identified by the title and the abstract, and full articles were obtained and assessed in detail.

DATA EXTRACTION:

Studies were scored according to the presence of 3 key methodological features of randomization, blinding accountability of all patients, including withdrawals, and the scores ranged from 0 to 5. Studies that received a score from 3 to 5 were considered high-quality studies, whereas those with a score of 2 or less were considered of low quality. A specifically designed data fomr was used to collect all relevant data, including details of the experimental design, patient demographics, technical aspects, outcome measures, and complications.

DATA SYNTHESIS:

Fifteen articles met the inclusion criteria for a total of 1201 patients. Outcomes at a minimun of 1 year showed a significantly higher trate of prolapse recerrences in the SH group (14 studies, 1063 patients; odds ratio, 5.5; P<.001) and patients were more likely to undergo further treatment to correct recurrent prolapses compared with the CH group (10 studies, 824 patients; odds ratio, 1.9; P= .02).

CONCLUSION:

Stapled hemorrhoidopexy is a safe technique for the treatment of hemorrhoids but carries a significantly higher incidence or recurrences and additional operations compared with CH. It is the patient's choice whether to accept a higher recurrence rate to take advantage of the short-term benefit of SH.

2017

Authors: **Ain** Q., **Bashir** Y., **Eguare** E. et al

Source: Irish Journal of Medical Science. Published Online 06 December 2017

https://link.springer.com/article/10.1007%2Fs11845-017-1715-8

Title: Evaluation of the effectiveness and patients' contentment with transanal haemorrhoidal artery dearterialisation and mucopexy (THD) for treatment of haemorrhoidal disease: a 6-year study

INTRODUCTION:

With high incidence of haemorrhoidal disease and significant complication rates of traditional haemorrhoidectomy procedures, transanal haemorrhoidal artery ligation and mucopexy (THD) emerges as a minimally invasive procedure with superior results. However, it is crucial that effectiveness of results and patient satisfaction be gauged based on post-operative experience, symptomology and recurrence.

AIM:

Our aim is to provide a long-term analysis of efficacy and patient's satisfaction for the procedure, for the largest patient population, in correlation to presenting symptoms and degree of haemorrhoids.

METHOD:

A prospective study was conducted for all the patients (324) that underwent THD between 2011 and 2016 in Naas General Hospital. The assessment was done for postoperative complications, symptoms pre- and postoperatively and patients' satisfaction rating. Clinical follow-up was done after 6 weeks and long-term follow-up by standardized questionnaire filled by telephonic clinic.

RESULTS:

Of the 324 patients who underwent surgery, 256 (79.0%) participated in the study. There were 119 (46.5%) males and 137 (53.5%) females. The average age of patients was 48.40 years (17–82). Two hundred and fifteen (84.0%) patients had no recurrence. Forty-one (16.0%) had recurrence requiring further treatment. There was statistically significant higher recurrence in patients with grade 3 and 4 haemorrhoids and per-rectal bleeding ($p < 0.05$) while there was no statistically significant recurrence for age, gender, sedentary lifestyle and constipation/pruritus. Two hundred and twenty-four (87.5%) patients were completely satisfied from the procedure and highly recommend the procedure.

CONCLUSION:

THD is a comparably pain-free procedure with improved results that prides in higher long-term satisfaction, minimal recurrence and fewer complications, in comparison to other surgical modalities.

2015

Authors: **Noguerales** F., **Díaz** R., **Salim** B. et al

Source: Cir Esp (2015); 93 (4): 236-240

https://www.ncbi.nlm.nih.gov/pubmed/25022843

Title: **Treatment of Haemorrhoids by Transanal Haemorrhoidal Dearterialization. Experience of Several Specialized Units**

INTRODUCTION:

Milligan–Morgan and Ferguson haemorrhoidectomy has been the gold standard treatment for symptomatic haemorrhoids for many years. However, escisional techniques are associated with a significant morbidity rate. In recent years, diverse techniques have been described in an attempt to decrease these complications. The guided transanal haemorrhoidal dearterialization THD) doppler is one of these techniques. We report our experience with this new technique.

METHODS:

We performed a prospective study of 475 patients from 5 hospitals from the National Health System, in Spain. The majority of these patients suffered from third grade haemorrhoids (256 [56%]) and underwent THD. We analyse and compare preoperative and postoperative results as well as the homogeneity of the technique between hospitals.

RESULTS:

Spinal anaesthesia was the most elected procedure by the anaesthetist (81.0%). Statistically significant differences were found between pre and postoperative symptoms (P=.03), with an overall improvement after surgery. The average hospitalisation was 0.4 ± 0.3 days. The mean number of days of oral analgesics was 8.8 2.7 days. The cumulative complication rate is 16%.

CONCLUSIONS:

THD is a safe and easily reproducible procedure. Postoperative outcomes demonstrated a low rate of morbidity and recurrence together with early discharge; therefore, a rapid incorporation to daily activities was noted.

2015

Authors: **LaBella** G. D., **Main** W. P. L., **Hussain** L. R.

Source: Tech Coloproctol (2015) 31st January 2015.

Available for Full Open Online Access

Title: **Evaluation of transanal hemorrhoidal dearterialization: a single surgeon experience**

BACKGROUND:

There is an increasing, though still limited, amount of evidence describing the use of the transanal hemorrhoidal dearterialization (THD) device for the treatment of hemorrhoidal disease. This study assesses postoperative outcomes from a single surgeon experience with the THD device.

METHODS:

From January 2009 to December 2011, 108 THD procedures were performed. With Doppler guidance, the THD device makes possible precise ligation of the branches of the superior hemorrhoidal artery. Patients were seen postoperatively at 3 weeks and 6 months. They underwent physical examination to determine whether there was recurrence of hemorrhoidal prolapse. They were asked to describe any bleeding, to rate pain using the visual analog scale, and to rate their level of satisfaction on a scale of 1–5 (with 5 = highly satisfied). A phone interview was used for follow-up at 1 year to determine the rate of recurrent prolapse.

RESULTS:

Of the 108 patients who underwent THD, two were lost to follow-up and excluded. All of the remaining 106 patients completed follow-up at 3 weeks and 6 months. At 3 weeks, 92 % of patients had no pain and 88 % were highly satisfied with the procedure at 3 weeks. This increased to 92 % satisfaction at 1 year. Prolapse recurrence was 7.5 % at 6 months and 10.3 % at 1 year. Bleeding was the most common complication, but did not require re-intervention or transfusion.

CONCLUSIONS:

THD is a same-day procedure for the treatment of hemorrhoidal disease that is safe and effective, and offers the potential for immediate return to normal activity.

Tech Coloproctol
DOI 10.1007/s10151-015-1269-6

ORIGINAL ARTICLE

Evaluation of transanal hemorrhoidal dearterialization: a single surgeon experience

G. D. LaBella · W. P. L. Main · L. R. Hussain

Received: 17 October 2014 / Accepted: 20 December 2014

Abstract
Background There is an increasing, though still limited, amount of evidence describing the use of the transanal hemorrhoidal dearterialization (THD) device for the treatment of hemorrhoidal disease. This study assesses postoperative outcomes from a single surgeon experience with the THD device.
Methods From January 2009 to December 2011, 108 THD procedures were performed. With Doppler guidance, the THD device makes possible precise ligation of the branches of the superior hemorrhoidal artery. Patients were seen postoperatively at 3 weeks and 6 months. They underwent physical examination to determine whether there was recurrence of hemorrhoidal prolapse. They were asked to describe any bleeding, to rate pain using the visual analog scale, and to rate their level of satisfaction on a scale of 1–5 (with 5 = highly satisfied). A phone interview was used for follow-up at 1 year to determine the rate of recurrent prolapse.
Results Of the 108 patients who underwent THD, two were lost to follow-up and excluded. All of the remaining 106 patients completed follow-up at 3 weeks and 6 months. At 3 weeks, 92 % of patients had no pain and 88 % were highly satisfied with the procedure at 3 weeks. This increased to 92 % satisfaction at 1 year. Prolapse recurrence was 7.5 % at 6 months and 10.3 % at 1 year. Bleeding was the most common complication, but did not require re-intervention or transfusion.
Conclusions THD is a same-day procedure for the treatment of hemorrhoidal disease that is safe and effective, and offers the potential for immediate return to normal activity.

Keywords Transanal hemorrhoidal dearterialization · Doppler-guided hemorrhoidal artery ligation · THD · DGHAL · Hemorrhoids

G. D. LaBella (✉)
Division of Colon and Rectal Surgery and Trauma Surgery, Department of Surgery, Bethesda North and Good Samaritan TriHealth Hospital, Cincinnati, OH, USA
e-mail: drlabella@gmail.com

W. P. L. Main
Department of Surgery, Good Samaritan TriHealth Hospital, Cincinnati, OH, USA

L. R. Hussain
TriHealth Hatton Research Institute, Good Samaritan TriHealth Hospital, Cincinnati, OH, USA

Introduction

Hemorrhoids are highly vascularized tissue located in the submucosa of the anal canal that helps in maintaining fecal continence. When hemorrhoids are associated with bleeding, prolapse, or pruritus, this is considered hemorrhoidal disease (HD). The prevalence of HD is reported to be 4–10 %, making it the most common disorder of the anal canal [1]. HD is usually treated conservatively for 6–8 weeks. However, about 10 % of patients will ultimately require surgical intervention [2]. Milligan–Morgan (open) or Ferguson (closed) hemorrhoidectomy is considered the gold standard for the surgical treatment of hemorrhoids [3, 4]. However, these procedures are associated with significant postoperative complications including pain, sepsis, anal stenosis, bleeding and incontinence [5]. In an effort to decrease postoperative pain, two new techniques have been proposed in the last two decades: stapled hemorrhoidopexy (SH) and Doppler-guided hemorrhoidal artery ligation (DGHAL). Both techniques result in less postoperative pain, a shorter hospital stay, and greater

Published online: 31 January 2015

patient satisfaction [6–13]. Numerous case reports have exposed some of the potential risks with SH including bleeding, large bowel obstruction, retroperitoneal sepsis, rectovaginal fistula, and rectal perforation [14–18]. DGHAL was first described by Morinaga in 1995 [19]. It has been shown to be safe and effective in the treatment of hemorrhoids and to be associated with a small learning curve [8, 20]. Since its introduction, numerous devices have been developed. Transanal hemorrhoidal dearterialization is sometimes used interchangeably with DGHAL; however, there is a specific THD device. This device (THD S.p.A., Correggio, Italy) consists of an anoscope with Doppler probe and light source for precise ligation of the hemorrhoidal branches of the superior hemorrhoidal artery. The THD device has a removable centerpiece which facilitates mucopexy. Through ligation, arterial inflow is decreased allowing the prolapsed hemorrhoid to shrink. Ligation with mucopexy has been shown to decrease the rate of recurrent prolapse [20–25].

Hemorrhoidal disease has marked differences in epidemiology and clinical presentation which may affect selection for surgical treatment and ultimately treatment results. Perception of pain, patient's expectations, and satisfaction are also highly dependent on the patients' population and the healthcare settings. In this regard, most of the studies on THD were carried out by academic centers in Europe. The aim of this study was to assess the postoperative outcome of a consecutive series of patients operated on in the USA by a single surgeon using the THD device.

Materials and methods

This was a prospective observational study. Institutional Review Board approval was obtained and all patients provided written consent. Between January 2009 and December 2011, a total of 108 consecutive THD procedures were performed for patients with grade II, III, and IV internal hemorrhoids. THD was not offered to patients with both external and internal hemorrhoids. In these patients, LigaSure (Covidien) hemorrhoidectomy was performed. All patients underwent preoperative history and physical examination, and hemorrhoids were graded according to Goligher's classification [26]. Patients were asked about preoperative symptoms including bleeding, pain, incontinence, and pruritus ani. They were also asked about dietary habits and fiber intake, medical therapy used to initially treat the hemorrhoids, and history of prior procedures for hemorrhoids. Preoperatively all patients received 10 mg of oral oxycodone 30 min to 1 h prior to surgery, and just prior to the procedure a perianal injection of 30 ml 0.5 % marcaine with epinephrine. Patients were discharged with a prescription for narcotic pain medication for no more than a week. Patients were evaluated postoperatively at 3 weeks and 6 months followed by a phone interview at 1 year after surgery. At each follow-up, patients were asked to rate their satisfaction with the surgical procedure on a scale of 1–5, with five signifying highly satisfied. Three weeks after surgery, patients were asked to assess their pain on a visual analog scale (VAS) of 0–10, with 0 representing no pain and 10 representing the worst possible pain. Postoperative complications such as bleeding and recurrence were also noted at each follow-up. All information was recorded and evaluated by the surgeon.

The surgical procedure has been described in detail by Ratto et al. [22]. Briefly, the anoscope was inserted into the anal canal gaining access to the distal rectum. Six branches of the superior hemorrhoidal artery were ligated with Doppler guidance (at the 1, 3, 5, 7, 9, 11 o'clock positions). This was done with a figure of eight 2-0 Vicryl suture. Following ligation, the suture was used in a running fashion distally and tied for mucopexy.

Results

Of the 108 patients who underwent THD, two patients lost to follow-up were not included in the study results. Of the remaining 106 patients, four (4 %) had grade II, 69 (64 %) had grade III, and 33 (32 %) had grade IV hemorrhoids. Overall, the mean age was 51 (±15 SD) years. Forty-one patients were male (39 %) and 65 patients were female (61 %). Bleeding was the predominant complaint, followed by pain (Table 1). Thirty patients (28 %) had a prior procedure: 62 % had undergone banding, 6 % had prior hemorrhoidectomy, and 32 % had undergone infrared coagulation. In all but five cases (95 %), ligation of all six hemorrhoidal arteries was performed. Ninety-eight patients (92 %) had mucopexy in addition to ligation.

Table 1 Preoperative symptoms

Symptom	Number of patients (% of 106 patients)
Prolapse	
Grade II	4 (4)
Grade III	69 (64)
Grade IV	33 (32)
Bleeding	63 (59)
Pain	
None	15 (14)
Minimal	34 (32)
Moderate	38 (36)
Severe	19 (18)
Pruritus	34 (32)
Incontinence	13 (12)

Seventy-five patients (71 %) reported some form of bleeding postoperatively. Of these 75 patients, 65 (87 %) experienced bleeding for less than 1 week. No patients required surgical re-intervention or transfusion. Twelve men with benign prostatic hyperplasia had a straight catheterization prior to extubation in the operative theater. There was no urinary retention postoperatively.

All 106 (100 %) patients had follow-up at 3 weeks and 6 months, and 93 (88 %) completed follow-up at 1 year. At 3 weeks, 98 patients (92 %) had no pain, while seven patients (7 %) rated pain as one on the VAS and one patient (1 %) as two. At 3 weeks, 93 patients (88 %) were highly satisfied with the procedure. Prolapse recurrence was noted in eight patients (7.5 %) at 6 months. Of these eight patients, six originally had grade IV hemorrhoids, while the other two had grade III hemorrhoids. At 1 year, 11 patients (10.3 %) reported recurrent prolapse and 98 patients (92 %) were highly satisfied with the procedure. Of the patients with prolapse, two underwent a repeat THD procedure, while the remainder underwent excisional hemorrhoidectomy.

Discussion

Hemorrhoidal tissue is an important component of fecal continence. Hemorrhoidal disease is common and can significantly affect quality of life. While most hemorrhoidal disease can be managed non-operatively, about 10 % of patients will require surgery. Ideal surgical treatment should allow a rapid return to normal activities, while maintaining normal anal anatomy and minimizing morbidity. Conventional hemorrhoidectomy is the gold standard; however, patients may be unable to return to normal activities for up to 3 weeks after this procedure because of pain. After conventional hemorrhoidectomy, 25 % of patients may experience sphincter dysfunction, 5–15 % postoperative bleeding or infection, and up to 30 % recurrence [6].

THD has been shown to be safe and effective [22]. It allows patients to return to normal activities immediately and to avoid many of the complications associated with SH. In comparison with SH, THD has been associated with less pain [6]. In a study by Festen et al., there was no significant difference in resolution of preoperative symptoms between SH and THD at 6 weeks (SH 83 %, THD 78.3 %, p 0.648) [8]. Avital et al. showed that in comparison with SH, DGHAL was associated with decreased hospital stay, time to first bowel movement, and time to complete functional recovery ($p = 0.001$) [6]. However, patient satisfaction was significantly higher with SH in this study (SH 92 %, DGHAL 82 %, $p = 0.016$). The authors concluded that they still preferred DGHAL to SH due to decreased perioperative morbidity [6].

Although, 75 of our patients (71 %) had some bleeding postoperatively with the majority of them (87 %) experiencing it for less than a week, no patients required re-intervention or transfusion. In a study done by Greenberg et al. following DGHAL, 11 % of patients required re-intervention for bleeding [27]. Felice et al. had one patient who needed a transfusion secondary to postoperative bleeding [28]. While bleeding is a common complication, re-intervention is usually not required.

Most of the patients treated in this study had grade III and IV hemorrhoids. Our 1-year prolapse recurrence rate of 10.3 % is comparable to the 3–25 % recurrence rate reported in the literature [5, 20, 21, 23, 25, 26]. In a review of DGHAL by Giordano et al., the recurrence rate was noted to be 10.8 % at 1 year or more [29]. In our study, two of the patients with recurrence underwent repeat THD and the remainder underwent excisional hemorrhoidectomy.

Distal Doppler-guided dearterialization (DDD) is a newer variation of THD. Using endorectal ultrasound, Ratto et al. showed that the hemorrhoidal arteries were primarily extrarectal at 5–6 cm proximal to the anorectal junction (ARJ) as defined by the puborectalis muscle and submucosal within 2 cm of the ARJ [30]. By performing suture ligation within 2 cm of the ARJ, more consistent dearterialization may be achieved. Mucopexy can still be performed with this technique. Using DDD, Ratto et al. showed that only three out of 100 patients had postoperative bleeding. Eight patients (8 %) had residual prolapse at 3 months, and five of those patients required repeated mucopexy [31]. With mucopexy, as performed in our study, there may have been unintentional ligation of more of the hemorrhoidal arteries than if proximal dearterialization was performed without mucopexy. Incorporation of DDD instead of a more proximal dearterialization may have improved our results especially with regard to postoperative bleeding.

Ninety-eight patients (92 %) were highly satisfied with the procedure at 1-year follow-up. Numerous studies have shown similar results ranging from 84–95 % [5, 20, 27, 30, 32]. Scheyer et al. reported that 71 % of patients were satisfied with DGHAL; however, a higher percentage, 91 %, would request it again and 93 % would recommend it to a friend [33].

The cost-effectiveness with THD is equivocal with other procedures such as SH. At our institution, the price difference between the hemorrhoid stapler and the THD device is $120, in favor of the stapler. However, in a study done by Infantino et al. [34], the stapler was $200 more expensive than the THD device. Further studies will need to be conducted to evaluate cost-effectiveness.

Since this is a single surgeon series, results may not be reproducible and there are numerous other limitations to this study, including the small size, lack of recording of

pain medication, and lack of a protocol to assess specific symptoms other than prolapse and patient satisfaction.

Conclusions

THD is a safe and effective treatment option and should be considered as an alternative to those procedures associated with high morbidity. This same-day procedure offers low morbidity with high potential for immediate return to normal activity. Additionally, 92 % of patients were satisfied with the procedure.

Conflict of interest None.

References

1. Kaidar-Person O, Person B, Wexner SD (2007) Hemorrhoidal disease: a comprehensive review. J Am Coll Surg 204: 102–117
2. Bleday R, Pena JP, Rothenberger DA, Goldberg SM, Buls JG (1992) Symptomatic hemorrhoids: current incidence and complications of operative therapy. Dis Colon Rectum 35:477–481
3. Ferguson JA, Heaton JR (1959) Closed hemorrhoidectomy. Dis Colon Rectum 2:176–179
4. Milligan ETC, Naunton Morgan C, Jones L, Officer R (1937) Surgical anatomy of the anal canal and the operative treatment of hæmorrhoids. Lancet 230:1119–1124
5. Wilkerson PM, Strbac M, Reece-Smith H, Middleton SB (2009) Doppler-guided haemorrhoidal artery ligation: long-term outcome and patient satisfaction. Colorectal Dis 11:394–400
6. Avital S, Itah R, Skornick Y, Greenberg R (2011) Outcome of stapled hemorrhoidopexy versus Doppler-guided hemorrhoidal artery ligation for grade III hemorrhoids. Tech Coloproctol 15:267–271
7. Bursics A, Morvay K, Kupcsulik P, Flautner L (2004) Comparison of early and 1-year follow-up results of conventional hemorrhoidectomy and hemorrhoid artery ligation: a randomized study. Int J Colorectal Dis 19:176–180
8. Festen S, van Hoogstraten MJ, van Geloven AA, Gerhards MF (2009) Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results. Int J Colorectal Dis 24:1401–1405
9. Giordano P, Gravante G, Sorge R, Ovens L, Nastro P (2009) Long-term outcomes of stapled hemorrhoidopexy vs conventional hemorrhoidectomy: a meta-analysis of randomized controlled trials. Arch Surg 144:266–272
10. Palimento D, Picchio M, Attanasio U, Lombardi A, Bambini C, Renda A (2003) Stapled and open hemorrhoidectomy: randomized controlled trial of early results. World J Surg 27:203–207
11. Senagore AJ, Singer M, Abcarian H, Fleshman J, Corman M, Wexner S, Nivatvongs S (2004) A prospective, randomized, controlled multicenter trial comparing stapled hemorrhoidopexy and Ferguson hemorrhoidectomy: perioperative and one-year results. Dis Colon Rectum 47(11):1824–1836
12. Walega P, Scheyer M, Kenig J et al (2008) Two-center experience in the treatment of hemorrhoidal disease using Doppler-guided hemorrhoidal artery ligation: functional results after 1-year follow-up. Surg Endosc 22:2379–2383
13. Wilson MS, Pope V, Doran HE, Fearn SJ, Brough WA (2002) Objective comparison of stapled anopexy and open hemorrhoidectomy: a randomized, controlled trial. Dis Colon Rectum 45:1437–1444
14. Brown S, Baraza W, Shorthouse A (2007) Total rectal lumen obliteration after stapled haemorrhoidopexy: a cautionary tale. Tech Coloproctol 11:357–358
15. Cipriani S, Pescatori M (2002) Acute rectal obstruction after PPH stapled haemorrhoidectomy. Colorectal Dis 4:367–370
16. Pescatori M, Gagliardi G (2008) Postoperative complications after procedure for prolapsed hemorrhoids (PPH) and stapled transanal rectal resection (STARR) procedures. Tech Coloproctol 12:7–19
17. Ripetti V, Caricato M, Arullani A (2002) Rectal perforation, retropneumoperitoneum, and pneumomediastinum after stapling procedure for prolapsed hemorrhoids: report of a case and subsequent considerations. Dis Colon Rectum 45:268–270
18. Wong LY, Jiang JK, Chang SC, Lin JK (2003) Rectal perforation: a life-threatening complication of stapled hemorrhoidectomy: report of a case. Dis Colon Rectum 46:116–117
19. Morinaga K, Hasuda K, Ikeda T (1995) A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. Am J Coll Surg 90:610–613
20. Forrest NP, Mullerat J, Evans C, Middleton SB (2010) Doppler-guided haemorrhoidal artery ligation with recto anal repair: a new technique for the treatment of symptomatic haemorrhoids. Int J Colorectal Dis 25:1251–1256
21. Faucheron JL, Poncet G, Voirin D, Badic B, Gangner Y (2011) Doppler-guided hemorrhoidal artery ligation and rectoanal repair (HAL-RAR) for the treatment of grade IV hemorrhoids: long-term results in 100 consecutive patients. Dis Colon Rectum 54:226–231
22. Ratto C, Donisi L, Parello A, Litta F, Doglietto GB (2010) Evaluation of transanal hemorrhoidal dearterialization as a minimally invasive therapeutic approach to hemorrhoids. Dis Colon Rectum 53:803–811
23. Denoya P, Tam J, Bergamaschi R (2014) Hemorrhoidal dearterialization with mucopexy versus hemorrhoidectomy: 3-year follow-up assessment of a randomized controlled trial. Tech Coloproctol 18:1081–1085
24. Denoya PI, Fakhoury M, Chang K, Fakhoury J, Bergamaschi R (2013) Dearterialization with mucopexy versus haemorrhoidectomy for grade III or IV haemorrhoids: short-term results of a double-blind randomized controlled trial. Colorectal Dis 15:1281–1288
25. Tempel MB, Pearson EG, Page M et al (2014) Survey of patient satisfaction after Doppler-guided transanal hemorrhoidal dearterialization performed in ambulatory settings. Tech Coloproctol 18:607–610
26. Conaghan P, Farouk R (2009) Doppler-guided hemorrhoid artery ligation reduces the need for conventional hemorrhoid surgery in patients who fail rubber band ligation treatment. Dis Colon Rectum 52:127–130
27. Greenberg R, Karin E, Avital S, Skornick Y, Werbin N (2006) First 100 cases with Doppler-guided hemorrhoidal artery ligation. Dis Colon Rectum 49:485–489
28. Felice G, Privitera A, Ellul E, Klaumann M (2005) Doppler-guided hemorrhoidal artery ligation: an alternative to hemorrhoidectomy. Dis Colon Rectum 48:2090–2093
29. Giordano P, Overton J, Madeddu F, Zaman S, Gravante G (2009) Transanal hemorrhoidal dearterialization: a systematic review. Dis Colon Rectum 52:1665–1671
30. Ratto C, Parello A, Donisi L, Litta F, Zaccone G, Doglietto GB (2012) Assessment of haemorrhoidal artery network using colour duplex imaging and clinical implications. Br J Surg 99:112–118
31. Ratto C, Donisi L, Parello A, Litta F, Zaccone G, De Simone V (2012) 'Distal Doppler-guided dearterialization' is highly

effective in treating haemorrhoids by transanal haemorrhoidal dearterialization. Colorectal Dis 14:e786–e789
32. Theodoropoulos GE, Sevrisarianos N, Papaconstantinou J et al (2010) Doppler-guided haemorrhoidal artery ligation, rectoanal repair, sutured haemorrhoidopexy and minimal mucocutaneous excision for grades III–IV haemorrhoids: a multicenter prospective study of safety and efficacy. Colorectal Dis 12:125–134
33. Scheyer M, Antonietti E, Rollinger G, Mall H, Arnold S (2006) Doppler-guided hemorrhoidal artery ligation. Am J Surg 191:89–93
34. Infantino A, Altomare DF, Bottini C et al (2012) Prospective randomized multicentre study comparing stapler haemorrhoidopexy with Doppler-guided transanal haemorrhoid dearterialization for third-degree haemorrhoids. Colorectal Dis 14:205–211

2014

Authors: **Tsang** Y. P., **Fok** K. L. B., **Cheung** Y. S. H. et al

Source: Tech Coloproctol (2014) 18: 1017-1022

https://link.springer.com/article/10.1007%2Fs10151-014-1170-8

Title: Comparison of transanal haemorrhoidal dearterialisation and stapled haemorrhoidopexy in management of haemorrhoidal disease: a retrospective study and literature review

BACKGROUND:

The aim of this study was to evaluate and compare transanal haemorrhoidal dearterialisation (THD) and stapled haemorrhoidopexy [also called procedure for prolapsed haemorrhoids (PPH)] in the management of haemorrhoidal disease, in terms of short-term outcomes and efficacy.

METHODS:

Patients presenting with symptomatic haemorrhoids were treated with THD. Patient demographics, preoperative data, post-operative pain scores, complications, recurrence, and patient satisfaction scores were evaluated and recorded. Patients with acute thrombosed haemorrhoids, external haemorrhoids only, or other concomitant anal diseases were excluded. These data were compared with the historical data of PPH.

RESULTS:

Forty consecutive patients underwent THD from February 2012 to July 2013 and were compared to 37 patients who underwent PPH taken from a medical records database. There were no significant differences in terms of demographic data, type of anaesthesia, operative time, and blood loss. Length of hospital stay, time to first postoperative bowel movement, and complications were similar between the two groups. The median pain score after THD and PPH was 1.71 and 5.00, respectively, on a scale of 0–10 (10 = worst possible pain) ($p = 0.000$). There was a significant improvement in bleeding and prolapse scores after THD. THD patients had an earlier return to normal daily activities (3.13 vs. 6.78 days, $p = 0.001$) when compared with the PPH group. Upon follow-up, patients in both groups had similar satisfaction scores, and complication and recurrence rates.

CONCLUSIONS:

Both THD and PPH appear to be safe procedures for haemorrhoidal disease, and they appear to have similar short-term outcomes. In particular, THD seems to be associated with a lower pain score than PPH, an earlier return to normal daily activities, and similar rates of complication and recurrence.

2014

Authors: **Ratto** C. & **De Parades** V.

Source: J Visc Surg. 2015 Apr;152(2 Suppl):S15-21
https://www.ncbi.nlm.nih.gov/pubmed/25262549

Title: Doppler-guided ligation of hemorrhoidal arteries with mucopexy: A technique for the future.

PURPOSE:

The transanal hemorrhoidal de-arterialization (THD) procedure is an effective treatment of hemorrhoidal disease. The ligation of hemorrhoidal arteries ("de-arterialization") can provide a significant reduction of arterial blood flow to the hemorrhoidal tissues. Plication of redundant rectal mucosa/submucosa ("mucopexy") can reposition prolapsing tissue to its original anatomical site. In this paper the surgical technique using a specific device (THD Doppler) and peri-operative patient management are illustrated.

METHODS:

After appropriate clinical assessment, patients undergo the THD procedure under general or spinal anesthesia, in either the dorsal lithotomy or prone jackknife position. A specifically designed device is used. In all patients, THD is performed, consisting of selective ligation of hemorrhoidal arteries identified by Doppler and marked with a mucosal stitch overlying the artery. In patients with hemorrhoidal or mucosal prolapse, a mucopexy is also performed using continuous suture(s) that include the redundant prolapsing mucosa and submucosa.

RESULTS:

In long-term follow-up, THD results in resolution of symptoms in the majority of patients. The most common complication is transient but sometimes painful tenesmus. Rectal bleeding occurs in only a very limited number of patients. There is little or no risk of fecal incontinence or chronic pain. Ano-rectal manometry and endo-anal ultrasound show no evidence of injury to physiologic sphincteric function.

CONCLUSIONS:

THD is a safe procedure and is, at present, one of the most effective treatments of hemorrhoidal disease.

2014

Authors: **Fretwell** V. & **Khan** A.

Source: Colorectal Disease, Volume 16, Supplement 3 (September 2014), P366

Title: **Transanal haemorrhoidal de-arterialisation: changing trends in haemorrhoid surgery**

AIM:

Transanal haemorrhoidal dearterilaisation (THD) is a non-excisional approach to the treatment of haemorrhoids. We present 5 years experience with the technique.

METHOD:

Data were prospectively collected between February 2009 and February 2014 for a single Consultant Colorectal Surgeon. Data collected included grade of haemorrhoids, previous treatments, performance of haemorrhoidopexy or other procedure, post operative complications including pain and the need for repeat procedures.

RESULTS:

One hundred and ninety five patients were included (M:F 107:88, median age 51). Sixty three per cent had grade 3 haemorrhoids with 76% having had rubber band ligation previously. Sixty patients had THD alone and in 128 it was combined with haemorrhoidopexy. Routine post operative outpatient follow up was discontinued after February 2012 due to favourable results (92% asymptomatic at 2 months). Overall 6 patients had post operative pain requiring morphine administration in the recovery room, 1 patient was re-admitted with bleeding, 5 patients required further surgery and 3 had recurrence of minor symptoms not requiring further surgery.

CONCLUSION:

The THD procedure is a new but safe, cost efficient and effective treatment for grade 2 and 3 haemorrhoids and with considerably lower morbidity than traditional open haemorrhoidectomy.

2014

Authors: **Al-Ozaibi** L., **Hazim** W., **Mazrouri** A., **Badri** F. & **Alani** A.

Source: Colorectal Disease, Volume 16, Supplement 3 (September 2014), P352

Title: **Transanal haemorrhoidal dearteralization (THD): 1 year follow-up results, the Dubai experience**

AIM:

To analyse the results of the THD technique in the treatment of haemorrhoidal disease.

METHOD:

This is a retrospective study of 42 patients who underwent haemorrhoidal artery ligation between September 2011 and October 2012 including 36 men and 6 women with stage II, and III haemorrhoids. Following surgery, patients were regu- larly evaluated after 1 week, 3 months, a year after operation.

RESULTS:

Eighty-six percent of the patients were male. Bleeding was the main pre- operative symptom, 52% of the patients had bleeding and prolapse and 24% had only bleeding. 62% of the patients had 6 ligations and 81% had mucopexy. Mean operative time 46.8 ± 9.4 min. 62% of the patients had postoperative pain, 76% of those were mild (score < 3).The postoperative complications were non-significant, 79% of the patients did not have any complications. After 1 year 17% had recurrence of symptoms. All cases done as a day case surgery.

CONCLUSION:

The THD technique has shown that it's safe and effective in the treatment of haemorrhoids. It's not a painless procedure but the postoperative pain is mild in the majority of the cases. The main advantage were less bleeding, fast recovery and no complications. It can be done safely as a day case surgery.

2014

Authors: **Béliard** A., **Labbé** F., **de Faucal** D., **Borie** F. et al.

Source: Journal of Visceral Surgery; Volume 151, Issue 4, September 2014, Pages 257-262

https://www.ncbi.nlm.nih.gov/pubmed/24726856

Title: A prospective and comparative study between stapled hemorrhoidopexy and hemorrhoidal artery ligation with mucopexy

AIM:

The aim of this study was to compare the efficacy between stapled hemorrhoidopexy (Longo technique) and transanal hemorrhoidal artery ligation with mucopexy (THDm) in the treatment of hemorrhoidal disease.

PATIENTS & METHODS:

From June 2009 to January 2011, 81 patients having grade II or III hemorrhoidal disease underwent prospective evaluation followed by surgery at two centers (27 Longo and 54 THD). Symptoms (bleeding, tenesmus, prolapse, fecal incontinence, pain) and the satisfaction score were compared on the first post-operative day and at 1, 6, 12, and 24 months thereafter. The follow-up was 24 months.

RESULTS:

There was no difference in mean length of stay. One complication (recto-vaginal fistula) was observed after Longo. The prolapse score was significantly lower after THDm than after Longo on the first post-operative day ($P<0.0015$). Bleeding score after THDm was significantly lower on the first post-operative day ($P=0.04$), but higher thereafter ($P=0.03$ and $P=0.04$). Tenesmus score after THDm was significantly lower for the first three months ($P<0.06$ and 0.001). On the first post-operative day and at one month, the visual analog pain score was significantly lower after THDm than that after Longo ($P<0.0003$ et $P<0.01$). On the first post-operative day and at one month, the satisfaction score was higher after THDm than after Longo ($P<0.001$).

CONCLUSIONS:

THD was safe and effective. Short-term outcomes after THDm were better than after Longo but long-term results seemed to be similar.

2014

Authors: **Giordano** P., **Tomasi** I., **Pascariello** A. et al.

Source: Colorectal Disease 2014 May;16(5):373-6

Available for Full Open Online Access

Title: **Transanal dearterialization with targeted mucopexy is effective for advanced haemorrhoids**

AIM:

Transanal haemorrhoidal dearterialization (THD) has become well established for the treatment of haemorrhoids. In this study we describe a technical modification of this technique, targeted mucopexy (THD TM), and report the results for advanced haemorrhoids.

METHOD:

The study included a prospective evaluation of patients with Grade IV (fourth-degree) haemorrhoids operated on with the THD TM technique. This consisted of an initial dearterialization when the haemorrhoidal arteries were transfixed and a second phase of mucopexy, using a different needle from that usually used in the original technique.

RESULTS:

From January 2007 to December 2011, 31 consecutive patients with Grade IV haemorrhoids were operated on using the THD TM technique. Postoperative pain was reported by 22 (70%) patients on day 1 and 19 (61%) on day 7, while nine (30%) did not experience any pain at all. Severe pain was reported by only nine (16%) patients. At a mean follow-up of 32 months, two (6.4%) patients required a further intervention for on-going symptoms.

CONCLUSION:

Transanal haemorrhoidal dearterialization TM is effective for advanced haemorrhoids.

Original article

doi:10.1111/codi.12574

Transanal dearterialization with targeted mucopexy is effective for advanced haemorrhoids

P. Giordano, I. Tomasi, A. Pascariello, E. Mills and S. Elahi

Department of Colorectal Surgery, Barts Health, London, UK

Received 21 May 2013; accepted 2 October 2013; Accepted Article online 27 January 2014

Abstract

Aim Transanal haemorrhoidal dearterialization (THD) has become well established for the treatment of haemorrhoids. In this study we describe a technical modification of this technique, targeted mucopexy (THD TM), and report the results for advanced haemorrhoids.

Method The study included a prospective evaluation of patients with Grade IV (fourth-degree) haemorrhoids operated on with the THD TM technique. This consisted of an initial dearterialization when the haemorrhoidal arteries were transfixed and a second phase of mucopexy, using a different needle from that usually used in the original technique.

Results From January 2007 to December 2011, 31 consecutive patients with Grade IV haemorrhoids were operated on using the THD TM technique. Postoperative pain was reported by 22 (70%) patients on day 1 and 19 (61%) on day 7, while nine (30%) did not experience any pain at all. Severe pain was reported by only nine (16%) patients. At a mean follow-up of 32 months, two (6.4%) patients required a further intervention for on-going symptoms.

Conclusion Transanal haemorrhoidal dearterialization TM is effective for advanced haemorrhoids.

Keywords Haemorrhoids, transanal haemorrhoidal dearterialization, targeted mucopexy, haemorrhoidal artery ligation

What does this paper add to the literature

This paper describes a technical modification of the original transanal haemorrhoidal dearterialization technique introduced by the senior author and reports the results achieved with it in patients with Grade IV haemorrhoids. We believe the modification has allowed a significant improvement in the outcome, especially when dealing with advanced haemorrhoids.

Introduction

Transanal haemorrhoidal dearterialization (THD) has been increasingly used in recent years for the treatment of haemorrhoids [1]. The technique has been recognized by the National Institute for Health and Care Excellence (NICE) as a safe and effective alternative to conventional haemorrhoidectomy or stapled haemorrhoidopexy [2]. In initial reports, THD was mostly used for early stage disease [3,4], but with time the indications have expanded to include more advanced stages in which prolapse predominates [5,6,7]. The aim of this study was to describe a technical modification of THD which includes targeted mucopexy (THD TM), using a different needle from that recommended for the original operation, and to report the results of treatment by this new technique.

Correspondence to: Mr Pasquale Giordano MD FRCS(Eng) FRCS(Ed), Department of Colorectal Surgery, Barts Health, Whipps Cross Hospital, Whipps Cross Road, Leytonstone, London E11 1NR, UK.
E-mail: pasquale.giordano@bartshealth.nhs.uk

Method

Patients

A prospective evaluation of all patients with Grade IV haemorrhoids having THD TM was conducted. They were entered in a specifically designed database and data about patient demographics and relevant history were recorded. Grade IV haemorrhoids were defined as those with constant prolapse, regardless of whether they were reducible or not. The severity of haemorrhoidal symptoms was scored using a specifically designed questionnaire assessing five different parameters each scoring 0–4, with 0 indicating no symptoms and 4 daily symptoms or symptoms with every defaecation (Table 1) [6]. A score of 0 corresponds to the complete

Table 1 Symptomatic questionnaire.

	Never	At least once per year	At least once per months	At least once per week	With every defaecation
Bleeding	0	1	2	3	4
Prolapse	0	1	2	3	4
Manual reduction	0	1	2	3	4
Discomfort/ pain/discharge	0	1	2	3	4
Impact on QoL	None (0)	Minimal (1)	Moderate (2)	Severe (3)	Very severe (4)

QoL, quality of life.

absence of haemorrhoidal symptoms while 20 equates to the worst possible symptoms. Postoperative pain was assessed daily for the first seven postoperative days, using a visual analogue score (VAS) of 0–10 (0 = no pain, 10 = the worst possible pain) with patients asked to record the most severe episode each day. The severity of the pain was defined as mild with a score from 1 to 3, moderate from 4 to 6 and severe from 7 to 10. Patients were reviewed in the outpatient clinic at 3 weeks and 6 and 12 months and at the time of closure of the study. The symptomatic questionnaire was completed at each follow-up.

Technique

All operations were performed as a day case under general anaesthesia by the same surgeon (PG). Each patient was prescribed a phosphate enema immediately before surgery. The procedure was carried out in the lithotomy position using a specifically designed proctoscope (THD slide; THD Lab®, Correggio, Italy) which incorporates a side-sensing Doppler probe and a window beyond this for the insertion of sutures. On inserting the proctoscope into the anal canal the Doppler transducer was used to locate in turn the terminal branches of the haemorrhoidal arteries. Starting from the three o'clock position the proctoscope was slowly withdrawn, bringing the transducer towards the dentate line to avoiding missing those branches penetrating the anorectal wall at a lower level.

Once identified, the haemorrhoidal artery was transfixed with 2/0 Vicryl® mounted on a 5/8 needle in a 'figure-of-eight' form. The level of transfixion depended on the site of the strongest signal. This was repeated with clockwise rotation of the proctoscope through 360°. Once the arteries were transfixed, attention was paid to the sites of greatest prolapse. These were then treated by a targeted mucopexy using the THD slide® which was reinserted to as near as possible to the targeted area of prolapse. From this point using 2/0 Vicryl™ stich mounted on a 4/8 needle a continuous suture was started and continued distally to within 5 mm of the dentate line taking care not to catch the anal epithelium. During this process the slide mechanism of the instrument was progressively opened to allow progression of the suture distally, while keeping the prolapsing mucosa away from the operating field. Once the continuous suture was completed the slide mechanism was removed from the proctoscope keeping the main body of the instrument fully inserted. The two ends of the suture were then tied pushing the knot proximally to achieve optimal plication of the distal rectal wall. Any external component was left undisturbed.

Results

From January 2007 to December 2011, 31 consecutive patients with Grade IV haemorrhoids were operated on with the modified THD TM technique (Table 2). The mean preoperative symptomatic score was 16.25 ± 2.44 [median 17 (11–20)]. The median number of arteries identified was six (five to eight) while the median number of plications per patient was three in 27 cases and four in three. The median operation time was 32 min (23–47). There were no intra-operative complications. Twenty-five patients were discharged on the day of the operation. Six (16%) male patients experienced urinary retention requiring catheterization and an overnight stay. In four the retention resolved spontaneously within 24 h and the patients were successfully discharged the day after surgery. The other two patients

Table 2 Demographic data.

No. of patients	31
Age (years)	53.58 ± 16.88
	Median 58
	Range 18–75
Gender	
Female	10
Male	21

Table 3 Postoperative pain on day 1.

Pain free	9 (29%)
Pain	22 (71%)
Minimal	15 (68%)
Mild	2 (9%)
Severe	5 (23%)

were started on alpha-blockers and referred to a urologist.

Some degree of postoperative pain was reported by 22 (71%) patients on day 1 and 19 (61%) on day 7, while nine (30%) had no pain at all. Pain was described as severe by nine (16%) patients (Table 3). Patients with severe pain still reported some discomfort at the end of the first week (mean VAS = 3). No patient reported any pain beyond the end of the third week. Other postoperative complications included tenesmus ($n = 3$), constipation ($n = 4$) and thrombosed haemorrhoid ($n = 1$). The mean duration of follow-up was 32 (6–58) months, with 27 patients available for 12-month assessment. The mean postoperative haemorrhoidal symptom score was 2.48 ± 4.30 [median 0 (0–15)]. There was only one case of recurrence which was treated by surgical removal. Another patient with symptoms suggestive of haemorrhoidal recurrence underwent examination under anaesthesia and was found to have a large fibro-epithelial polyp at the site of one of the previous mucosal plications. The polyp was excised and the symptoms completely resolved. A third patient underwent excision of skin tags under local anaesthesia for cosmetic reasons.

Discussion

Minimally invasive techniques for the treatment of haemorrhoids aim to minimize the postoperative pain normally associated with conventional haemorrhoidectomy. Some techniques are less painful but they may not be as effective for the more advanced grades of haemorrhoid [8–10]. For this group of patients conventional haemorrhoidectomy is still considered the gold standard [11]. The arterial branches supplying the haemorrhoids can penetrate the rectal wall at different levels from the dentate line [12,13]. THD aims to occlude the distal branches of the superior rectal artery, thus eliminating the main blood supply to the haemorrhoids, and symptoms resolve or improve in about 90% of patients [1]. Recurrence in the case of advanced grade is high, however [10,11], and it soon became clear that to treat advanced haemorrhoidal disease the prolapsing component had to be dealt with as well. Plication of the prolapsing mucosa was therefore introduced as part of THD [14]. The original plication technique used a 2/0 polygliactin suture mounted on a 5/8 needle. When plication of the rectal mucosa was needed the suture used to transfix the artery was then applied to the mucosa and submucosa in the form of a continuous suture distally towards the dentate line. Although this technique has been effective in most cases and has reduced recurrence it has some limitations for more advanced grades of haemorrhoid. First the shape of the 5/8 needle greatly limits the amount of tissue that can be taken. Although this may not be a major problem for small degrees of prolapse, it becomes so when dealing with a large prolapsing component. In this circumstance, a 3/8 needle as used in the technique described here allows the surgeon to control precisely the amount of tissue taken with each bite, which will differ from patient to patient depending on the size of the haemorrhoids and any associated mucosal rectal prolapse.

The course of the arteries along the rectal wall is very variable. In 2004 Aigner *et al.* [12] demonstrated that some of the distal branches of the rectal artery enter the muscularis propria very distally and suggested that these vessels might be responsible for the recurrences observed after THD. More recently Ratto *et al.* [13] have used colour duplex imaging to try to define the anatomy of the haemorrhoidal arteries in patients suffering with haemorrhoidal symptoms. According to their findings, 2.5% of arteries lie in the submucosal layer at 4 cm from the anorectal junction, 67% at 3 cm, 96.6 at 2 cm and 100% at 1 cm. Since the arteries will only be within reach of the transfixing stitch when in the submucosal plane, effective transfixation requires that the stitch be applied close to the dentate line. This will inevitably leave a very short length of mucosa between the stitch and the dentate line, which will not be sufficient to allow effective mucopexy, especially when a large prolapsing component is present. To overcome this problem Ratto *et al.* [15] suggested that the rectal mucosa be marked by diathermy once the arteries have been identified by Doppler imaging, and start the running suture proximally to that point and then use the same suture to overrun the point where the mark has been placed. Our concern with this technique is that the mucosa can be displaced when handling the proctoscope during the plication of the rectal mucosa and therefore the mark may not accurately identify the position of the underlying artery. The technical modification we have described has the advantage that it allows accurate transfixation and ligation of the artery. Furthermore, dividing the procedure into two phases, dearterialization and plication, using different needles, also allows the areas of prominent prolapse to be targeted.

In this consecutive series of 31 patients with Grade IV haemorrhoids we report a recurrence rate of 3%, and further intervention to treat ongoing symptoms was required in only 6% of patients. There is little information of the results of THD for Grade IV haemorrhoids, but initial results without mucopexy reported a recurrence rate of over 50% [9,11]. With the introduction of mucosal plication this has fallen [14,16]. Thus in a multicentre study the recurrence rate of 50% before mucopexy dropped to 11% after it was introduced [14]. Similar results have been reported in a series of 100 patients with Grade IV haemorrhoids operated on with the haemorrhoidal artery ligation (HALO) and rectoanal repair technique, with 9% recurrence at a mean of 34 months [17]. In conclusion, THD with mucopexy is an effective treatment for advanced haemorrhoids and the technical modification (THD TM) can further improve the results.

Author contributions

Mr Pasquale Giordano contributed substantially to the conception and design of the study and the interpretation of data, and drafted and provided critical revision of the article and gave final approval of the version to be published. Mr Ivan Tomasi contributed to acquisition of data, their analysis and interpretation. Dr Annalisa Pascariello, Dr Edward Mills and Dr Sinha Elhai contributed to acquisition of data.

References

1 Giordano P, Overton J, Madeddu F, Zaman S, Gravante G. Transanal hemorrhoidal dearterialization: a systematic review. *Dis Colon Rectum* 2009; **52:** 1665–71.

2 NICE Interventional Procedure Guidance 342, N2155 12 May 10. http://www.nice.org.uk/nicemedia/live/12236/48673/48673.pdf

3 Morinaga K, Hasuda K, Ikeda T. A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. *Am J Gastroenterol* 1995; **90:** 610–3.

4 Sohn N, Aronoff JS, Cohen FS, Weinstein MA. Transanal hemorrhoidal dearterialization is an alternative to operative hemorrhoidectomy. *Am J Surg* 2001; **182:** 515–9.

5 Denoya PI, Fakhoury M, Chang K, Fakhoury J, Bergamaschi R. Dearterialisation with mucopexy vs. Haemorrhoidectomy for Grade III or IV Haemorrhoids: short-term results of a double-blind randomised controlled trial. *Colorectal Dis* 2013; **15:** 1281–8.

6 Giordano P, Nastro P, Davies A, Gravante G. Prospective evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: three-year outcomes. *Tech Coloproctol* 2011; **15:** 67–73.

7 Infantino A, Altomare DF, Bottini C *et al.* Prospective randomized multicentre study comparing stapler haemorrhoidopexy with Doppler-guided transanal haemorrhoid dearterialization for third-degree haemorrhoids. *Colorectal Dis* 2012; **14:** 205–11.

8 Giordano P, Gravante G, Sorge R, Ovens L, Nastro P. Long-term outcomes of stapled hemorrhoidopexy vs conventional hemorrhoidectomy: a meta-analysis of randomized controlled trials. *Arch Surg* 2009; **144:** 266–72.

9 Ortiz H, Marzo J, Armenda'riz P, De Miguel M. Stapled hemorrhoidopexy vs. diathermy excision for fourth-degree hemorrhoids: a randomized, clinical trial and review of the literature. *Dis Colon Rectum* 2005; **48:** 809–15.

10 Scheyer M, Antonietti E, Rollinger G, Mall H, Arnold S. Doppler-guided hemorrhoidal artery ligation. *Am J Surg* 2006; **191:** 89–93.

11 Khafagy W, El Nakeeb A, Fouda E *et al.* Conventional haemorrhoidectomy, stapled haemorrhoidectomy, Doppler guided haemorrhoidectomy artery ligation; post operative pain and anorectal manometric assessment. *Hepatogastroenterology* 2009; **56:** 1010–5.

12 Aigner F, Bodner G, Conrad F, Mbaka G, Kreczy A, Fritsch H. The superior rectal artery and its branching pattern with regard to its clinical influence on ligation techniques for internal hemorrhoids. *Am J Surg* 2004; **187:** 102–8.

13 Ratto C, Parello A, Donisi L, Litta F, Zaccone G, Doglietto GB. Assessment of haemorrhoidal artery network using colour duplex imaging and clinical implications. *Br J Surg* 2012; **99:** 112–8.

14 Dal Monte PP, Tagariello C, Sarago M *et al.* Transanal haemorrhoidal dearterialisation: nonexcisional surgery for the treatment of haemorrhoidal disease. *Tech Coloproctol* 2007; **11:** 333–8.

15 Ratto C, Donisi L, Parello A, Litta F, Zaccone G, De Simone V. Distal Doppler-guided dearterialization' is highly effective in treating haemorrhoids by transanal haemorrhoidal dearterialization. *Colorectal Dis* 2012; **14:** e786–9.

16 Ratto C, Giordano P, Donisi L, Parello A, Litta F, Doglietto GB. Transanal haemorrhoidal dearterialization (THD) for selected fourth-degree haemorrhoids. *Tech Coloproctol* 2011; **15:** 191–7. IF 1.5.

17 Faucheron JL, Poncet G, Voirin D, Badic B, Gangner Y. Doppler-guided hemorrhoidal artery ligation and rectoanal repair (HAL-RAR) for the treatment of grade IV hemorrhoids: long-term results in 100 consecutive patients. *Dis Colon Rectum* 2011; **54:** 226–31.

2013

Authors: **Ratto** C., **Parello** A., **Donisi** F., **Litta** G. et al.

Source: Colorectal Disease 2013, 15 (Suppl. 3), 48-116, Poster LTP90 from ESCP Meeting 2013 in Belgrade

Title: **Efficacy of THD Doppler procedure in treating hemorrhoidal symptoms**

AIM:

Doppler-guided Transanal Hemorrhoidal Dearterialization (THD) seems able to influence effectively pathophysiology of hemorrhoidal disease (HD). Clinical efficacy of THD Doppler procedure in patients with HD has been evaluated.

METHOD:

Clinical assessment of 626 HD patients, treated with this surgical technique (including dearterialization mucopexy), was performed pre- and postoperatively (mean follow-up: 33.9 ± 22.2; range: 12-100 months). A HD-specific symptom-based score was used including evaluation of: bleeding, prolapse, manual reduction, discomfort/pain, impact on QoL (severity graded as: 0 = never; 1 = at least once/year; 2 = at least once /month; 3 = at least once / week; 4 = every bowel movement)

RESULTS:

The preoperative mean score (15.1 ± 2.8) dropped to 1.2 ± 3.0 postoperatively ($P < 0.001$). Preoperatively, grade 3-4 symptoms concerned 67.4% of patients for bleeding, 89.2% for prolapse, 75.1% for manual reduction,77.2% for discomfort/pain, 89.0% for impact on QoL. At follow-up, these features were 3.2%, 7.7%, 2.9%, 2.7% and 3.9%, respectively, while grade 0 symptoms concerned 93.6% of patients for bleeding, 89.3% for prolapse, 95.7% for manual reduction, 85.3% for discomfort/pain, 84.2% for impact on QoL.

CONCLUSION:

THD Doppler procedure showed very high efficacy in controlling all HD-related symptoms.

2013

Authors: **Verre** L., **Rossi** R., **Gaggelli** I., **Di Bella** C. et al.

Source: Minerva Chir. 2013 Dec; 68(6):543-50
https://www.ncbi.nlm.nih.gov/pubmed/24193286

Title: **PPH versus THD: a comparison of two techniques for III and IV degree haemorrhoids. Personal experience**

AIM:

The aim of our study was to evaluate, through prospective randomized study, the outcome and the immediate and late complications of the two types of surgery most widely used for degree III-IV haemorrhoids.

METHODS:

A total of 122 patients with degree III and IV hemorrhoids were elected for surgical intervention and, randomly, underwent surgery for PPH or THD. We assessed the most common immediate postoperative complications. The patients have been followed for three months with a mean follow-up at 1 month and 3 months after surgery. Parameters taken into consideration were: bleeding, pain at rest and after evacuation, soiling, constipation and tenesmus.

RESULTS:

Five patients in PPH group (7.9%) had a major postoperative bleeding, whereas no such episode occurred in THD group (P=ns). In percentage terms, VAS score was lower in THD group than in PPH group, although the difference was not statistically significant. Finally parameters values observed, during the follow-up, proved to be lower for THD group compared to PPH group.

CONCLUSIONS:

PPH and THD are two surgical treatments for degree III and IV haemorrhoids with low perioperative complications and good results in the short term. However, our experience shows that better results in terms of pain and fewer postoperative complications are obtained after THD surgery, such surgery is less invasive and more adaptable to the needs of day surgery.

2013

Authors: **Korolenko** K., **Korolenko** V. & **Tominets** M.

Source: Colorectal Disease 2013, 15 (Suppl. 3), 48-116, Poster P297 from ESCP Meeting 2013 in Belgrade

Title: **Treatment of grade III haemorrhoids with anorectal thrombosis**

AIM:

Acute anorectal thrombosis is common complication in 40% to 67% of patients. Various treatment methods can be found in literature. Some authors recommend conservative treatment, others prefer surgery. Conservative methods result in recurrence (78% - 95%). Surgery (removal of internal and external complexes) is associated with serious complications. We aimed to improve the results and safety of hemorrhoids treatment with anorectal thrombosis.

METHOD:

Since March 2008 75 patients with combined thrombosed piles of grade III underwent surgery on admission day. Operation included removal of thrombosed piles with catgut suturing followed by THD procedure with anopexy. Age 20-72 years, 71.5% males.

RESULTS:

Patients reported pain at the site of thrombosed piles excision. No post operation complication were seen. Hospital stay took 1 to 3 days. Patients fully recovered in 5-10 days. In 4 years follow-up no patient had recurrence of anorectal thrombosis. 2.5% of patients experienced a small amount of bleeding during defecation, which was managed with conservative treatment.

CONCLUSION:

This study confirms that surgical treatment of anorectal thrombosis with simultaneous THD procedure for grade III hemorrhoids. This method does not increase complications and is maximally radical. In 5-10 days patients recovered completely.

2013

Authors: **Pyrogovskyy** V., **Sorokin** B., **Tachiev** R., **Zadorozhniy** S., **Plemyanik** S., **Taranenko** A., **Slobenets** S., **Lashchenko** M., **Murga** P., **Shetelinets** U. & **Noyes** A.

Source: Colorectal Disease 2013, 15 (Suppl. 3), 48-116, Poster P315 from ESCP Meeting 2013 in Belgrade

Title: **THD for chronic haemorrhoids treatment**

AIM:

Haemorrhoids are one of the most common conditions affecting working people. In CIS countries incl. Ukraine standard surgical treatment is performed in 97% with 25 days on disability leave. Less traumatic procedures are done only in 3% and not always effective. THD procedure suggested in 1995 became an alternative for surgery and out-patient treatment methods.

METHOD:

In Ukraine THD was firsty performed at Kiev Region Hospital. From November 2007 till March 2013 504 THD procedures were performed. Age 21-73 years (mean age 37.6 years). Males – 203 (40.3%), female – 301 (59.7%). 10% patients of grade II, 77.3% - grade III and 9.6% - grade IV. All six points were sutured using THD Evolution.

RESULTS:

Twenty-eight patients required analgesia mainly after anopexy. Post-op complications: 1 submucosal fistula, 5 massive bleeding, 36 thrombosis treated in a conservative manner, 24 patients reported prolapse after pexy. Hospital stay lasted 1 day with full recovery in 24-48 h. Only patients after anal fissure excision during THD had to stay at hospital 2-3 days.

CONCLUSION:

THD is an alternative compared to mini-invasive and traditional methods.

This treatment option is highly effective, with minor pain and short recovery period. THD can be combined with anal fissure surgery.

2013

Authors: **De Simone** V., **Parello** A., **Donisi** L., **Litta** F. et al.

Source: Colorectal Disease 2013, 15 (Suppl. 3), 48-116, Poster 316 from ESCP Meeting 2013 in Belgrade

Title: **THD Doppler procedure decreases haemorrhoidal artery hyperflow**

AIM:

THD Doppler procedure provides haemorrhoidal dearterialization in six sectors of low rectum, to reduce arterial hyperflow. How Doppler-guided arteries ligations could influence hemorrhoidal blood flow is unknown.

METHOD:

Seventeen III-degree haemorrhoids patients underwent THD Doppler procedure. Before and 12 months after surgery, they were submitted to endoanal ultrasound and colour duplex imaging. Arteries within internal piles were sampled, and peak systolic (PS), acceleration time (AT), end diastole (ED), resistivity index (RI), and pulsatility index (PI) were evaluated. Pre-op and post-op data were compared.

RESULTS:

THD Doppler was successful in treating bleeding in all patients and prolapse in all but one. Significant reduction of values was demonstrated for: PS (from 18.7 ± 1.1 to 10.3 ± 0.4 cm/s, $P < 0.05$), RI (from 1.0 ± 0.2 to 0.8 ± 0.5, $P < 0.05$), and PI (from 5.5 ± 0.3 to 2.8 ± 0.4, $P < 0.05$). Mean ED variation was statistically not significant (from 1.9 ± 0.2 to 2.0 ± 0.4 cm/s, $P = 0.753$), while mean AT was significantly increased (from 65.6 ± 3.6 to 83.3 ± 4.7 cm/s2, $P < 0.05$)

CONCLUSION:

Artery ligation modifies significantly haemorrhoidal hemodynamic. Reduction of post-op blood flow incoming to piles is demonstrated by decrease at PS and entire cardiac cycle (PI and RI). Successful arteries decongestion, after THD Doppler, results in prolonged AT. Diastolic flow velocity (ED) did not undergo significant variations.

2013

Authors: **Trenchuk** V., **Lagoda** V., **Tchornous** I.

Source: Colorectal Disease 2013, 15 (Suppl. 3), 48-116, Poster 326 from ESCP Meeting 2013 in Belgrade

Title: **THD for thrombosed haemorrhoids**

AIM:

Improvement of efficacy and safety of thrombosed haemorrhoids treatment using THD procedure.

METHOD:

In 1995 Morinaga described a new technique for surgical treatment of haemorrhoids – Transanal Haemorrhodail Dearterialisation (THD). This technique eliminates haemorrhoidal symptoms by Doppler-guided ligation of SRA terminal branches. Procedures were performed using THD.

RESULTS:

Thrombosed piles (grade I-II) were treated by standard conventional treatment 3-4 days prior operation. After acute inflammatory signs elimination, THD procedure was performed. Operational window in the distal part of special anoscope with incorporated Doppler probe allowed applying stitches on arteries under spinal anesthesia. From October 2010 THD procedure were performed in 132 patients (71.5% male, age range 20-72 years). The majority (70%) had grade III haemorrhoids including 45 patients with acute thrombosed piles. After procedure 57, 3% of patients had no pain symptoms. Hospital stay lasted 1 day (2-3 days in case of thrombosed piles). We have observed 2 complications: two cases of intraoperational bleeding followed by additional ligation. Patients fully recovered in 3-5 days. In 3 years follow-up any serious complications or recurrence haven't been registered.

CONCLUSION:

This study presents THD procedure as safe, effective, non-excisional, anatomy-saving, 1 day surgery for haemorrhoids without post-operational impact on continence.

2013

Authors: **Popov** V., **Zhivkov** E., **Tokov** P. et al

Source: Khirurgiia (Sofiia). 2013;(3):4-7

Title: Advantages of transanal hemorrhoidal dearterialization as compared to other surgical techniques for the treatment of hemorrhoidal disease

Transanal hemorrhoidal dearterialization (THD) is a new surgical technique used for the treatment of hemorrhoidal disease. It is known for its easy performance and low perioperative risk. 44 patients have been operated by this method at the Clinic of General, Liver and Pancreatic Surgery for a period of 22 months. A comparative analysis was performed between the postoperative results with the use of transanal hemorrhoidal dearterialization, modified hemorrhoidectomy of Milligan-Morgan, and Whitehead's hemorrhoidectomy.

CONCLUSIONS:

When comparing transanal hemorrhoidal dearterialization with other methods, we found that it has an excellent aesthetic effect, requires shorter hospital stay and less analgesics, and causes less discomfort in the postoperative period.

2013

Authors: **Talha** S., **Burke** J.P., **Waldron** D. et al

Source: Acta Gastroenterol Belg. 2013 Jun;76(2):231-4
https://www.ncbi.nlm.nih.gov/pubmed/23898561

Title: Early quality of life outcomes following Doppler guided transanal haemorrhoidal dearterialisation: a prospective observational study

BACKGROUND AND AIMS:

There are few studies examining the quality of life (QOL) of patients with haemorrhoidal disease. Transanal heamorrhoidal dearterialization (THD) is a treatment modality for heamorrhoidal disease in which a Doppler transducer is used to locate the supplying arteries that are subsequently ligated. The aim of this study was to assess symptoms and QOL changes following THD.

PATIENTS AND METHODS:

This was a prospective evaluation of QOL and symptom changes following THD. Patient symptoms, demographics and QOL were recorded preoperatively and 1-month post-operatively following THD using the medical outcomes study short-form-36 (SF-36).

RESULTS:

Thirteen patients undergoing THD were evaluated. One month following THD symptoms of haemorrhoid protrusion, bleeding, anal pain, painful defaecation, constipation and tenesmus, had all significantly reduced ($P < 0.05$). Limitations in usual role activities because of physical health problems (53.8 +/- 10.5 Vs 90.4 +/-4.5, $P = 0.004$), vitality, energy and fatigue (45 +/- 6.9 Vs 73.5 +/- 5.0, $P= 0.003$), general mental health, psychologic distress and wellbeing (60.9 +/- 6.9 Vs 83.1 +/- 5.9, $P= 0.023$), limitations in social activities because of physical or emotional problems (58.7 +/- 8.8 Vs 84 +/- 5.9, $P = 0.025$), and physical pain (52.9 +/- 7.9 Vs 84.6 +/- 6.4, $P= 0.005$) scores had all improved 1-month following THD.

CONCLUSIONS:

THD significantly reduces symptoms of haemorrhoidal disease and improves specific aspects of QOL 1-month following surgery.

2012
Authors: **Morett** R. S.
Source: Cirujano General Vol. 34 Núm. 2 - 2012
http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-00992012000200005

Title: Desarterialización hemorroidal transanal como tratamiento quirúrgico de la enfermedad hemorroidal: Reporte inicial

OBJECTIVE:

To assess the results of transanal hemorrhoidal dearterialization (THD) as alternative surgical treatment to hemorrhoidal disease in 250 consecu- tive patients.

Setting: Hospital Español (Third level Health Care Center).

DESIGN:

Descriptive, prospective, observational, and cross-sectional study. Statistical analysis: Percentages as summary measure for qualitative variables.

PATIENTS & METHODS:

The THD procedure was performed in 116 men and 134 women; it consisted in ligating the branches of the superior rectal artery, Doppler-guided, and adding mucosal pexis to correct the prolapse. Analyzed variables were: age, gender, Goligher's hemorrhoidal grading, preoperative symptomatology, aggregated anal disease, surgical time for the THD alone or with an added procedure, postsurgical pain, in-hospital stay, complications, and satisfactoriness based on the analog visual scale (AVS), return to normal activities, recurrence of hemorrhoidal disease. All patients were followed for 1 year after surgery.

RESULTS:

Average age was of 42.8 years. According to Goligher's classification, most patients, 140 (56%), corresponded to grade II, to grade III pertained 89 (36%), and grade IV with 21 (8%). Preoperative symptomatology included bleeding, prolapse, and pruritus in 101 (40%), only prolapse in 86 (34%), and bleeding in 63 (25%). Only 22 (8.8%) patients of the series coursed with acute inflammatory symptom.

Aggregated diseases were: simple anal fistula in 11, deep fistula in 7, anal fissure in 19, symptomatic rectocele in 3. Average surgical time was of 28 min when performing THD alone, and of 35 min when adding a complementary anorectal procedure. Post- surgical pain according to AVS was 0-1 in 183 (73%), 2-3 in 47 (19%), 4-5 in 15 (6%), 6-7 in 5 (2%); 183 (73%) patients did not require analgesia. In-hospital stay below 24 hours in 183 (73%) patients and more than 24 hours in 67 (27%). The degree of satisfactoriness of the patient based on AVS was: 8-10 in 224 (89.6%), 6-7 in 12 (4.8), 4-5 in 9 (3.6%), and 1-3 in 5 (2%). Minor complications occurred in 22% of patients, recurrent prolapse and bleeding occurred in 13 (5.2%) patients; 220 (88%) returned to their daily activities in an average of 3 days.

CONCLUSION:

THD seems to be a valid method for the nonexcisional treatment of hemorrhoidal disease, being effective, safe, with a low incidence of complications.

2012
Authors: **Gomez-Rosado** J.C., **Sanchez-Ramirez** M.
Source: Cirugía Española Volume 90, Issue 8, October 2012, Pages 513-517
Available for Open Online Access

Title: **Resultados a un año tras desarterialización hemorroidal guida por doppler**

INTRODUCCIÓN:

La desarterialización hemorroidal guiada por doppler (THD) es una técnica no exerética para el tratamiento de las hemorroides, consistente en la ligadura de las ramas distales de la arteria rectal superior. El propósito de este trabajo es evaluar la seguridad y eficacia de esta técnica tras un seguimento de un año.

MATERIAL Y MÉTODO:

Se intervienen 30 pacientes mediante THD por hemorroides sintomáticas grado II o III. La media de edad fue de 49,9 años (30-70 años). En todos se utilizó el dispositivo THD. Los procedimientos se realizaron bajo anestesia intradural en régimen de corta estancia. Evaluamos tiempo operatorio, dolor, sangrado, estancia postoperatoria, complicaciones y síntomas tras 3-6 y 12 meses.

RESULTADOS:

El tiempo operatorio medio fue de 23 minutos (15-50). El valor de dolor según la escala visual analógica (EVA) fue durante el primer día de 5,5 (el 90% requirió analgesia). Tras el segundo día, sólo 2 pacientes necesitaron analgesia. Un paciente describió dolor persistente hasta los 3 meses, 2 sangrado leve. Una reintervención por trombosis hemorroidal al 108 día. No otras complicaciones. No reingresos. Estancia media: 1,4 días (0-2), y el restablecimiento de actividad diaria normal se realizó a los 7-8 días. 26 pacientes (87%) describen tenesmo, autolimitado en 3 meses.

Tras un año, 2 pacientes han sido reintervenidos, 3 han recurrido (2 prolapsos leves y 1 sangrado ocasional). La tasa de resolución total fue del 80%.

CONCLUSIONES:

la desarterialización hemorroidal guiada por doppler parece ser efectiva tras un año, con un porcentaje de complicaciones bajo.

CIR ESP. 2012;xx(xx):xxx–xxx

CIRUGÍA ESPAÑOLA

www.elsevier.es/cirugia

Original

Resultados a un año tras desarterialización hemorroidal guiada por doppler☆

Juan-Carlos Gomez-Rosado, María Sanchez-Ramirez, Luis C. Capitan-Morales, Javier Valdes-Hernandez, María L. Reyes-Diaz, Juan Cintas-Catena, Juan M. Guerrero-Garcia, Juan Galan-Alvarez y Fernando Oliva-Mompean*

Unidad de Cirugía Colorrectal, Clínica de Gestión Cirugía General y del Ap. Digestivo, Hospital Universitario Virgen Macarena. Sevilla, España

INFORMACIÓN DEL ARTÍCULO

Historia del artículo:
Recibido el 27 de enero de 2012
Aceptado el 1 de marzo de 2012
On-line el xxx

Palabras clave:
Hemorroides
Ligadura de arteria hemorroidal
Guiado por doppler
THD
Cirugía mínimamente invasiva

RESUMEN

Introducción: La desarterialización hemorroidal guiada por doppler (THD) es una técnica no exerética para el tratamiento de las hemorroides, consistente en la ligadura de las ramas distales de la arteria rectal superior. El propósito de este trabajo es evaluar la seguridad y eficacia de esta técnica tras un seguimiento de un año.

Material y método: Se intervienen 30 pacientes mediante THD por hemorroides sintomáticas grado II o III. La media de edad fue de 49,9 años (30-70 años). En todos se utilizó el dispositivo THD®. Los procedimientos se realizaron bajo anestesia intradural en régimen de corta estancia. Evaluamos tiempo operatorio, dolor, sangrado, estancia postoperatoria, complicaciones y síntomas tras 3-6 y 12 meses.

Resultados: El tiempo operatorio medio fue de 23 minutos (15-50). El valor de dolor según la escala visual analógica (EVA) fue durante el primer día de 5,5 (el 90% requirió analgesia). Tras el segundo día, sólo 2 pacientes necesitaron analgesia. Un paciente describió dolor persistente hasta los 3 meses, 2 sangrado leve. Una reintervención por trombosis hemorroidal al 10° día. No otras complicaciones. No reingresos. Estancia media: 1,4 días (0-2), y el restablecimiento de actividad diaria normal se realizó a los 7-8 días. 26 pacientes (87%) describen tenesmo, autolimitado en 3 meses.

Tras un año, 2 pacientes han sido reintervenidos, 3 han recurrido (2 prolapsos leves y 1 sangrado ocasional). La tasa de resolución total fue del 80%.

Conclusiones: La desarterialización hemorroidal guiada por doppler parece ser efectiva tras un año, con un porcentaje de complicaciones bajo.

One year follow-up after doppler-guided haemorrhoidal artery ligation

Keywords:
Haemorrhoids

ABSTRACT

Introduction: The Doppler-guided haemorrhoidal artery ligation (DG-HAL) is a non-exeresis technique for the treatment of haemorrhoids, consisting in the ligature of the distal

☆ Trabajo presentado en el 6th Scientific Meeting of the European Society of Coloproctology. Copenhaguen, Denmark, September 2011. Abstract publicado en Col. Disease 2011; 13(Supl.6): 47.

* *Autor para correspondencia.*
Correo electrónico: dr.gomez.rosado@gmail.com (J.-C. Gomez-Rosado).

0009-739X/$ – see front matter
doi:10.1016/j.ciresp.2012.03.002

Cómo citar este artículo: Gomez-Rosado J-C, et al. Resultados a un año tras desarterialización hemorroidal guiada por doppler. Cir Esp. 2012. doi:10.1016/j.ciresp.2012.03.002

Haemorrhoidal dearterialisation
Doppler-guided
THD
Minimally invasive surgery

branches of the upper rectal artery. The aim of this work is to evaluate the safety and efficacy of this technique after one year of follow-up.

Material and method: A total of 30 patients were operated on using DG-HAL for grade II or III haemorrhoids. The mean age was 49.9 years (30–70 years). The THD® (Transanal Haemorrhoidal Dearterialisation) device was employed in all cases. The procedures were performed under intradural anaesthesia in a short-stay surgery unit. The operating time, pain, bleeding, postoperative stay, and complications and symptoms after 3-6 months and 12 months were recorded.

Results: The mean operating time was 23 minutes (15-50). The pain according to a visual analogue scale (VAS) was 5.5 during the first day (90% required analgesia). Only 2 patients required analgesia after the second day. One patient described persistent pain up to 3 months, and 2 slight bleeding. A further operation was performed due to a haemorrhoidal thrombosis on the 10th day. There were no other complications and no re-admissions. The mean hospital stay was 1.4 days (0-2), and normal daily activity re-established at 7-8 days. A large majority (87%) of patients described having tenesmus, which disappeared in 3 months.

After one year, two patients had had further operations, 3 had recurrences (2 slight prolapses and 1 occasional bleeding). The success rate was 80%.

Conclusions: Haemorrhoidal dearterialisation using Doppler-guided arterial ligation seems to be effective after one year, with a low percentage of complications.

Introduccion

El interés por mejorar la satisfacción del paciente tras la cirugía de las hemorroides ha llevado el desarrollo de nuevas técnicas no excisionales, como alternativas a la hemorroidectomía de Milligan y Morgan[1] o de Ferguson[2], consideradas como gold standard. Así se han desarrollado métodos ambulatorios como la escleroterapia[3], fotocoagulación[4], crioterapia[5], o ligadura de Barron[6], que, si bien eran menos dolorosos, tenían como desventaja la necesidad de varias sesiones, así como la alta tasa de recurrencia.

Posteriormente, en 1995, se presentaron la anopexia grapada[7–9] y otro procedimiento basado en la ligadura de las ramas terminales de la arteria rectal superior, utilizando un proctoscopio especialmente diseñado y equipado con una sonda doppler, denominado *haemorrhoid artery ligation (HAL)*, descrito por Morinaga[10] y cols. o *transanal haemorrhoid dearterialization* (THD) por Sohn[11].

La desarterializacion hemorroidal transanal es una técnica quirúrgica no excisional para el tratamiento de las hemorroides, consistente en la ligadura de las ramas distales de la arteria rectal superior[7], incluida en un estroma de tejido conjuntivo y fibras musculares lisas. Este procedimiento se basa en el hecho de que, si ligamos las ramas terminales de la rectal superior con puntos de transición justo por encima del punto detectado por la sonda doppler, a través de la ventana de intervención, unos 3 cm por encima de la línea dentada, podemos disminuir el flujo arterial sin comprometer el retorno venoso.

El efecto esperado es la reducción del flujo sanguíneo y la congestión del plexo hemorroidal. En tal caso, las hemorroides se colapsan y por consiguiente disminuye el sangrado y el dolor. Además la regeneración del tejido conectivo facilita la retracción de las hemorroides, con la consiguiente reducción del prolapso y mejoría de los síntomas[8].

Con esta técnica el anodermo sensible por debajo de la línea dentada se evita, minimizando el dolor postoperatorio y potenciando la recuperación en menor tiempo[9].

El propósito de este estudio es evaluar la seguridad y eficacia de la desarterializacion hemorroidal transanal guiada por doppler, después de un seguimiento a corto y medio plazo.

Materiales y métodos

Pacientes

Entre marzo de 2009 y marzo de 2010, realizamos THD guiado por doppler en 30 pacientes (19 hombres y 11 mujeres) con edades comprendidas entre los 30 y 70 años (media 50, Desviación estándar(DS) = 12,491).

Los pacientes se seleccionaron según sintomatología clínica y exploración física que confirmarse la presencia de hemorroides grado II ó III. Cualquier otra patología anal se descartó, así como otras causas de rectorragia, con rectosigmoidoscopia flexible realizada por los gastroenterólogos. También se descartaron pacientes con hemorroides de primer grado, menores de 18 años, trombosis hemorroidal, embarazo, y todos aquellos que prefirieron realizarse una hemorroidectomía de Milligan-Morgan.

Los pacientes fueron totalmente informados sobre las alternativas de tratamiento así como de las posibles complicaciones de la técnica quirúrgica, y se les requirió consentimiento informado en un formulario específico.

Técnica

En todos los casos se utilizó el dispositivo THD® (distribuido por Palex Medical). Consiste en un rectoscopio especialmente diseñado y equipado con una sonda Doppler y una fuente de luz. La sonda Doppler está orientada hacia la ventana de

Cómo citar este artículo: Gomez-Rosado J-C, et al. Resultados a un año tras desarterialización hemorroidal guiada por doppler. Cir Esp. 2012. doi:10.1016/j.ciresp.2012.03.002

intervención, localizada al final del rectoscopio y así la arteria puede ser identificada en el punto de contacto de dicha sonda doppler y ser ligada de forma selectiva a través de esta ventana. Un pivote circular localizado en el centro de la luz del rectoscopio permite apoyar el portaagujas para realizar el giro de una forma más precisa.

La noche anterior al procedimiento se administra un enema de limpieza para evacuar el recto. No administramos profilaxis antibiótica. 30 minutos antes de la intervención se administra premedicación mediante maleato de midazolan (Dormicum®, Roche) a dosis de 3 mg intramuscular.

Los procedimientos se realizan bajo anestesia intradural (silla de montar), en posición de Lloyd-Davis.

Tras la introducción del rectoscopio, se localizan las arterias terminales mediante la sonda doppler. Son seis las ramas terminales de la arteria rectal superior, habitualmente localizadas en las posiciones 1,3,5,7,9,11 según el horario del reloj, y se ligan aproximadamente unos 3 cm sobre la línea dentada con una sutura reabsorbible incluida en el pack para tal fin.

En todos los casos se procedió en régimen de ingreso en corta estancia.

Estadísticas

Los datos de los pacientes se incluyeron de forma prospectiva en una base de datos elaborada a tal efecto por los autores, en Microsoft Access 2007®. Fueron recogidos datos de edad, sexo, síntoma predominante, índice de severidad para la incontinencia fecal (Wexner), duración de la intervención, dolor postoperatorio, sangrado, estancia y complicaciones. Tras el alta, los pacientes cumplimentaron un registro del dolor según la escala visual analógica (EVA) durante la primera semana. Se revisaron a los 3, 6 y 12 meses tras la cirugía. Registramos el estado clínico, presencia de sangrado, prolapso, dolor (EVA), escala de Wexner, complicaciones y otros síntomas perianales que pudiese comentar el paciente. También se registraron los reingresos y el tiempo de regreso a las actividades de la vida diaria. Todo ello fue procesado mediante el paquete estadístico SPSS® 16.0 Mac® (SPSS Inc.)

El parámetro principal evaluado fue la tasa de éxito, definiéndose éste como la resolución de los síntomas preoperatorios y la no necesidad de algún tratamiento posterior. Los parámetros secundarios analizados fueron el dolor postoperatorio, complicaciones, reingresos y tiempo de normalización de la actividad diaria.

Resultados

La duración media de los procedimientos fue de 23,3 minutos (rango:15-50 minutos, DS:9,70). El dolor postoperatorio medio (EVA) fue de 5.5 (DS = 1,30) durante los dos primeros días (27/30 necesitó analgésicos). Tras el segundo día, 2/30 pacientes necesitaron analgesia, con un valor medio de dolor de 3 puntos (DS = 1,38) a los 7 días, exceptuando un paciente que desarrolló una trombosis hemorroidal a los 10 días, y se le realizó una trombectomía bajo anestesia local en urgencias. Solamente un paciente describió un dolor persistente hasta los 3 meses, sin que pudiésemos comprobar ninguna causa que lo justificara.

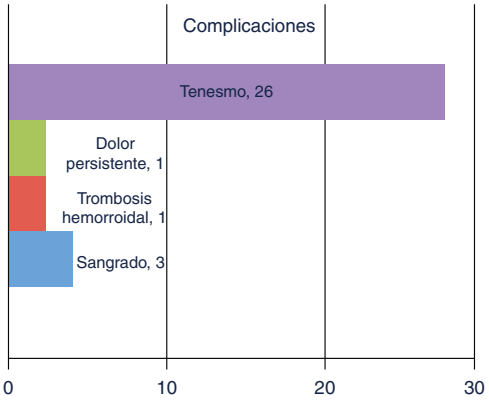


Figura 1 – Complicaciones.

El análisis mediante test de Student para muestras apareadas detecta una diferencia significativa ($p < 0,001$) al comparar de las escalas de dolor a los 2 días con semana y 3 meses. (media 0,12 DS = 0,58)

2/30 casos mostraron sangrado leve, pero un tercer paciente necesitó ser reintervenido a causa de un sangrado más importante. Ninguna otra complicación más fue descrita. (fig. 1) Ningún paciente fue reingresado a causa de eventos relacionados con la cirugía. La media de tiempo de estancia fue 1.4 días (rango: 0-2), y la reinserción a la actividad diaria normal fue habitualmente en 7-8 días (media = 7,6 días). 26 pacientes describieron tenesmo autolimitado a los tres meses. El score de Wexner no se modificó en ninguno de los pacientes (Wexner basal medio 0,46 (0-3).

Después de un seguimiento de un año, 2/30 pacientes han sido reintervenidos, 3/30 han desarrollado recurrencia de los síntomas, consistentes en un prolapso leve, y un caso describió sangrado ocasionalmente de poca intensidad. La tasa de éxito global fue del 80% (fig. 2)

Discusión

Además de la Hemorroidectomía de Milligan y Morgan o de Ferguson, existen otros métodos para el manejo de las hemorroides, algunos menos agresivos, incluso posibles en

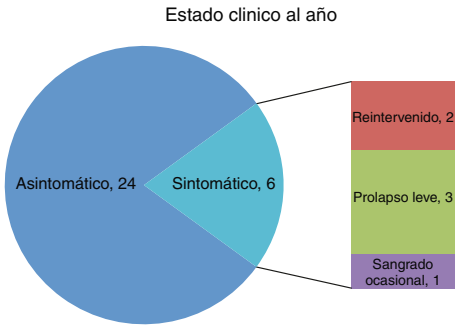


Figura 2 – Estado clínico al año.

Cómo citar este artículo: Gomez-Rosado J-C, et al. Resultados a un año tras desarterialización hemorroidal guiada por doppler. Cir Esp. 2012. doi:10.1016/j.ciresp.2012.03.002

régimen de consulta externa, y otros más agresivos, los cuales precisan de un quirófano, e incluso hospitalización[1-9,10,11,12]. Respecto a la primera opción, se pueden obtener resultados discretos, mientras que en la segunda los resultados a largo plazo son mejores, pero no exentos de complicaciones, incluyendo infección del sitio quirúrgico, sangrado o incluso incontinencia. En cualquier caso, bastantes ensayos prospectivos aleatorizados han considerado a la hemorroidectomía como la opción más efectiva para tratar las hemorroides, a pesar de su mayor tasa de complicaciones o dolor postoperatorio[13]. El resto de las opciones no ha demostrado ventajas reales frente la hemorroidectomía[14,15]. Es por ello por lo que deben considerarse las preferencias y opinión de los pacientes[16].

Tras la demostración mediante técnicas de doppler color de que existen de forma constante seis ramas terminales de la rectal superior, en una posición también constante (1, 3, 5, 7, 9, 11 según las agujas del reloj, en posición de litotomía) en el canal anal[17], se han descrito nuevos abordajes como la anopexia grapada[7-9] o la desarterialización hemorroidal transanal[10-11].

La anopexia grapada se basa en la disrupción de las ramas terminales de la arteria rectal superior, además de la escisión del prolapso, y su fijación en el canal anal mediante una endograpadora circular. THD, que también está basado en la disrupción de las ramas terminales y la fijación de la mucosa rectal, muestra una diferencia esencial: no es un procedimiento escisional: la ligadura se realiza bajo control doppler, con sutura reabsorbible, preservando los cojinetes hemorroidales, y la mucopexia traccionando del prolapso mediante una plicatura de la mucosa[18,19]. Más aún, el tejido conectivo del la hemorroide colapsada se regenera hasta la resolución del prolapso.

A pesar de que Festen y cols[20]. describen en un ensayo aleatorizado y controlado una tasa de complicaciones similares entre la anopexia grapada y el THD, otras publicaciones defienden la desarterialización hemorroidal, sin complicaciones a reseñar[21], frente a las complicaciones severas descritas en profesionales poco experimentados con la anopexia grapada, tales como dolor persistente, sepsis de origen pélvico, hemorragia, perforación rectal, fístulas rectovaginales y rectouretrales, peritonitis e incontinencia[22–28]. Centros experimentados han informado también complicaciones, como peritonitis severa que requiere intervención de Harmann[29].

Las complicaciones de THD son raras y leves, y los pacientes pueden ser dados de alta en el mismo día, en régimen ambulatorio. En nuestra serie, los primeros pacientes fueron hospitalizados, pero tras una experiencia inicial y con la ausencia de complicaciones precoces, consideramos su realización en régimen de cirugía mayor ambulatoria (CMA). De hecho, en comparación con la hemorroidectomía, THD demostró mucho menor dolor, menor estancia y retorno precoz al trabajo. En nuestro estudio, podemos confirmar estos resultados, con una baja tasa de requerimientos analgésicos tras el segundo día, estancias cortas, y retorno precoz a la actividad normal. Ratto y cols[30]. publican buenos resultados en hemorroides de grado IV utilizando THD, con una mejoría significativa de los síntomas en la mayoría de los pacientes, y recientemente Eliad Karin[31] ha publicado que, incluso, THD guiado por doppler es seguro y efectivo para las hemorroides de grado III en pacientes con enfermedad de Crohn sin actividad anorrectal.

Nuestras complicaciones son similares al resto de autores de la literatura[23], con un sangrado del 10% (excepto un caso que tuvo que ser reintervenido). El tenesmo descrito en otras series en el 26% de los pacientes asciende en nuestra serie hasta el 86,7%. Probablemente está originado por la flogosis de los cojinetes hemorroidales tras la ligadura. En cualquier caso, se autolimita a los tres meses.

El porcentaje de recurrencia detectado ha sido del 20%, aunque solamente 2 pacientes (6,7%) necesitaron reintervención. En ese caso, preferimos hemorroidectomía, a pesar de que una nueva desarterialización hubiera sido posible sin complicaciones especiales[23,32,33]. De todos modos, se necesitan más estudios controlados a largo plazo para establecer el papel real de THD en el tratamiento de las hemorroides.

Como conclusión, podemos afirmar que la desarterialización hemorroidal guiada por doppler es segura, fácil de realizar y ofrece ventajas relacionadas con menor dolor postoperatorio, morbilidad y reinserción a la vida laboral, con un aceptable porcentaje de recurrencia tras un seguimiento al año.

BIBLIOGRAFÍA

1. Milligan ETC, Morgan C, Naughton JLF, Office RR. Surgical anatomy of the anal canal and the operative treatment of haemorrhoids. Lancet. 1937;II:1119–24.
2. Ferguson JA, Mazier WP, Ganchrow MI, Friend WG. The closed technique of hemorrhoidectomy. Surgery. 1971;70:480–4.
3. Graham-Stewart CW. Injection treatment of haemorrhoids. BMJ. 1962;1:213–26.
4. Neiger A. Infrared-photo-coagulation for hemorrhoids treatment. Int Surg. 1989;74:142–3.
5. Lewis MI. Diverse methods of managing hemorrhoids: cryohemorrhoidectomy. Dis Colon Rectum. 1973;16:175–7.
6. Barron J. Office ligation of internal haemorrhoids. Am J Surg. 1963;105:563–70.
7. Dal Monte PP, Tagariello C, Giordano P, Cudazzo E, Shafi A, Sarago M, Franzini M. Transanal haemorrhoidal dearterialization: nonexcisional surgery for the treatment of haemorrhoidal disease. Tech Coloproctol. 2007;11:333–9.
8. Attila Bursics, Krisztina Morvay, Péter Kupcsulik, Lajos Flautner. Comparison of early and 1-year follow-up results of conventional hemorrhoidectomy and hemorrhoid artery ligation: a randomized study. Int J Colorectal Dis. 2004;19:176–80.
9. Giordano P, Overton J, Madeddu J, Zaman S, Gravante G. Transanal Hemorrhoidal Dearterialization: A Systematic Review. Dis Colon Rectum. 2009;52:1665–71.
10. Oh C. Problems of cryohemorrhoidectomy. Cryobiology. 1982;19:283–6.
11. Ho Y-H, Tan M, Seow-Choen F. Micronized purified flavonidic fraction compared favorably with rubber band ligation and fiber alone in the management of bleeding hemorrhoids: randomized controlled trial. Dis Colon Rectum. 2000;43:66–9.
12. MacRae HM, McLeod RS. Comparison of hemorrhoidal treatment modalities: a meta-analysis. Dis Colon Rectum. 1995;38:687–94.
13. Thorbeck CV, Montes MF. Haemorrhoidectomy: randomized controlled clinical trial of ligasure compared with Milligan-Morgan operation. Eur J Surg. 2002;168:482–4.

Cómo citar este artículo: Gomez-Rosado J-C, et al. Resultados a un año tras desarterialización hemorroidal guiada por doppler. Cir Esp. 2012. doi:10.1016/j.ciresp.2012.03.002

14. Khan S, Pawlak SE, Eggenberger JC, et al. Surgical treatment of hemorrhoids: prospective, randomized trial comparing closed excisional hemorrhoidectomy and the harmonic scalpel technique of excisional hemorrhoidectomy. Dis Colon Rectum. 2001;44:845–9.
15. Arbman G, krook H, Haapaniemi S. Closed vs. open hemorrhoidectomy; is there any differences? Dis Colon Rectum. 2001;43:31–4.
16. Cantero R, Balibrea JM, Ferrigni C, Sanz M, García-Pérez JC, Pérez R, Luffiego A, Forero GR, Balibrea JL. Desarterialización hemorroidal transanal guiada por Doppler. Una alternativa en el tratamiento de las hemorroides. Cir Esp. 2008;83:252–5.
17. Meintjes D. Doppler guided hemorrhoidal artery ligation (HAL) for the treatment of hemorrhoids. Results in 1415 patients. Patients studies 2000. Disponible en: www.pharma.it/eng/pati.htm
18. Faucheron JL, Gangner Y. Doppler-Guided Hemorrhoidal Artery Ligation for the Treatment of Symptomatic Hemorrhoids: Early and Three-Year Follow-up Results in 100 Consecutive Patients. Dis Colon Rectum. 2008;51:945–9.
19. Greenberg R, Karin E, Avital S, Skormick Y, Werbin N. First 100 cases with Doppler-guided hemorrhoidal artery ligation. Dis Colon Rectum. 2006;49:485–9.
20. Festen F, van Hoogstraten MJ, van Geloven AAW, Gerhards MF. Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results. Int J Colorectal Dis. 2009;24:1401–5.
21. Ratto C, Donisi L, Parello A, Litta F, Doglietto GB. Evaluation of Transanal Hemorrhoidal Dearterialization as a Minimally Invasive Therapeutic Approach to Hemorrhoids. Dis Colon Rectum. 2010;53:803–11.
22. Sutherland LM, Burchard AK, Matsuda K, et al. A systematic review of stapled hemorrhoidectomy. Arch Surg. 2002;137:1395–406.
23. Molloy RG, Kingsmore D. Life-threatening pelvic sepsis after stapled haemorrhoidectomy. Lancet. 2000;355:810.
24. Cheetham MJ, Mortensen NJ, Nystrom PO, Kamm MA, Phillips RK. Persistent pain and faecal urgency after stapled haemorrhoidectomy. Lancet. 2000;356:730–3.
25. Herold A, Kirsch J. Pain after stapled haemorrhoidectomy. Lancet. 2000;356:2187.
26. How YH, Seow-Choen F, Tsang C, Eu KW. Randomized trial assessing anal sphincter injuries after stapled haemorrhoidectomy. Br J Surg. 2001;88:1449–55.
27. Ripetti V, Caricato M, Arullani A. Rectal perforation, retropneumoperitoneum and pneumomediastinum after stapling procedure for prolapsed hemorrhoids: report of a case and subsequent considerations. Dis Colon Rectum. 2002;45:268–70.
28. Maw A, Eu KW, Seow-Choen F. Retroperitoneal sepsis complicating stapled hemorrhoidectomy. Report of a case and review of the literature. Dis Colon Rectum. 2002;45: 826–8.
29. Oughriss M, Yver R, Faucheron JL. Complications of stapled hemorrhoidectomy: a French multicentric study. Gastroenterol Clin Biol. 2005;29:429–33.
30. Ratto C, Giordano P, Donisi L, Parello A, Litta F, Doglietto GB. Transanal haemorrhoidal dearterialization (THD) for selected fourth-degree haemorrhoids. Tech Coloproctol. 2011;15:191–7.
31. Eliad Karin, Shmuel Avital, Iris Dotan, Yehuda Skornick, Ron Greenberg. Doppler-guided haemorrhoidal artery ligation in patients with Crohn's disease. Colorectal Dis. 2012;14:111–4.
32. Felice G, Privitera A, Ellul E, Klaumann M. Doppler-guided hemorrhoidal artery ligation: an alternative to hemorrhoidectomy. Dis Colon Rectum. 2005;48:2090–3.
33. Scheyer M, Antonietti E, Rollinger G, Mall H, Arnold S. Doppler-guided hemorrhoidal artery ligation. Am J Surg. 2006;191:89–93.

Cómo citar este artículo: Gomez-Rosado J-C, et al. Resultados a un año tras desarterialización hemorroidal guiada por doppler. Cir Esp. 2012. doi:10.1016/j.ciresp.2012.03.002

2012

Authors: **Karas** J., **Chang** P., **Denoya** P., **Fakhoury** M., **Fakhoury** J., **Stein** S., **Gregg** T., **Russo** N., **Amrani** S., **Kwan** A., **Essani** R. & **Bergamaschi** R.
State University of New York, Stony Brook, New York, USA
Source: Abstract B6 from ESCP Meeting 2012 in Wien

Title: **Doppler-guided transanal haemorrhoidal dearterialisation with mucopexy versus Ferguson haemorrhoidectomy for Grade III or IV haemorrhoids: short-term results of a single blind randomized controlled trial**

AIM:

The study hypothesis was that there is no difference in postoperative pain after Doppler-guided transanal haemorrhoidal dearterialization (THD) and Ferguson haemorrhoidectomy (FH).

METHOD:

This was a prospective, single-centre, single-blind, randomized controlled trial. Patients with three-quadrant disease were randomized to THD or FH. Postoperative pain was evaluated using the Faecal Incontinence Quality-of-Life Score (FIQOL), Brief Pain Inventory (BPI), general health survey (SF-12) questionnaires. To demonstrate a 20% difference in postoperative pain, 44 patients were required.

RESULTS:

Twenty-four THD patients were comparable with 17 FH patients for age (P=0.107), BMI (P=0.559), ASA class (P=0.569), comorbidity (P=0.592), haemorrhoidal grade (P=0.986), POSSUM (P=0.552), FIQOL (P=NS), and constipation scores (P=0.628). The operation time was shorter in THD patients (P=0.043) with no difference in blood loss (P=0.961) or intraoperative adverse events (P=0.808). THD patients had less postoperative pain (P=0.011) and urinary retention (P=0.012), earlier first bowel movement (P=0.001). Pain medication requirement (P=0.001) and duration (P=0.001) were reduced in THD patients. BPI showed improved pain control in THD patients on postoperative day 1, 3, 5, 7, 14. Three month follow-up showed no significant difference in FIQOL, SF-12, and constipation scores but BPI showed less pain.

CONCLUSION:

THD resulted in significantly less postoperative pain compared with FH for grade III or IV haemorrhoids.

2012

Authors: **Yap** J.R., **Ris** F., **Skala** K., **Zufferey** G., **Roche** B.
University Hospital of Geneva, Geneva, Switzerland
Source: Abstract P312 from ESCP Meeting 2012 in Wien

Title: **Is transanal hemorrhoidal dearterialization (THD) tolerated under local anesthesia?**

AIM:

THD is often performed under general anaesthesia. In our institution we perform THD under local anaesthesia as an ambulatory procedure. Our goal was to evaluate the feasibility of this procedure.

METHOD:

From 2009 to 2012, 69 consecutive patients with symptomatic 3rd degree haemorrhoids were operated by THD in the outpatient setting under perineal block. All patients were discharged 40 min after the procedure. Follow-up examinations were planned at day 5, 21 and 42. Patients were questioned regarding bleeding, pain (VAS) and tenesmus.

RESULTS:

For pain: 23 patients reported none, 23 patients had pain between 1 and 4, 5 had VAS 8-10. For bleeding: 32 had none, 28 had light drops of bleeding related to bowel movement, four patients reported bleeding teaspoon amounts lasting 3 days, one had bleeding caused by diarrhea 5 days post-op. For tenesmus: 39 had none, 21 felt a level of one out of three and five patients a level of two out of three for a duration of 1-2 days. Complications: thromboses in five patients and reprolapse in 6.

CONCLUSION:

THD appears to be a safe and well-tolerated procedure in the ambulatory setting under perineal block. Patients had few minor complications.

2012

Authors: **Avital** S., **Inbar** R., **Karin** E., **Greenberg** R.

Source: Tech Coloproctology (2012) 16:291-294

https://www.ncbi.nlm.nih.gov/pubmed/22653264

Title: **Is Doppler ultrasonography essential for hemorrhoidal artery ligation?**

BACKGROUND:

Doppler ultrasonography enables accurate identification of the terminal branches of the superior rectal artery prior to hemorrhoidal artery ligation (HAL). However, since the positions of these branches have been found to be relatively constant, the question arises as to the necessity of ultrasonography for their identification. The aim of the current study was to examine the positions of all arteries identified and ligated during the HAL procedure.

METHODS:

We recorded the position of all arteries located and ligated in 135 consecutive patients who underwent the HAL procedure during the years 2003 to 2006.

RESULTS:

In all patients, 6-8 terminal arterial branches were located above the dentate line. In 102 (76 %) patients, terminal branches were located in all 6 of the odd-numbered clock positions around the anus (1, 3, 5, 7, 9, and 11 o'clock in the lithotomy position). If we had ligated arteries only at these odd-numbered clock positions, without using Doppler ultrasonography, we would have located all the arteries in 96 (71 %) of our patients.

CONCLUSION:

The number and location of arterial branches of the superior rectal artery are relatively constant. Nevertheless, if, Doppler ultrasonography had not been performed and, ligation in the HAL procedure had been at the odd-numbered clock positions only, then at least one artery would have been missed in 29 % of our patients.

2012
Authors: **Sobrado-Junior** C.W., **Hora** W.
Source: Arq Bras Cir Dig. 2012 Oct-Dec;25(4):293-7
Available for Open Online Access

Title: **Transanal desarterialization guided by Doppler associated to anorectal repair in hemorrhoids: THD technique**

INTRODUCTION:

Surgical treatment for hemorrhoids should be indicated individually and is based on the predominant symptom (bleeding or prolapse), severity of disease and the presence or absence of external component (plicoma). Surgeons must choose among varied techniques the one suitable for each case.

TECHNIQUE:

The THD procedure consists of Doppler guided high ligation, selective to up six submucosal arterial branches that supply the hemorrhoids, leading to its desarterialization associated with prolapse repair (anorectal repair or lifting). It uses special equipment and kit.

CONCLUSION:

THD technique has shown good initial results. Because surgical technique respects the anatomy, it acts directly on the pathophysiology of the disease and corrects its principal consequences; it looks quite promising. Its initial application may be in patients with hemorrhoids grade II, which have surgical indication, grades III and IV, the latter being associated with resection of plicomas.

ABCDDV/887

ABCD Arq Bras Cir Dig
2012;25(4):293-297

Technique

TRANSANAL DESARTERIALIZATION GUIDED BY DOPPLER ASSOCIATED TO ANORECTAL REPAIR IN HEMORRHOIDS: THD TECHNIC

Desarterialização transanal guiada por doppler associada ao reparo anorretal na doença hemorroidária: a técnica do THD

Carlos Walter **SOBRADO-JUNIOR**, José Américo Bacchi **HORA**

From Discipline of Coloproctology, Faculty of Medicine, University of São Paulo, SP, Brazil.

ABSTRACT - ***Introduction*** - Surgical treatment for hemorrhoids should be indicated individually and is based on the predominant symptom (bleeding or prolapse), severity of disease and the presence or absence of external component (plicoma). Surgeons must choose among varied techniques the one suitable for each case. ***Technic*** - The THD procedure consists of Doppler guided high ligation, selective to up six submucosal arterial branches that supply the hemorrhoids, leading to its desarterialization associated with prolapse repair (anorectal repair or lifting). It uses special equipment and kit. ***Conclusion*** - THD technique has shown good initial results. Because surgical technique respects the anatomy, it acts directly on the pathophysiology of the disease and corrects its principal consequences; it looks quite promising. Its initial application may be in patients with hemorrhoids grade II, which have surgical indication, grades III and IV, the latter being associated with resection of plicomas.

HEADINGS – Surgery. Hemorrhoids. Technique

Correspondence:
Carlos Walter Sobrado Junior,
e-mail: cwsobrado@hotmail.com

Financial source: none
Conflicts of interest: none

Received for publication: 25/06/2012
Accepted for publication: 13/08/2012

RESUMO – ***Introdução*** – O tratamento cirúrgico para hemorroidas deve ter indicação individual e baseia-se no sintoma predominante (sangramento ou prolapso), na gravidade da doença e na presença ou ausência de componente externo (plicoma). Cabe ao cirurgião conhecer as mais variadas técnicas para que possa encontrar o tratamento mais adequado caso a caso. ***Técnica*** – O procedimento THD consiste na ligadura alta seletiva e guiada por Doppler de até seis ramos arteriais submucosos que irrigam as hemorroidas, levando à sua desarterialização, associada à correção do prolapso (reparo anorretal ou lifting). Utiliza equipamento e kit especiais. ***Conclusão*** - A técnica do THD tem mostrado bons resultados iniciais. Por ser técnica cirúrgica em que se respeita a anatomia, ela age diretamente sobre a fisiopatologia da afecção e corrige suas principais consequências, ela parece bastante promissora. Sua aplicação inicial pode ser nos pacientes com doença hemorroidária de II grau, que tenham indicação de tratamento cirúrgico, e de III e IV graus, nestes últimos, podendo ser associada à ressecção de plicomas.

DESCRITORES - Cirurgia. Hemorroidas. Técnica.

INTRODUCTION

The search for the optimal surgical treatment of hemorrhoidal disease dates back to historical times, currently being necessary in only 10-20% of symptomatic patients first[3]. In the last century, many techniques have been developed, but few have signed up such as those proposed by Milligan-Morgan[21], Parks[24] and Ferguson[8] , which can still be considered the gold standard in surgical treatment of this disease. In order to simplify the therapeutic process, were developed outpatient treatment modalities, such as sclerotherapy[12], variceal ligation[2], cryotherapy[19] and photocoagulation[23]. Arriving to the era of minimally invasive surgery, were created methods of mechanical anopexia[20]and, more recently, Doppler-guided

hemorrhoidal desarterialization, or THD (Transanal hemorrhoidal dearterialization) object of this text. Therapy must be instituted individually, based on predominant symptom (bleeding or prolapse), severity of disease and the presence or absence of external component (plicoma). Surgeons face themselves with varied techniques, so they can find the most suitable treatment in each case.

Anatomophysiological bases of the technique

The length of the anal canal varies from 2.5 to 4 cm above the anal verge. Inferiorly it is limited to the perianal skin, highly innervated and sensitive area. Has its epithelial lining divided by dentate line in two areas: the cranial, less sensitive to pain with visceral innervation and distal, more sensitive. The blood supply to the rectum and the anal canal is supplied by three arteries: the superior rectal artery, a branch of the inferior mesenteric artery, middle rectal artery, a branch of the internal iliac artery, and inferior rectal artery, a branch of the internal pudendal artery.The internal hemorrhoidal plexus, also called the corpus cavernosum of the rectum, appears histologically as a cavernous venous network with arteriovenous shunts, surrounded by connective tissue, within or below the rectal mucosa. This plexus receives its blood supply exclusively from the terminal branches of the superior rectal artery.

According to Aigner[1] , in healthy individuals, the mean diameter of the terminal branches of the upper rectal artery is 0.92 mm with average flow of 11.9 cm / sec and in patients suffering from hemorrhoidal diseases, both the diameter, as the flow increases, being the mean diameter of 1.87 mm with average flow of 33.9 cm / sec. Recent studies[28] , with endoanal ultrasound Doppler (360° - rotating ltrasonographic endoprobe) demonstrated that in the circumference of the wall of the distal rectum, 6 cm above the anal verge, is generally identified six arterial branches located in positions 1, 3, 5, 7, 9 and 11 hours in individuals with or without hemorrhoids. In the same study showed that in patients with hemorrhoidal disease, there is increased arterial blood flow velocity and decrease in venous resistance.

In theory, arterial blood hyperflow going to the hemorrhoids in higher speed leads to congestion and venous injury, which causes stasis, edema and prolapsed nipples. Hypertension by overflow, also contributes to the degeneration of the connective tissue. The increased force during defecation further impairs venous drainage. All this stress on connective tissue leads, with time, to degeneration and the onset of symptoms of prolapse, bleeding, discomfort, burning, mucous secretion, pain and itching.

Historical evolution

Treatment for Doppler-guided hemorrhoidal desarterialization for hemorrhoidal disease - HAL (only desarterialization) was first described in Japan in 1995 by Morinaga et al.,[22] , who reported good results in 116 patients evaluated for pain, bleeding and prolapse after a month of monitoring. A northamerican group in 2001, after operating on 60 patients, considered it an option to hemorrhoidectomy, in most cases[32]. Since then, both the technique HAL and anorectal repair equipment have been improved. Data collected from case series, increasingly bigger, and with longer follow-up have been published, mainly in Europe[6]. Currently, the technique THD (desarterialization associated to hemorrhoidopexia) have been indicated for refractory hemorrhoidal disease 2nd degree, 3rd degree and selected cases of 4th degree.

TECHNIC

The procedure consists of selective high ligation, Doppler guided, up to six submucosal arterial branches that supply the hemorrhoids, leading to its desarterialization associated with prolapse repair (anorectal repair or lifting).

Was developed a special anoscope coupled on the side of its tip to a Doppler sensor, which allows to listen to the submucosa arterial pulse sound, locating the artery. After soft digital examination with anesthetic gel or lubricant, anoscope is introduced. By means of the sound, the arterial branches are identified with great precision and its ligature is made with absorbable 00 (polyglycolic acid) to approximately 6 cm above the dentate line, through a side window on the instrument. This initial desarterialization already reduces the engorgement of the hemorrhoidal tissue, facilitating its reduction, suspension and fixation (Figure 1).

Later, there will be a simple continuous running suture with the same thread in craniocaudal direction to place about 1.0 cm above the dentate line, which tied after the starting point, lead to pexia of mucosal tissue prolapsed, which return to their anatomical position. At this stage, it must avoided deep sutures involving the anal sphincter, because hinder lifting of prolapsed tissue, and also increase postoperative pain. This procedure should be conducted in six arterial branches located in positions 1, 3, 5, 7, 9 and 11 hours. Finally, hemostasis is reviewed and a dressing is positioned with the introduction of a hemostat, as part of kit THD (Figures 2 and 3).

So, the interruption of blood flow is added to the mucosal pexia and hemorrhoids, directing

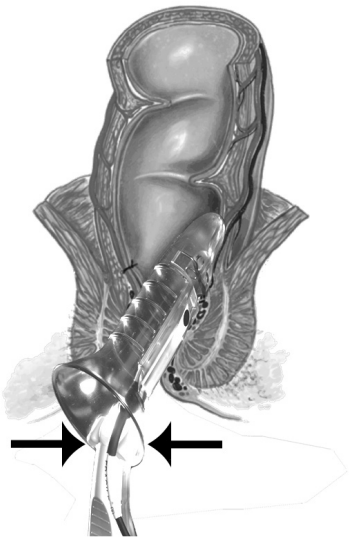
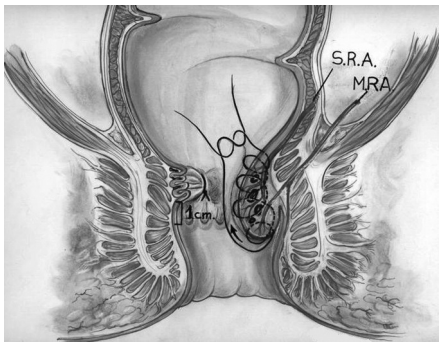


FIGURE 1 - Location of the arterial pulse by Doppler to perform the initial suture. (Source: Carlo Ratto)



SRA = superior rectal artery. MRA = middle rectal artery

FIGURE 2 - Representation of the end of the running suture for anorectal repair (lifting or hemorrhoidopexia). (Source: Carlo Ratto)

FIGURE 3 - Schematic view of the final aspect of the anorectal repair (hemorrhoidopexia) and hemorrhoidal desarterialization. (Source: http://www.thdlab.com.br/tratamentos/1/curar-hemorroidas.html)

treatment to the resolution of the two main symptoms of hemorrhoids: bleeding and prolapse. Because there is no tissue resection and the entire procedure take place above the dentate line, is expected to reduce postoperative pain, compared to hemorrhoidectomy procedures. Antibiotics are used as prophylaxis routine (Figures 4 and 5).

FIGURE 4 - Preoperative appearance

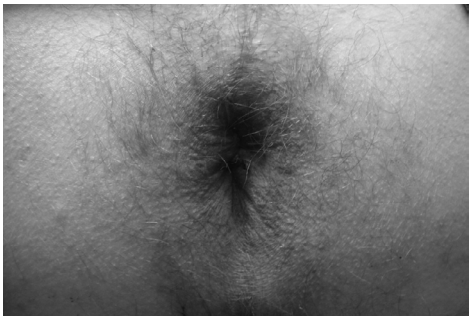


FIGURE 5 - Postoperative appearance after the THD technic

Commercial fibers (plantago ovata, psillium, methylcellulose) are prescribed routinely and, as analgesics, dipyrone and antiinflammatories (ketoprofen). All patients were examined weekly for four weeks, when they are questioned about pain, stool frequency, stool appearance, bleeding, satisfaction with the procedure and return to work.

DISCUSSION

In 2009, in a review of 1996 cases published in the literature, it was concluded that the treatment is safe for hemorrhoids grades II and III, and that further studies about its efficacy are necessary in more advanced cases and in longer follow-up. In 2011, a French group, in an uncontrolled study with 100 patients with grade IV hemorrhoids, obtained good results with median follow-up of 34 months 16. In the same year, Ratto et al. published the results of the procedure in 35 consecutive patients

with more advanced hemorrhoidal disease, obtaining similar data[29], which suggests that the technique has potential use for the majority of cases with surgical indication[28,29,30,33]. Since then, initial experiments in several countries[5,13,25,27,34], have been published, with good results, the procedure being isolated or associated with other techniques. Brazil has gaining adherents in recent years, measured by conferences, presentations and publications on initial experience[16,31]; it showed good results and low complication rates at two years follow-up.

Were found six publications of comparative studies using hemorrhoidal desarterialization. Four of them were comparing it to the mechanic anopexia, showing similar results in the medium term, with one of them observing a lower incidence of early complications and faster return to work for groups of desarterialization[10], and other two, slight reduction of pain in the early postoperative[9,17]. A Chinese desarterialization group of patients has been very favorable for the early complications and postoperatively pain[26]. In comparative paper with closed hemorrhoidectomy and TDH technique, showed less pain and earlier recovery, with similar results in a year[4]. Indian study found no differences between simple desarterialization and Doppler-guided ligation of hemorrhoids within one year of follow-up[14]. Egyptian study already showed that hemorrhoidectomy is superior to PPH and to desarterialization in advanced cases, where there anal plicomas, and is similar in the other aspects[15].

CONCLUSIONS

The THD technique has shown good initial results. It respects the anatomy, acts directly on the pathophysiology of the disease and corrects its principal consequences. So, THD seems quite promising. Its initial application may be in patients with second-degree hemorrhoids, with surgical indication, and also in grades III and IV, the latter associated with plicomas resection

REFERENCES

1. Aigner F, Bodner G, Conrad F, Mbaka G, Kreczy A, Fritsch H. The superior rectal artery and its branching pattern with regard to its clinical influence on ligation techniques for internal hemorrhoids. Am J Surg. 2004 Jan;187(1):102-8.
2. Barron J. Office ligation of internal hemorrhoids. Am J Surg. 1963 Apr;105:563-70.
3. Bleday R, Pena JP, Rothenberger DA, Goldberg SM, Buls JG. Symptomatic hemorrhoids: current incidence and complications of operative therapy. Dis Colon Rectum. 1992 May;35(5):477-81.
4. Bursics A, Morvay K, Kupcsulik P, Flautner L. Comparison of early and 1-year follow-up results of conventional hemorrhoidectomy and hemorrhoid artery ligation: a randomized study. Int J Colorectal Dis. 2004 Mar;19(2):176-80.
5. Charúa Guindic L, Fonseca Muñoz E, García Pérez NJ, Osorio Hernández RM, Navarrete Cruces T, Avendaño Espinosa O, Guerra Melgar LR. Hemorrhoidal desarterialization guided by Doppler. A surgical alternative in hemorrhoidal disease management. Rev Gastroenterol Mex. 2004 Apr-Jun;69(2):83-7.
6. Faucheron JL, Gangner Y. Doppler-guided hemorrhoidal artery ligation for the treatment of symptomatic hemorrhoids: early and three-year follow-up results in 100 consecutive patients. Dis Colon Rectum. 2008 Jun;51(6):945-9.
7. Faucheron JL, Poncet G, Voirin D, Badic B, Gangner Y. Doppler-guided hemorrhoidal artery ligation and rectoanal repair (HAL-RAR) for the treatment of grade IV hemorrhoids: long-term results in 100 consecutive patients. Dis Colon Rectum. 2011 Feb;54(2):226-31.
8. Ferguson JA, Mazier WP, Ganchrow MI, Friend WG. The closed technique of hemorrhoidectomy. Surgery. 1971 Sep;70(3):480-4.
9. Festen S, van Hoogstraten MJ, van Geloven AA, Gerhards MF. Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results. Int J Colorectal Dis. 2009 Dec;24(12):1401-5.
10. Giordano P, Nastro P, Davies A, Gravante G. Prospective evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: three-year outcomes. Tech Coloproctol. 2011 Mar;15(1):67-73.
11. Giordano P, Overton J, Madeddu F, Zaman S, Gravante G. Transanal hemorrhoidal dearterialization: a systematic review. Dis Colon Rectum. 2009 Sep;52(9):1665-71.
12. Graham-Stewart CW. Injection treatment of haemorrhoids. Br Med J. 1962 Jan 27;1(5273):213-6.
13. Greenberg R, Karin E, Avital S, Skornick Y, Werbin N. First 100 cases with Doppler-guided hemorrhoidal artery ligation. Dis Colon Rectum. 2006 Apr;49(4):485-9
14. Gupta PJ, Kalaskar S, Taori S, Heda PS. Doppler-guided hemorrhoidal artery ligation does not offer any advantage over suture ligation of grade 3 symptomatic hemorrhoids. Tech Coloproctol. 2011 Dec;15(4):439-44.
15. Hafagy W, El Nakeeb A, Fouda E, Omar W, Elhak NG, Farid M, Elshobaky M. Conventional haemorrhoidectomy, stapled haemorrhoidectomy, Doppler guided haemorrhoidectomy artery ligation; post-operative pain and anorectal manometric assessment. Hepatogastroenterology. 2009 Jul-Aug;56(93):1010-5.
16. Hora, JAB; Klajner, S; Kruglensky, D; Sobrado Jr, CW. Tratamento Cirúrgico da Doença Hemorroidária por Desarterialização Transanal Guiada por Doppler associada ao Reparo Anorretal (A Técnica do THD): Experiência Inicial. 1º Congresso Paulista de Coloproctologia. São Paulo 8 e 9 de junho de 2012.
17. Infantino A, Altomare DF, Bottini C, Bonanno M, Mancini S. Prospective randomized multicentre study comparing stapler haemorrhoidopexy with Doppler-guided transanal haemorrhoid dearterialization for third-degree haemorrhoids. Colorectal Dis. 2012 Feb;14(2):205-211.
18. Jeong WJ, Cho SW, Noh KT, Chung SS. One Year Follow-up Result of Doppler-guided Hemorrhoidal Artery Ligation and Recto-Anal Repair in 97 Consecutive Patients. J Korean Soc Coloproctol. 2011 Dec;27(6):298-302.
19. Lewis MI. Diverse methods of managing hemorrhoids: cryohemorrhoidectomy. Dis Colon Rectum. 1973 May-Jun;16(3):175-7. Neiger A (1989) Infrared-photo-coagulation for hemorrhoids treatment. Int Surg 74:142–143
20. Longo A. Treatment of haemorrhoids disease by reduction of mucosa and haemorrhoidal prolapse with a circular suturing device: a new procedure. Proceedings of the Sixth World Congress of Endoscopic Surgery. Monduzzi, 1998;777–84.
21. Milligan ETC, Morgan C, Naughton JLF, Office RR. Surgical anatomy of the anal canal and the operative treatment of haemorrhoids. Lancet 1937; II:1119–24
22. Morinaga K, Hasuda K, Ikeda T. A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. Am J Gastroenterol. 1995 Apr;90(4):610-3.

23. Neiger A. Infrared-photo-coagulation for hemorrhoids treatment. Int Surg. 1989 Jul-Sep;74(3):142-3.
24. Parks AG. The surgical treatment of haemorrhoids. Br J Surg. 1956 Jan;43(180):337-51.
25. Pol RA, van der Zwet WC, Hoornenborg D, Makkinga B, Kaijser M, Eeftinck Schattenkerk M, Eddes EH. Results of 244 consecutive patients with hemorrhoids treated with Doppler-guided hemorrhoidal artery ligation. Dig Surg. 2010;27(4):279-84.
26. Qin PP, Huang B, Cai HJ, Ge Q, Wang ZL. A prospective controlled comparative study of Doppler-guided hemorrhoidal artery ligation versus operative procedures for prolapse and hemorrhoids. Zhonghua Yi Xue Za Zhi. 2010 Nov 30;90(44):3131-4.
27. Ramírez JM, Aguilella V, Elía M, Gracia JA, Martínez M. Doppler-guided hemorrhoidal artery ligation in the management of symptomatic hemorrhoids. Rev Esp Enferm Dig. 2005 Feb;97(2):97-103.
28. Ratto C, Donisi L, Parello A, Litta F, Doglietto GB. Evaluation of transanal hemorrhoidal dearterialization as a minimally invasive therapeutic approach to hemorrhoids. Dis Colon Rectum. 2010 May;53(5):803-11.
29. Ratto C, Giordano P, Donisi L, Parello A, Litta F, Doglietto GB. Transanal haemorrhoidal dearterialization (THD) for selected fourth-degree haemorrhoids. Tech Coloproctol. 2011 Jun;15(2):191-7.
30. Scheyer M. Doppler-guided recto-anal repair: a new minimally invasive treatment of hemorrhoidal disease of all grades according to Scheyer and Arnold. Gastroenterol Clin Biol. 2008 Jun-Jul;32(6-7):664
31. Sobrado Jr CW, Hora JAB. Tratamento Cirúrgico da Doença Hemorroidária por Desarterialização Transanal Guiada por Doppler associada ao Reparo Anorretal: A Técnica do THD. Atualização em Cirurgia do Aparelho Digestivo e em Coloproctologia – São Paulo: Departamento de Gastroenterologia da Faculdade de Mediccina da USP, 2012. Jul 2012: 319-326.
32. Sohn N, Aronoff JS, Cohen FS, Weinstein MA. Transanal hemorrhoidal dearterialization is an alternative to operative hemorrhoidectomy. Am J Surg. 2001 Nov;182(5):515-9.
33. Testa A, Torino G, Gioia A. DG-RAR (Doppler-guided recto-anal repair): a new mini invasive technique in the treatment of prolapsed hemorrhoids (grade III-IV): preliminary report. Int Surg. 2010 Jul-Sep;95(3):265-9.
34. Toh EL, Ng KH, Eu KW. The fourth branch of the superior rectal artery and its significance in transanal haemorrhoidal dearterialisation. Tech Coloproctol. 2010 Dec;14(4):345-8.

2011
Authors: Giordano P.
Source: Tech Coloproctol (2011) 15: 257-258
Title: Outcome of stapled haemorrhoidopexy versus doppler-guided haemorrhoidal artery ligation for grade III haemorrhoids (Editorial)

Tech Coloproctol (2011) 15:257–258
DOI 10.1007/s10151-011-0723-3

EDITORIAL

Outcome of stapled haemorrhoidopexy versus doppler-guided haemorrhoidal artery ligation for grade III haemorrhoids

P. Giordano

Received: 5 July 2011 / Accepted: 7 July 2011 / Published online: 29 July 2011

Currently, multiple operations are available for the treatment of symptomatic haemorrhoids, and no method is universally accepted as superior to the others. The operative approach is often tailored to the individual patient depending on the surgeon's preference and experience. Ideally, the surgical procedure for the treatment of haemorrhoids should be a technique able to provide long-term relief of symptoms whilst being economical, safe, easy to perform and well tolerated by patients. In recent years, we have seen a shift towards less invasive procedures mostly aimed at avoiding or minimizing postoperative pain. New techniques such as stapled haemorrhoidopexy (SH) and doppler-guided haemorrhoidal artery ligation (DGHAL) also known as transanal haemorrhoidal artery ligation (THD) have now become widely accepted for the treatment of symptomatic haemorrhoids. Both SH and DGHAL have the advantage of not leaving wounds in the anal canal which improves convalescence by reducing postoperative discomfort. The expected reduction in postoperative pain makes these procedures appealing to the patients, and indeed, their short-term benefits compared to conventional surgery have been clearly demonstrated in prospective comparative trials and/or observational studies [1–3]. However, the real innovation introduced by these procedures is the fact that they aim to treat the symptoms whilst not excising the diseased tissue, as in conventional haemorrhoidectomy (CH), but by restoring the normal anatomy and correcting the physiology of the haemorrhoidal plexus. This means that the long-term benefits are potentially by far more important than the short-term ones. With that in mind, the question is whether they actually work and whether any of these new modalities of treatment is superior to the other. In this issue of techniques in coloproctology, Avital et al. [4] showed that pain is significantly lower in the DGHAL group during the first 24 h, at the time of the first bowel movement, and at 1 week after the operation. However, in this study, a mucopexy in association with the DGHAL was never performed. It could be argued that performing a plication of the rectal mucosa may improve outcomes but may also lead to more postoperative pain. Two different prospective trials comparing SH to THD with rectal mucopexy as standard have shown less pain and earlier recovery following the THD procedure [5, 6]. However, reduced postoperative pain although important is not a measure of success for which safety and effectiveness remain the main benchmarks. To date, there are only a very few other studies comparing the two techniques directly and only one reporting results at a relatively long follow-up. Based on the evidence available from comparative studies, these procedures have demonstrated to be equally effective. In Avital et al.'s [4] study, 18% of patients in the DGHAL group suffered from ongoing haemorrhoidal symptoms whilst only 3% of the patients in the SH group did. This reflected in a higher number of patients requiring further intervention in the DGHAL group. However, once again it could be argued that the patients in the DGHAL group did not receive any mucopexy and this may have certainly influenced the outcome. Indeed, in the prospective trials where rectal mucopexy was used as a standard part of the THD procedure, the improvement of symptoms was similar in both groups [5, 6]. In the few comparative studies available, one major complication was reported following SH whilst none were encountered in the DGHAL patients [6]. Outside these studies, a significant number of major complications

P. Giordano (✉)
Department of Colorectal Surgery, Whipps Cross University Hospital, Whipps Cross Road, London E11 1NR, UK
e-mail: pasquale.giordano@whippsx.nhs.uk

have been described following SH [7]. On the contrary, no major problems have ever been reported following DGHAL/THD. It is unlikely that this difference can be explained by the fact that SH gained popularity earlier than DGHAL, and the literature on SH is by far more extensive than that on the other technique. Giving a definite explanation of why major complications may occur following SH is impossible; however, it is possible that the "blind" excision of part of the rectal wall performed with this technique is somehow related to the complications. The fact that THD is a non-excisional technique should virtually eliminate the possibility of major problems being associated with it.

A recent meta-analysis of long-term outcomes of SH versus CH demonstrated a significantly higher overall rate of prolapse recurrence in the SH group [8]. The difference was even more significant in the subset of patients with III and IV degree haemorrhoids. We currently do not have enough data on long-term outcomes for DGHAL/THD and therefore we do not know at this stage whether the encouraging early results obtained using this technique will be maintained over time. Large multicentre trials are expected to better define the role of these new procedures.

There is no doubt that SH and DGHAL/THD have been able to capture the interest of surgeons; we now have to see whether they will able to stand the test of time.

Conflict of interest Mr. Pasquale Giordano is a trainer in the THD technique.

References

1. Nisar PJ, Acheson AG, Neal KR, Scholefield JH (2004) Stapled hemorrhoidopexy compared with conventional hemorrhoidectomy: systematic review of randomized, controlled trials. Dis Colon Rectum 47:1837–1845
2. Bursics A, Morvay K, Kupcsulik P, Flautner L (2004) Comparison of early and 1-year follow-up results of conventional hemorrhoidectomy and hemorrhoid artery ligation: a randomized study. Int J Colorectal Dis 19:176–180
3. Khafagy W, El Nakeeb A, Fouda E et al (2009) Conventional haemorrhoidectomy, stapled haemorrhoidectomy, doppler guided haemorrhoidectomy artery ligation; post operative pain and anorectal manometric assessment. Hepatogastroenterology 56:1010–1015
4. Avital S, Itah R, Skornick Y, Greenberg R (2011) Outcome of stapled hemorrhoidopexy versus doppler-guided hemorrhoidal artery ligation for grade III haemorrhoids. Tech Coloproctol 15. doi:10.1007/s10151-011-0699-z
5. Festen S, van Hoogstraten MJ, van Geloven AA, Gerhards MF (2009) Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomised trial on postoperative complication and short-term results. Int J Colorectal Dis 24:1401–1405
6. Giordano P, Nastro P, Davies A, Gravante G (2011) Prospective evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: 3-year outcomes. Tech Coloproctol 15:67–73
7. Pescatori M, Gagliardi G (2008) Postoperative complications after procedure for prolapsed hemorrhoids (PPH) and stapled transanal rectal resection (STARR) procedures. Tech Coloproctol 12:7–19
8. Giordano P, Gravante G, Sorge R, Ovens L, Nastro P (2009) Long-term outcomes of stapled hemorrhoidopexy versus conventional hemorrhoidectomy: a meta-analysis of randomized controlled trials. Arch Surg 144:266–272

2011

Authors: **Cudazzo** E., **De Cesare** C., **Faraci** R., **Bianchi** M., **Mariani** L.

Source: Il Giornale di Chirurgia (Journal of Surgery), volume 32-n. 1/2 pag. 17-22 January/February 2011

https://www.giornalechirurgia.it/materiale_cic/531_XXXII_1-2/4628_dearterializzazione/index.html

Title: **Dearterializzazione emorroidaria transanale Doppler-guidata: contributo casistico**

La ricerca di procedure innovative, in grado di associare la possibilità di cura della patologia emorroidaria con caratteristiche di "minivasività", continua a destare crescente interesse.

Il presente lavoro riporta i risultati ottenuti nel corso della nostra esperienza sul trattamento della patologia emorroidaria con tecnica di de arterializzazione transanale Doppler-guidata, tecnica perfezionata dal 2005 ad oggi su una casistica di 408 pazienti.

Sono stati valutati, in un follow-up a breve termine, il grado di soddisfazione, il dolore post-operatorio, il tempo di recupero della normale vita lavorativa e l'incidenza di complicanze precoci e tardive nei pazienti sottoposti a questo trattamento.

I risultati ottenuti incoraggiano l'uso della metodica che si presenta come una tecnica sicura, di rapida esecuzione, poco dolorosa e caratterizzata da una scarsa incidenza di complicanze post-operatorie.

2011

Authors: **Infantino** A., **Altomare** D. F., **Bottini** C., **Bonanno** M., **Mancini** S. and the **THD group of the SICCR** (Italian Society of Colorectal Surgery)

Source: Colorectal Disease. Article accepted on 17th January 2011
https://www.ncbi.nlm.nih.gov/pubmed/21689317

Title: **Prospective randomised multicenter study comparing Stapler Haemorrhoidopexy (SH) with Doppler guided Transanal Haemorrhoid Dearterialization (THD) for III degree haemorrhoids**

AIM:

Doppler guided Transanal Haemorrhoid Dearterialization (THD) and Stapler Haemorrhoidopexy (SH) have been demonstrated to be less painful than Milligan-Morgan.

The aim of this study was to compare the effectiveness of THD vs SH in the treatment of III degree haemorrhoids in an equivalent trial.

METHOD:

169 patients with III degree haemorrhoids were randomised on-line to receive THD (85) or SH (84) in 10 colorectal units well-trained in both techniques. The mean follow up period was 17 months (range 15-20 months).

RESULTS:

Early minor postoperative complications occurred in 30.6% in the THD group and 32.1% in the SH group. There was a less intensive pain in THD group in the first postoperative week for spontaneous pain and pain on defecation but this was not statistically significant. Late complications were significantly higher (P=0.028) in the SH group. In THD and SH group residual haemorrhoids persisted in 12 and 6 patients (P=0.14). Six patients in the SH group and 10 in the THD group underwent further treatment of haemorrhoids (P=0.34). No differences were found in postoperative incontinence. The ODS score was significantly higher in the SH group ($p<0.02$). QoL improved in both groups equally. Postoperative in hospital stay was 1,14 in THD and 1,31 days in SH group ($p=0.03$)

CONCLUSIONS:

Both techniques are effective for III degree haemorrhoids in the medium term. THD has a better cost/effective ratio and low (not significant) compared with SH. Postoperative pain and recurrence did not differ significantly between the two groups.

2009

Authors: **Infantino** A., **Bellomo** R., **Dal Monte** PP., **Salafia** C., **Tagariello** C., **Ionizzo** CA., **Spazzafumo** L., **Romano** G., **Altomare** DF.

Source: Published Online 15 April 2009. Colorectal Dis. 2010 Aug; 12(8):804-9

https://www.ncbi.nlm.nih.gov/pubmed/19508513

Title: **Transanal Haemorrhoidal Artery Echodoppler Ligation and anopexy (THD) is effective for II and III degree haemorrhoids: a prospective multicentric study**

INTRODUCTION:

We report a multicentric prospective study which aimed to evaluate Doppler-assisted ligation of the terminal haemorrhoidal arteries (THD) for II and III degree haemorrhoids.

METHODS:

112 patients from five colorectal units, including 81 males, mean age 48±13 years, with II degree (39) and III degree (73) haemorrhoids, were treated by Doppler-guided transanal de-arterialization and anopexy using a new device (THD).

RESULTS:

The mean operative time was 33.9±8.8 minutes, and the mean number of ligatures applied was 7.2±1.5. Postoperatively 72% of patients did not need analgesics and the other 28% used non-steroidal anti-inflammatory drugs 1-3 times/day for less than 2 days. All the patients were operated as a day case. Early post-operative complications included haemorrhoidal thrombosis (2 patients), bleeding (1) treated by haemostatic suture, dysuria (6), and acute urinary retention (1). After a mean follow-up of 15.6±6.5 months (range 6-32), 2/105 (20.9%) patients complained of minor bleeding, while mild pain was still present in 4/51 (7.8%). There were no statistically significant differences in the sample population regarding gender or stage of the disease. Tenesmus was cured in 15/17, dyschaezia in 20/22 patients and mucous soiling in 10/10 patients. No new cases of altered defaecation or faecal incontinence were recorded. Overall 85.7% of patients were cured and 7.1% improved. Residual haemorrhoids were treated by elastic band ligation in 9 (8%) patients and by surgical excision in a further 5 (4.5%).

CONCLUSION:

Doppler-assisted ligation of the terminal branches of the haemorrhoidal arteries for II and III degree haemorrhoids is highly effective and painless. Complications are few and the technique can be performed as a day case.

2008

Authors: **Cantero** R., **Balibrea** JM., **Ferrigni** C., **Sanz** M., **García Pérez** JC., **Pérez** R., **Luffiego** A., **Forero** RG., **Balibrea** JL.

Source: Cir Esp. 2008 May;83(5):252-5

Available for Open Online Access

Title: **Desarterialización hemorroidal transanal guiada por Doppler. Una alternativa en el tratamiento de las hemorroides**

INTRODUCCIÓN:

La frecuencia de la enfermedad hemorroidal y el deterioro de la calidad de vida durante el postoperatorio inmediato ha hecho que aparezcan nuevas técnicas para lograr una mayor satisfacción de los pacientes.

PACIENTES Y MÉTODO:

Se realizó un estudio prospectivo en que, desde octubre de 2005 a septiembre de 2006, se intervino de forma consecutiva a 50 pacientes con diagnóstico de hemorroides de grado III de Goligher. Para la realización de la desarterialización hemorroidal se utilizó un dispositivo denominado THD, la técnica consiste en la reducción del flujo arterial hemorroidal, mediante ligadura de ramas terminales de la arteria hemorroidal superior por encima de la línea dentada, comenzando en posición anterior y seguimos según las agujas del reloj: 1, 3, 5, 7, 9, 11. El seguimiento se realiza a la semana, al mes, 3 y 6 meses y 1 año.

RESULTADOS:

Hemos intervenido a 50 pacientes de forma consecutiva con diagnóstico de hemorroides de grado III. La media de edad fue de 45 (intervalo, 25-78) años. La indicación de cirugía fue dolor-incomodidad en 40 (80%); sangrado en 35 (70%), y prolapso en 6 (12%). El procedimiento siempre fue realizado bajo anestesia locorregional. La duración media del procedimiento fue de 25 (intervalo, 20-35) min. El 90% de los pacientes precisó de analgesia durante las primeras 24 h, que disminuyó hasta un 15% los que la mantuvieron hasta el tercer día y sólo en 2 (4%) pacientes se mantuvo durante una semana. El dolor se resolvió a las 48 h de la cirugía en todos los pacientes que consultaron por este motivo, salvo en 1 (2,5%) paciente que presentó recidiva tanto del dolor como de su prolapso. Esto permitió que los pacientes se incorporasen a su vida cotidiana en 48-72 h.

CONCLUSIONES:

A la espera de estudios aleatorizados, podemos decir que en nuestra experiencia la desarterialización hemorroidal transanal guiada por Doppler es una técnica que se debe ofrecer al paciente con afección hemorroidal.

Localizador web
Artículo 212.498

Desarterialización hemorroidal transanal guiada por Doppler. Una alternativa en el tratamiento de las hemorroides

Ramón Cantero, José María Balibrea, Carlos Ferrigni, Manuel Sanz, Juan Carlos García Pérez, Rosa Pérez, Ángela Luffiego, Raimundo G. Forero y José Luis Balibrea
Departamento de Cirugía. Universidad Complutense. Hospital Clínico Universitario San Carlos. Madrid. España.

Resumen

Introducción. **La frecuencia de la enfermedad hemorroidal y el deterioro de la calidad de vida durante el postoperatorio inmediato ha hecho que aparezcan nuevas técnicas para lograr una mayor satisfacción de los pacientes.**

Pacientes y método. **Se realizó un estudio prospectivo en que, desde octubre de 2005 a septiembre de 2006, se intervino de forma consecutiva a 50 pacientes con diagnóstico de hemorroides de grado III de Goligher. Para la realización de la desarterialización hemorroidal se utilizó un dispositivo denominado THD^{R} (diseñado por TKC SRL y distribuido por Palex Medical), la técnica consiste en la reducción del flujo arterial hemorroidal, mediante ligadura de ramas terminales de la arteria hemorroidal superior por encima de la línea dentada, comenzando en posición anterior y seguimos según las agujas del reloj: 1, 3, 5, 7, 9, 11. El seguimiento se realiza a la semana, al mes, 3 y 6 meses y 1 año.**

Resultados. **Hemos intervenido a 50 pacientes de forma consecutiva con diagnóstico de hemorroides de grado III. La media de edad fue de 45 (intervalo, 25-78) años. La indicación de cirugía fue dolor-incomodidad en 40 (80%); sangrado en 35 (70%), y prolapso en 6 (12%). El procedimiento siempre fue realizado bajo anestesia locorregional. La duración media del procedimiento fue de 25 (intervalo, 20-35) min. El 90% de los pacientes precisó de analgesia durante las primeras 24 h, que disminuyó hasta un 15% los que la mantuvieron hasta el tercer día y sólo en 2 (4%) pacientes se mantuvo durante una semana. El dolor se resolvió a las 48 h de la cirugía en todos los pacientes que consultaron por este motivo, salvo en 1 (2,5%) paciente que presentó recidiva tanto del dolor como de su prolapso. Esto permitió que los pacientes se incorporasen a su vida cotidiana en 48-72 h.**

Conclusiones. **A la espera de estudios aleatorizados, podemos decir que en nuestra experiencia la desarterialización hemorroidal transanal guiada por Doppler es una técnica que se debe ofrecer al paciente con afección hemorroidal.**

Palabras clave: *Desarterialización. Hemorroides. Doppler.*

DOPPLER-GUIDED TRANSANAL HAEMORRHOIDAL DEARTERIALISATION. AN ALTERNATIVE TREATMENT FOR HAEMORRHOIDS

Introduction. **The frequency of haemorrhoid disease and the deterioration in the quality of life in the immediate post-operative period has led to the appearance of new techniques in an attempt to obtain improve patient satisfaction.**

Patients and method. **A prospective study was carried out in which 50 consecutive patients with a diagnosis of Goligher grade III haemorrhoids were intervened. To perform the haemorrhoid dearterialisation, a device called THD^{R} was used (designed by TKC SRL and distributed by Palex Medical). The technique consisted of, a reduction in arterial flow using ligation of the terminal branches above the anorectal ring, starting in the anterior position, it was carried out in a clockwise direction: 1, 3, 5, 7, 9, 11. Follow up was carried out at one week, 1 month, 3 months, 6 months and 1 year.**

Results. **We intervened 50 consecutive patients with a diagnosis of grade III haemorrhoids. The mean age was 45 years (range, 25-78). The surgical indication was, pain-discomfort, 40 (80%); bleeding, 35 (70%), prolapse 6 (12%). The procedure was always performed under local/regional anaesthesia. The mean duration of the procedure was 25 minutes (range, 20-35). Analgesia was required by 90% of the patients during the first 24 hours, decreasing to 15% for those who continued to require it until the third day and only 2 (4%) patients continued for one**

Correspondencia: Dr. R. Cantero Cid.
Departamento de Cirugía. Hospital Clínico San Carlos.
Martín Lagos, s/n. 28040 Madrid. España.
Correo electrónico: rcanteroc@medynet.com

Manuscrito recibido el 11-6-2007 y aceptado el 28-1-2008.

week. Pain was resolved 48 hours after surgery, in all patients who consulted for this reason, except for one patient (2.5%) who had a recurrence in the pain as well as in his prolapse. This meant that patients could re-start their daily living within 48-72 hours.

Conclusions. **Pending for randomised studies, we can say that in our experience, Doppler guided transanal haemorrhoidal dearterialisation is a technique that should be offered to the patient with haemorrhoidal disease.**

Key words:

Introducción

La introducción de múltiples procedimientos para el tratamiento de la afección hemorroidal no hace sino demostrar que, aún hoy en día, no se dispone de una técnica que se caracterice por presentar pocas complicaciones y, sobre todo, escaso dolor postoperatorio. Además, debemos considerar que en algunos pacientes (con alteración esfinteriana, inmunodeprimidos graves) no debemos utilizar la hemorroidectomía convencional.

En 1995, Morinaga et al[1] introdujeron una alternativa a la hemorroidectomía convencional, basada en la ligadura de las ramas terminales de la arteria hemorroidal superior. De este modo, se reduce el flujo sanguíneo al plexo hemorroidal y el volumen de las hemorroides, con lo que se consigue la mejoría de los síntomas.

Este trabajo ha sido diseñado para probar la eficacia de la desarterialización hemorroidal transanal guiada por Doppler, valorando los resultados quirúrgicos, el dolor postoperatorio y la recuperación funcional.

Pacientes y método

Desde octubre de 2005 a septiembre de 2006 se intervino, de forma consecutiva, a 50 pacientes con diagnóstico de hemorroides de grado III de Goligher. Analizamos de forma prospectiva cuatro parámetros: recurrencia de sintomatología, dolor postoperatorio, incidencia de complicaciones y grado de satisfacción durante el seguimiento.

Al realizar la historia clínica de los pacientes se hizo especial hincapié en resaltar afección anorrectal concomitante, tratamientos previos y la sintomatología previa. Ninguno de los pacientes de esta serie fue tratado con otro tipo de procedimiento invasivo para afección hemorroidal, ni presentaba enfermedad anal concomitante.

Técnica quirúrgica

Para realizar la desarterialización hemorroidal se utilizó un dispositivo denominado THD® (diseñado por TKC SRL y distribuido por Palex Medical), equipado con un transductor Doppler (para localizar las ramas terminales de la arteria hemorroidal superior) y una fuente de luz que se introducen en un proctoscopio desechable, que presenta una ventana donde se acopla el portaagujas para ligar las ramas arteriales; la penetración de la aguja es de 6 mm. El procedimiento se realiza en posición de litotomía bajo anestesia locorregional ("técnica en silla de montar").

La técnica consiste en la reducción del flujo arterial hemorroidal, mediante ligadura de ramas terminales de la arteria hemorroidal superior por encima de la línea dentada, con el consiguiente colapso de las hemorroides y disminución de la tensión (permite la regeneración de tejido conectivo dentro del cojinete y facilita el anclaje de la hemorroide), e induce la reducción permanente del prolapso. La sutura usada para ligar la rama arterial sirve también para realizar una pexia en la mucosa rectal, elevando el cojinete hemorroidal por encima de la línea dentada (fig. 1).

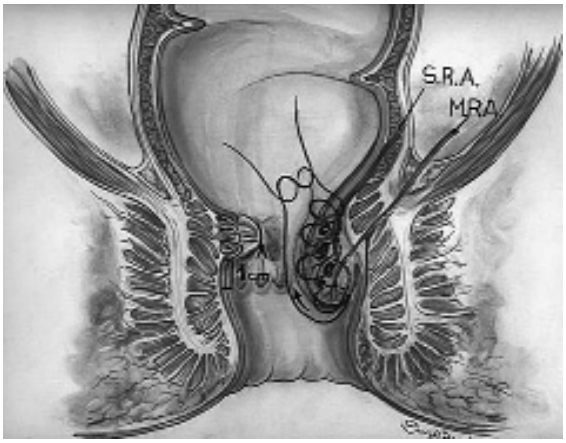


Fig. 1. Sutura de rama terminal de la arteria hemorroidal superior y realización de la pexia rectal. M.R.A.: arteria rectal media; S.R.A.: arteria rectal superior. Reproducida con permiso de G.F. Medical Division (www.thd.it).

Se introduce el proctoscopio; se sitúa la sonda Doppler a 1-2 cm de la línea pectínea. Siempre comenzamos en la posición anterior y seguimos según las agujas del reloj: 1, 3, 5, 7, 9, 11. A través de la ventana del proctoscopio se dan de 6 a 8 puntos (ácido poliglucólico 2/0 con aguja 5/8), uno por cada rama arterial detectada con la sonda Doppler. Una vez realizado, se comprueba de nuevo con la sonda Doppler que no haya señal distal a la ligadura arterial.

Si es preciso reparar el componente de prolapso hemorroidal, se dan de 3 a 6 puntos en cada sutura para conseguir de este modo la plicatura de la mucosa y la submucosa.

Se da de alta a los pacientes dentro de un ámbito de cirugía ambulatoria (3-4 h tras la cirugía) y se los instruye para valorar su dolor postoperatorio durante la primera semana, mediante una escala visual analógica. El seguimiento se realiza a la semana, 1 mes, 3 meses, 6 meses y 1 año.

Resultados

Hemos intervenido a 50 pacientes (19 [38%] mujeres y 31 [62%] varones) de forma consecutiva con diagnóstico de hemorroides de grado III. La media de edad fue de 45 (intervalo, 25-78) años.

La indicación de cirugía fue: dolor-incomodidad, 40 (80%); sangrado, 35 (70%), prolapso, 6 (12%). Ninguno de los pacientes había sido tratado de forma invasiva por su enfermedad hemorroidal. De los 35 pacientes que consultaron por rectorragia, 12 refirieron en su historia clínica ingesta de anticoagulantes orales por cardiopatía isquémica y/o valvulopatía cardíaca.

El procedimiento siempre se realizó con anestesia locorregional (técnica "en silla de montar"). La duración media del procedimiento fue de 25 (intervalo, 20-35) min.

En todos los pacientes se aplicó un protocolo de analgesia, si era necesario, con ketorolaco 10 mg vía oral. El 90% de los pacientes precisó de analgesia durante las primeras 24 h, que disminuyó hasta un 15% en los que la mantuvieron hasta el tercer día y sólo en 2 (4%) pacientes se mantuvo durante una semana; estos 2 pacientes, diagnosticados de fisura anal aguda y nódulo hemorroidal, fueron tratados médicamente con resultado satisfactorio.

TABLA 1. **Resultados técnicos y escala de dolor postoperatorio (50 pacientes con grado III)**

Tiempo quirúrgico (media)	25 min
Ramas ligadas (n)	6,5
Dolor día 1 postoperatorio	1,5 (0-3)
Dolor día 7 postoperatorio	0 (0-1,2)

TABLA 2. **Resolución de síntomas preoperatorios**

Síntoma	Pacientes	Resueltos	Mejoría
Dolor	40 (80%)	39 (97,5%)	1 (2,5%)
Sangrado	35 (70%)	31 (89%)	4 (11%)
Prolapso	6 (12%)	5 (83,3%)	1 (16,7%)

El 30% de los pacientes presentaron sangrado residual tras la cirugía, con una duración entre 2 y 5 días. La sensación de ocupación en el canal anal se manifestó en 10 (20%) pacientes y fue desapareciendo paulatinamente en 1-2 semanas tras la cirugía.

No hubo sangrado mayor, incontinencia, retención urinaria, impactación fecal ni ningún caso de mortalidad postoperatoria.

La variable dolor posquirúrgico se mide mediante escalas visuales analógicas, a las 24 h y a la semana de la intervención quirúrgica (tabla 1). Las escalas van de 1 a 10: 1 es ausencia de dolor y 10, el peor dolor que se pueda imaginar. Es un cuestionario de 14 ítems, en los que se recoge información de la intensidad del dolor. El dolor se resolvió a las 48 h de la cirugía en todos los pacientes que consultaron por este motivo, salvo en 1 (2,5%) paciente que presentó recidiva tanto del dolor como de su prolapso. Esto permitió que los pacientes se incorporasen a su vida cotidiana en 48-72 h.

El intervalo de dolor a la semana varía, dentro de la escala analógica visual, de 0 a 3, teniendo en cuenta los 2 pacientes que sufrieron complicación en la región anal.

Con un seguimiento mínimo de 1 año, en 4 (11%) de 35 pacientes que consultaron por sangrado, éste se ha mantenido; en uno de ellos se indicó de nuevo la desarterialización hemorroidal y a los 3 meses de la segunda cirugía está sin hemorragia; otra paciente está pendiente de realizar hemorroidectomía convencional y el último ha desestimado la cirugía porque se encuentra asintomático (tabla 2).

Discusión

Es sintomático el gran número de técnicas que existen para el tratamiento de las hemorroides, unas menos agresivas[2,3], que incluso pueden realizarse en la consulta, y otras más cruentas[4,5], que precisan anestesia locorregional y, por tanto, un quirófano. Con las primeras se obtienen resultados discretos y en algunos casos no exentas de morbilidad; en el otro grupo, los resultados a largo plazo son mejores, pero encontramos una mayor tasa de complicaciones que van desde infección de la herida hasta incontinencia fecal.

Un análisis de 18 estudios prospectivos y aleatorizados encontró que la hemorroidectomía es el tratamiento más efectivo en el tratamiento de la afección hemorroidal[6], pero no exento de múltiples potenciales complicaciones y un mayor dolor postoperatorio, lo que hace que deba individualizarse el tratamiento, y contar con las preferencias y necesidades del paciente. Dentro de la hemorroidectomía hay diversas opciones instrumentales, pero no se ha demostrado una clara ventaja diferenciadora entre ellas[7-12].

Con el estudio de la fisiopatología de las hemorroides, resaltando la importancia del aumento del flujo arterial y la reciente demostración por parte de Meintjes[13] de la presencia constante de seis ramas terminales de la arteria hemorroidal superior, se han basado dos nuevos abordajes para el tratamiento de las hemorroides: la hemorroidopexia, según técnica de Longo, y la desarterialización hemorroidal transanal[1,5].

La hemorroidopexia se centra en la disrupción de la arteria rectal superior y la exéresis del prolapso y su fijación en el interior del canal anal mediante un instrumento de autosutura circular. La técnica que empleamos con THD se basa también en estos dos preceptos, pero primero la ligadura de las ramas arteriales se realiza con control de la sonda Doppler y la fijación de la mucosa rectal se realiza con una pexia mediante puntos de material reabsorbible. En anteriores estudios[14-16] con la técnica de desarterialización hemorroidal transanal, se ha usado otro dispositivo (HAL-Doppler, AMI, Feldkirch, Austria) y no se realizaba pexia, con lo que no se objetivaba la sensación de ocupación en el canal anal descrita en algunos de los pacientes de nuestra serie.

Al contrario que con la desarterialización hemorroidal, exenta hasta el momento de complicaciones, la hemorroidopexia descrita por Longo sí que ha puesto de manifiesto diversos tipos de complicaciones que van desde fístula hasta dolor muy difícil de tratar[17].

En un primer momento, se comenzó a utilizar la desarterialización hemorroidal en pacientes con esta enfermedad, pero con contraindicación de realizar la hemorroidectomía clásica[18], pero en estos momentos varios grupos han publicado su experiencia con esta técnica, de elección en hemorroides de grado II y III[14,15,18].

Nuestros resultados, comparados con los de otros estudios, son similares respecto a la mejoría del dolor anal; también en cuanto a resolver el problema del sangrado hemos obtenido unos resultados en consonancia con los de otras series (el 11 frente al 9-14%)[14,15,18]; en nuestra serie, creemos que se debe en parte a la ingesta de anticoagulantes (12 de 35 pcientes), ya que todos los pacientes que mantuvieron la hemorragia (4 de 35) tomaban anticoagulantes, lo que hace que los resultados no sean tan satisfactorios en este apartado.

Aun así, creemos que los resultados a corto plazo son alentadores, teniendo en cuenta que se trata de una enfermedad benigna, pero que ocasiona gran incomodidad preoperatoria y grandes molestias y un estimable gasto socioeconómico por el absentismo laboral. Esto se puede controlar con este nuevo abordaje, ya que el dolor es prácticamente inexistente y la reincorporación a la vida cotidiana, en 48-72 h desde la intervención.

En conclusión, la desarterialización hemorroidal transanal guiada por Doppler es una técnica que, en espera

de estudios aleatorizados, se debe explicar a los pacientes que van a ser intervenidos por afección hemorroidal, con sus ventajas en cuanto a morbilidad postoperatoria inmediata (escaso o nulo dolor) y reincorporación a la vida cotidiana.

Bibliografía

1. Morinaga K, Hasuda K, Ikeda T. A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (moricorn) in conjunction with a Doppler flowmeter. Am J Gastroenterol. 1995;90:610-3.
2. Ho Y-H, Tan M, Seow-Choen F. Micronized purified flavonidic fraction compared favorably with rubber band ligation and fiber alone in the management of bleeding hemorrhoids: randomized controlled trial. Dis Colon Rectum. 2000;43:66-9.
3. MacRae HM, McLeod RS. Comparison of hemorrhoidal treatment modalities: a meta-analysis. Dis Colon Rectum. 1995;38:687-94.
4. Oh C. Problems of cryohemorrhoidectomy. Cryobiology. 1982;19: 283-6.
5. Longo A. Treatment of hemorrhoidal disease by reduction of mucosa and hemorrhoidal prolapse with circular stapling device: a new procedure. 6th World Congress of Endoscopic Surgery. Bologna: Monduzzi Editore; 1998. p. 777-84.
6. MacRae HM, McLeod RS. Comparison of hemorrhoidal treatment modalities: a meta-analysis. Dis Colon Rectum. 1995;38:687-94.
7. Thorbeck CV, Montes MF. Haemorrhoidectomy: randomised controlled clinical trial of ligasure compared with Milligan-Morgan operation. Eur J Surg. 2002;168:482-4.
8. Chung CC, Ha JP, Tai YP, Tsang WW, Li MK. Double-blind, randomized trial comparing harmonic scalpel hemorrhoidectomy, bipolar scissors hemorrhoidectomy, and scissors excision: ligation technique. Dis Colon Rectum. 2002;45:789-94.
9. Armstrong DN, Frankum C, Schertzer ME, Ambroze WL, Orangio GR. Harmonic scalpel hemorrhoidectomy: five hundred consecutive cases. Dis Colon Rectum. 2002;45:354-9.
10. Khan S, Pawlak SE, Eggenberger JC, et al. Surgical treatment of hemorrhoids: prospective, randomized trial comparing closed excisional hemorrhoidectomy and the harmonic scalpel technique of excisional hemorrhoidectomy. Dis Colon Rectum. 2001;44:845-9.
11. Arbman G, Krook H, Haapaniemi S. Closed vs. open hemorrhoidectomy; is there any difference? Dis Colon Rectum. 2001;43: 31-4.
12. Tan JJ, Seow-Choen F. Prospective, randomized trial comparing diathermy and harmonic scalpel hemorrhoidectomy. Dis Colon Rectum. 2001;44:677-9.
13. Meintjes D. Doppler guided hemorrhoidal artery ligation (HAL) fr the treatment of hemorrhoids. Results in 1415 patients. Patients studies 2000. Disponible en: www.pharma.it/eng/pati.htm
14. Felice G, Privitera A, Ellul E, Klaumann M. Doppler-guided hemorrhoidal artery ligation: An alternative to hemorrhoidectomy. Dis Colon Rectum. 2005;48:2090-3.
15. Greenberg R, Karin E, Avital S, Skormick Y, Werbin N. First 100 cases with Doppler-guided hemorrhoidal artery ligation. Dis Colon Rectum. 2006;49:485-9.
16. Ramirez JM, Aguilella V, Elia M, Garcia JA, Martinez M. Doppler-guided hemorrhoidal artery ligation in the management of the symptomatic hemorrhoids. Rev Esp Enferm Dig. 2005;97: 97-103.
17. Sutherland LM, Burchard AK, Matsuda K, et al. A systematic review of stapled hemorrhoidectomy. Arch Surg. 2002;137:1395-406.
18. Sohn N, Aronoff JS, Cohen FS, Weinstein MA. Transanal hemorrhoidal desarterialization is an alternative to operative hemorrhoidectomy. Am J Surg. 2001;182:515-9.

2008

Authors: **Lienert** M., **Horstmann** O.

Source: Coloproctology, 30. Jahrgang, Heft 1, Januar 2008

Title: Transanale-Hämorrhoiden-Dearterialisation (THD) und Hämorrhoidal-Arterien-Ligatur (HAL): Evaluation der minimal-invasiven Therapie des Hämorrhoidalleidens

HINTERGRUND:

Der Verschluss der die Hämorrhoidalknoten speisenden Arterien stellt eine Alternative zur klassischen resezierenden Therapie und der Stapler-Hämorrhoidektomie dar. Das 1995 von Morinaga inaugurierte Verfahren basiert auf der Drosselung der Blutzufuhr der Hämorrhoidalknoten unter Verwendung eines speziellen Rektoskopes. Hiermit kann die Arterie mittels Dopplersonde aufgesucht und oberhalb der Linea dentata unterbunden werden. Bei der in Italien entwickelten THD wird ein ähnlich aufgebautes Proktoskop verwendet. THD und HAL unterscheiden sich in der Führung des Nadelhalters sowie der äußeren Form des Proktoskopes. Daneben wurde mit der THD das Prinzip der Anupexie eingeführt. Bei der Anupexie wird, neben der Umstechung der Arterie, zusätzlich das prolabierte Gewebe durch eine wendelartige nach anal laufender Naht in den oberen Analkanal retrahiert.

PATIENTEN UND METHOD:

In unserer Klinik wurde zunächst bei 410 Patienten das Verfahren der Hämorrhoidal-Arterien-Ligatur (HAL) vom März 2001 bis Dezember 2005 angewandt. Ab Januar 2006 setzten wir die Transanale-Hämorrhoiden-Dearterilisation (THD) an 166 Patienten ein. Hierbei wurde mit der Anupexie die Indikationsstellung ausgeweitet. Es wurden alle Stadien des Hämorrhoidalleidens behandelt (HAL Grad I: n = 5, Grad II: n = 155, Grad III: n = 136, Grad IV: n = 14; THD Grad I: n = 5, Grad II: n = 65, Grad III: n = 90, Grad IV: n = 6). Die programmmierte Nachuntersuchung erfolgte nach sechs Wochen. Hierbei wurden anamnestisch und proktoskopisch Schmerzen. Rezidive und weitere Symptome erfasst.

ERGEBNISSE:

Unsere Erfahrungen der laufenden Untersuchung zeigen einen extrem niedrigen postoperativen Schmerzmittelbedarf, eine kurze Rekonvaleszens und eine geringe Komplikationsrate. Am häufigsten wurden Restknoten (HAL 39%, THD 35%) gefunden. Thrombosen fanden sich nicht. Postoperative Nachblutungen nach HAL traten in 2% auf. Persistierende Blutungen fanden sich bei der HAL in 4%. Fistulöse Veränderungen wurden nach beiden Verfahren nicht beobachtet. Die Rate der entzündlichen Komplikationen lag unter 1%. 75% der Patienten waren zufrieden oder sehr zufrieden.

SCHLUSSFOLGERUNG:

Beide Verfahren stellen eine gute Alternative zur klassischen operativen Therapie des Hämorrhoidalleidens dar, mit erniedrigtem Schmerzmittelbedarf und hoher Erfolgsrate. Hierbei bietet die THD eine viel versprechende Weiterentwicklung der HAL mit verbesserten Ergebnissen, trotz Ausweitung der Indikation unter Einsatz der Anupexie.

2008

Authors: **Theodoropoulos** G. E., **Sevrisarianos** N., **Papaconstantinou** J. et al

Source: Colorectal Disease 2008, 12, 125-134

https://www.ncbi.nlm.nih.gov/pubmed/19055522

Title: Doppler-guided haemorrhoidal artery ligation, rectoanal repair, sutured haemorrhoidopexy and minimal mucocutaneous excision for grades III–IV haemorrhoids: a multicenter prospective study of safety and efficacy

OBJECTIVE:

The isolated use of Doppler-guided haemorrhoidal artery ligation (DGHAL) may fail for advanced haemorrhoids (HR; grades III and IV). Suture haemorrhoidopexy (SHP) and mucopexy by rectoanal repair (RAR) result in haemorrhoidal lifting and fixation. A prospective evaluation was performed to evaluate the results of DGHAL combined with adjunctive procedures.

METHOD:

The study included 147 patients with HR (male patients: 102; grade III: 95, grade IV: 52) presenting with bleeding (73%) and prolapse (62%).

RESULTS:

More ligations were required for grade IV than grade III HR (10.7 + 2.8 vs 8.6 + 2.2, $P < 0.001$). SHP (28 patients) and RAR (18 patients) at 1–4 positions were deemed necessary in 46 (31%) patients. Minimal (muco-) cutaneous excision (MMCE) was added in 23 patients. SHP / RAR was applied more frequently in grade IV HR (60% vs 16%, $P < 0.001$). In patients not having MMCE, SHP / RAR was added in 57% of grade IV cases ($P < 0.001$). Complications included residual prolapse (10; two second surgery), bleeding (15; two second DGHAL), thrombosis (four), fissure (three) and fistula (one). Analgesia was required not at all, up to 1–3 days, 4–7 days and >7 days by 30%, 31%, 16% and 14% of the patients, respectively. SHP / RAR was associated with greater discomfort (17% vs 6%, $P < 0.001$). No differences were found between SHP and RAR. At an average follow-up of 15 months, 96% of patients were asymptomatic and 95% were satisfied.

CONCLUSION:

DGHAL with the selective application of SHP / RAR is a safe and effective technique for advanced grade HR.

2007

Authors: **Dal Monte** PP., **Tagariello** C., **Giordano** P., **Cudazzo** E., **Shafi** A., **Saragò** M., **Franzini** M.

Source: Techniques in Coloproctology. 2007; 11 (4): 333-339
https://www.ncbi.nlm.nih.gov/pubmed/21505901

Title: Transanal haemorrhoidal dearterialization: non excisional surgery for the treatment of haemorrhoidal disease

BACKGROUND:

Transanal haemorrhoidal dearterialisation (THD) is a nonexcisional surgical technique for the treatment of piles, consisting in the ligation of the distal branches of the superior rectal artery, resulting in a reduction of blood flow and decongestion of the haemorrhoidal plexus. The aim of this study was to assess the long-term efficacy of this treatment.

METHODS:

The procedure was carried out using a proctoscope with a Doppler probe. The terminal branches were located with Doppler and then sutured.

RESULTS:

From January 2000 to May 2006, we performed THD in 330 patients (180 men; mean age, 52.4 years), including 138 second-degree, 162 third degree and 30 fourth-degree haemorrhoids. There were 23 postoperative complications (7 cases of bleeding, 5 thrombosed piles, 4 rectal haematomas, 2 anal fissures, 2 cases of dysuria, 1 of haematuria and 2 needle ruptures). The mean postoperative pain score was 1.32 on a visual analog scale. 219 patients were followed for a mean of 46 months (range, 22–79), including 100 patients with second-degree, 104 with third-degree and 15 with fourth-degree haemorrhoids. The operation completely resolved the symptoms in 132 patients (92.5%) with preoperative bleeding and in 110 patients (92%) with preoperative prolapse.

CONCLUSION:

The efficacy and relapse rate of this procedure appears to be similar to that of traditional surgery and stapled haemorrhoidopexy. The technique was effective and safe for all degrees of haemorrhoids because of the excellent results, low complication rate and minor postoperative pain.

2006

Authors: **Cudazzo** E., **Bianchi** M., **Mariani** L., **Faraci** R., **Iosca** A., **Franzini** M.

Source: XVI Congresso Nazionale Video Chirurgia ACOI, Alessandria 2-4 febbraio 2006

Title: **Dearterializzazione Emorroidaria Transanale doppler-guidata (THD)**

Nella genesi del sanguinamento della malattia emorroidaria è di importanza fondamentale la componente iperafflusso o la discrepanza tra l'afflusso arterioso e il deflusso venoso. Pertanto la legatura dei rami distali delle arterie rettali superiori rappresenta un elemento essenziale per il controllo delle sue complicanze. La metodica della Dearterializzazione Emorroidaria Transanale doppler-guidata (THD) è un metodo semplice, sicuro, altamente efficace e relativamente indolore applicabile al trattamento delle emorroidi sanguinanti di ogni grado che non rispondono a terapie conservative igienico-dietetiche e farmacologiche.

Lo strumento, realizzato e brevettato da THD SpA – Correggio (RE), comprende un anuscopio monouso nel cui spessore è stata ricavata una fenestratura rettangolare per introdurre la sonda doppler. Al di sopra della sonda c'è una finestra attraverso la quale è possibile applicare un punto di sutura sulla mucosa rettale prospiciente. Nella punta dell'apparecchio è presente un repere forato nel quale può alloggiare la punta del portaghi in maniera da standardizzare la traiettoria dell'ago che penetra nella mucosa ad una profondità di 6 mm e garantire la legatura dell'arteria individuata dal doppler. Il manico dell'anuscopio alloggia il cavo a fibre ottiche collegato alla fonte luminosa per permettere l'illuminazione dell'interno dello strumento. Completano l'attrezzatura la sonda e l'apparecchiatura doppler che dà un rilievo sonoro alla pulsazione arteriosa rilevata.

Introdotto l'anuscopio nel canale anale e individuati i rami terminali delle arterie rettali superiori si applica attraverso la finestra un punto di Vycril 00 con ago 5/8. Lo stesso punto viene applicato due volte ad X sulla stessa arteria a differente altezza e quindi legato in modo da consentire una leggera pessia, utile per ridurre un eventuale prolasso mucoso. Legata l'arteria scompare, a valle del nodo, la pulsazione precedentemente rilevata dal doppler.

Le arterie da legare sono sei posizionate alle ore dispari nella circonferenza anale. Dal Febbraio al dicembre 2005 abbiamo applicato la metodica a 31 pazienti. Inizialmente abbiamo selezionato emorroidi di 3° grado in cui il sintomo principale era il sanguinamento, successivamente abbiamo utilizzato la metodica in pazienti con emorroidi di 4° grado con buoni risultati.

Nel post-operatorio non è presente dolore, ma talora il senso di peso e qualche piccolo sanguinamento che scompaiono dopo i primi tre o quattro giorni. Non abbiamo mai avuto le rare complicanze descritte in letteratura e nei nostri pazienti la ripresa lavorativa è avvenuta dopo 2-3 giorni.

La presentazione della metodica non si prefigge un confronto con altri metodi ma ha il semplice scopo di segnalare una nuova arma nel trattamento della patologia emorroidaria. Il suo insuccesso non preclude altre possibilità terapeutiche, ma la maneggevolezza ne incoraggia l'utilizzo prima di ogni altra metodica maggiormente invasiva e potenzialmente più pericolosa in termini di complicanze. L'immediata ripresa lavorativa sottolinea l'economicità della metodica sia per il paziente che per la struttura sanitaria e quindi per la società intera.

2004

Authors: **Lienert** M., **Ulrich** B.

Source: Dtsch Med. Wochenschr. 2004 Apr. 23; 129 (17): 947-50 [Article in German]

https://www.ncbi.nlm.nih.gov/pubmed/15083397

Title: **Doppler-guided ligation of the hemorrhoidal arteries. Report of experiences with 248 patients**

BACKGROUND AND OBJECTIVE:

Since the beginning of 2001, Doppler-guided ligation of the hemorrhoidal arteries has been used at this clinic in almost all patients with various forms of hemorrhoidal disease. Aim of this study was to ascertain whether this intervention can be done without general anaesthesia, the hemorrhoidal knots regress and this procedure provides advantages over the classical methods of treating hemorrhoids.

PATIENTS AND METHODS:

Early results of Doppler-guided ligation in 248 patients are presented. Through a special proctoscope the arteries leading to the hemorrhoidal cushions are located in the pain-free rectum under Doppler guidance and suture ligated. The form of anaesthesia, duration of the operation, numbers and sites of the ligatures, additional interventions and postoperative complications were recorded.

RESULTS:

171 patients (69%) needed no anaesthesia. 147 patients (Without additional interventions) were re-examined 6 weeks after the operation: 61.2% were free of symptoms. A total of 87.7% were at least improves. The complication rate was low.

CONCLUSION:

In our experience Doppler-guided ligation has been a well tolerated efficacious method with few complications in the ambulatory treatment of hemorrhoids. The ideal indication for this methods is nonprolapsing hemorrhoids.

2004

Authors: **Dal Monte** PP., **Tagariello** C., **Saragò** M., **Giordano** P.

Source: British Journal of Surgery. 2004 May; 91 (1): 70

Title: **Doppler-guided transanal haemorrhoidal dearterialisation is an effective technique for the treatment of symptomatic haemorrhoids**

AIMS:

To assess the efficacy and safety of Doppler-guided transanal haemorrhoidal dearterialisation (THD) for the treatment of haemorrhoids

METHODS:

Patients with second- and third-degree haemorrhoids who had failed to respond to conservative treatment and/or sclerotherapy were offered THD. The procedure was performed using a specifically designed proctoscope. The proctoscope has on its right side a small channel for the insertion of a fine Doppler probe there is a small window to allow suturing of the rectal mucosa 2-3 cm above the dentate line. The Doppler probe was used to locate all the terminal branches of the haemorrhoidal arteries, which were then sutured. Patients were followed up at 1 week, 2 months and every 6 months thereafter.

RESULTS:

From January 200 to September 2003, 130 patients (61 female, mean age 53 years) underwent this procedure and were followed up for a minimum of 2 months (mean follow-up 38 months). All patients returned to work within 3 days. In 121 (93%) patients the operation resolved the symptoms. In the nine patients with failure repeat Doppler showed at least one residual artery. Six of these nine patients underwent further THD, which was successful in all cases. There were seven postoperative complications (two PR bleeds, three thrombosed piles, one submucosal rectal haematoma and one urinary retention).

One postoperative bleeding required re-intervention.

CONCLUSION:

THD is a safe and effective procedure. With minimal postoperative pain and quick recovery THD has the potential to become the treatment of choice for second and third-degree haemorrhoids.

2004

Authors: **Aigner** F., M.D.a,c., **Bodner** G., M.D.b., **Conrad** F., M.D.c., **Mbaka** G., M.D.e., **Kreczy** A., M.D.d., **Fritsch** H., M.D.a.

Source: Am J Surg. 2004 Jan;187(1):102-8

https://www.americanjournalofsurgery.com/article/S0002-9610(03)00433-1/pdf

Title: The superior rectal artery and its branching pattern with regard to its clinical influence on ligation techniques for internal hemorrhoids

---

BACKGROUND:

The hemorrhoidal artery ligation has been used for submucosal ligation of hemorrhoidal arteries by means of an ultrasonographic transducer since 1995. The success of this technique depends on the submucosal course of these arteries. Our investigation deals with branches of the superior rectal artery which pierce the rectal wall where they cannot be reached by this method.

METHODS:

The branching patterns were investigated by means of 5 macroscopic preparations of adult pelves, histological section series of 35 fetal and 3 adult pelves impregnated in epoxy-resin, and transperineal color Doppler ultrasound of 7 proctologic patients and 28 volunteers.

RESULTS:

Additional branches of the superior rectal artery coursing in outer layers of the rectal wall were shown entering the rectal wall just above the levator ani muscle to supply the internal hemorrhoidal plexus (corpus cavernosum recti).

CONCLUSION:

The terminal course of the branches of the superior rectal artery is not only applied to the rectal submucosa. We have shown that additional branches may be detected by ultrasonography and should be taken into account by the operating surgeon.

2003

Authors: **Bursics** A., **Morvay** K., **Kupcsulik** P., **Flautner** L.

Source: Int. J. Colorectal Dis. 2004 Mar; 19 (2): 176-80. Epub 2003 Jul. 5

https://www.ncbi.nlm.nih.gov/pubmed/12845454

Title: Comparison of early and 1-year follow-up results of conventional hemorrhoidectomy and hemorrhoid artery ligation: a randomized study

BACKGROUND AND AIMS:

Doppler-guided hemorrhoid artery ligation is a new approach for treating hemorrhoids. Early and 1-year follow-up results of the procedure are presented and compared with those of closed scissors hemorrhoidectomy in a prospective randomized study.

PATIENTS AND METHODS:

Sixty consecutively recruited patients were randomized into two groups: group A (n=30) was treated with standardized closed scissors hemorrhoidectomy and group B (n=30) with Doppler-guided hemorrhoid artery ligation. The follow-up period was 11.7+/-4.6 months.

RESULTS:

The average need for minor analgesics was 11.7+/-12.6 doses in group A and 2.9+/-7.7 in group B. Patients in group A spent 62.9+/-29.0 hours in hospital postoperatively and those in group B 19.8+/-41.8 hours. Return to normal daily activities took 24.9+/-24.5 days in group A and 3.0+/-5.5 days in group B. Neither the disappearance (26 vs. 25 patients) nor the recurrence of preoperative symptoms (5 vs. 6 patients) differed significantly between the two groups.

CONCLUSION:

Both procedures were effective in treating hemorrhoids. The 1-year results of Doppler-guided hemorrhoid artery ligation do not differ from those of closed scissors hemorrhoidectomy. Doppler-guided hemorrhoid artery ligation seems to be ideal for 1-day surgery, and it fulfills the requirements of minimally invasive surgery.

1996

Authors: **Shafik** A., **Mostafa** H.

Source: Acta Anat (Basel). 1996;157(1):80-6

https://www.ncbi.nlm.nih.gov/pubmed/9096745

Title: Study of the arterial pattern of the rectum and its clinical application

The purpose of this communication was to study rectal arterial supply in order to characterize its various patterns and use them to help avoid rectal ischemic complications and, in addition, to explain some of the unknown rectal pathologic conditions. Thirty-two cadavers were studied. The pelvic organs were eviscerated. The rectal arteries were examined by direct dissection in 12 specimens and after injecting the inferior mesenteric artery with barium sulfate in 20 specimens. The superior rectal artery (SRA) and vein were found to be enclosed in a fibrous sheath which was connected to the posterior rectal surface by an anterior mesorectum containing the "transverse rectal branches', and to the sacrum by an avascular posterior mesorectum. Small lymph nodes were scattered alongside the anterior mesorectum. The SRA gave rise to 4 branches: transverse rectal, descending rectal, rectosigmoid and terminal. The transverse rectal arteries arose from the SRA in 24 specimens and from the descending rectal artery in 8. They were distributed to the upper half of the rectum. The rectosigmoid artery was distributed to the descending limb of the sigmoid colon and rectosigmoid junction. We found 2 terminal branches in 21/32 cadavers and 3 in 11/32. They communicated in the lower half of the rectum. The inferior rectal arteries were present in all the dissected cadavers while the middle rectal arteries could be identified in only 50% of the cadavers. Two arterial patterns were recognized: annular in the upper rectal half provided by the transverse rectal arteries and plexiform in the lower half supplied by the SRA terminal branches.

1995

Authors: **Morinaga** K., **Hasuda** K., **Ikeda** T.

Source: Am. J. Gastroenterol. 1995 Apr; 90 (4): 610-3
https://www.ncbi.nlm.nih.gov/pubmed/7717320

Title: **A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter**

OBJECTIVES:

To assess the usefulness of hemorrhoidal artery ligation (HAL) for internal hemorrhoids with a newly devised instrument (the Moricorn).

METHODS:

We devised a new instrument (the Moricorn) that is used in conjunction with a Doppler flowmeter. This instrument allows for easy and safe ligation of the hemorrhoidal artery. HAL with the Moricorn was performed on 116 patients with internal hemorrhoids who had episodes of anal pain, bleeding, and prolapse. One month after treatment, the effect was evaluated on the basis of improvement of symptoms and the shrinkage of hemorrhoidal tissue.

RESULTS:

The treatment's effect was observed in 50 of 52 patients (96%) with pain, 50 of 64 (78%) with prolapse, and 92 of 96 (95%) with bleeding. No patient required anesthesia throughout the entire procedure. No major complications were encountered with this treatment.

CONCLUSION:

HAL with the Moricorn is a simple, safe, and effective method. However, further observations predicated on a longer follow-up, a larger number of patients, and comparisons with other conventional treatments are called for.

1992

Author: **Sun** WM., **Peck** RJ., **Shorthouse** AJ., **Read** NW.

Source: Br J Surg. 1992 Jun; 79(6): 592-4

https://www.ncbi.nlm.nih.gov/pubmed/1611462

Title: Haemorrhoids are associated not with hypertrophy of the internal anal sphincter, but with hypertension of the anal cushions

A combined manometric and ultrasonographic study of the internal anal sphincter was carried out in 20 patients with haemorrhoids and 20 age-matched normal controls. Mean(s.e.m.) basal anal pressure was significantly higher in patients than in controls, 62(4) versus 45(6) cmH2O (P less than 0.05), although there were no significant differences in mean maximum basal and squeeze pressures. During rectal distension 90 per cent of patients showed no reduction in anal pressure in the outermost anal channel, although the internal sphincter electromyogram was suppressed and the external sphincter electromyogram did not necessarily increase above baseline. The mean (s.e.m.) maximum residual pressure was significantly higher in patients, 70(6) versus 45(6) cmH2O (P less than 0.05). Direct pressure measurement in anal cushions exhibited abnormally high median pressure in patients compared with controls, 35 versus 10 cmH2O (P less than 0.001). Pressures recorded during coughing and straining were also significantly higher in patients than in controls (P less than 0.001). Ultrasonographic study of the anal canal revealed a clear image of the internal sphincter, the thickness of which could easily be measured. The mean(s.e.m.) thickness of the sphincter was not significantly different, 2.3(0.2) versus 2.1(0.1) mm, between patients with haemorrhoids and controls (P = 0.18). The absence of any significant differences in the internal sphincter thickness between normal subjects and patients with haemorrhoids suggests that the high anal pressure in patients with haemorrhoids is of vascular origin.

1978

Author: **Ayoub** SF.

Source: Acta Anat (Basel). 1978;100(3):317-27

https://www.ncbi.nlm.nih.gov/pubmed/619506

Title: **Arterial supply to the human rectum**

The arterial supply to the human rectum was studied in 42 autopsy specimens. 32 were fixed in formalin and dissected. Five were radiographed after filling their arterial bed with a radio-opaque substance. The remaining five specimens were used to prepare plastic casts of the arterial bed. The superior rectal artery is the chief rectal artery. It forms a recto-sigmoid branch, an upper rectal branch and then divides into right and left terminal branches. Terminal branches extend downwards and forwards around the lower two thirds of the rectum to the level of the levator ani. The middle rectal artery, of appreciable diameter, on one or both sides of the rectum, is found supplying a limited part of the rectum in 12% of the specimens. Its presence can be anticipated by observing the diameter of the superior rectal artery and its two terminal branches. The inferior rectal artery supplies the anal canal below the levator ani. Rectal twigs of other pelvic arteries terminate at the pararectal tissues occasionally reaching the wall of the rectum. Extramural anastomoses were not observed between the main rectal arteries, but intramural ones were present, mainly between the superior and the inferior rectal arteries.

1976

Author: **Guntz** M., **Parnaud** E., **Bernard** A., **Chome** J., **Regnier** J. et al.

Source: Bull Assoc Anat (Nancy). 1976 Sep; 60(170):527-38
https://www.ncbi.nlm.nih.gov/pubmed/1028448

Title: **Vascularization of the anal canal**

The arterial blood supply of the anal canal derives from the superior, middle and inferior rectal arteries, whose branches reach the anal submucosa. Three main arterial trunks in the right anterior, right posterior and left lateral positions can be isolated below the pectinate line. They come, for the most important part, from the superior rectal artery. On the course of the anal submucosal venous plexus are fusiform, saccular or serpiginous dilatations confined to the lower half of the anal canal. This plexus is mainly tributary of the superior rectal vein to the portal system and secondly, of the middle and inferior rectal veins and the lateral sacral veins to the inferior vena cava. Arterio-venous direct communications have been demonstrated by serial section and by radiography of cadaveric specimens and by selective inferior mesenteric arteriography in patients. The erectile property of the anal submucosa as suggested by large vascular spaces, arterio-venous shunts and glomic systems may function in the erectile mechanism.

1975

Author: **Thomson** WH.

Source: Br. J. Surg. 1975 Jul; 62 (7): 542-52

https://www.ncbi.nlm.nih.gov/pubmed/1174785

Title: **The Nature of Haemorrhoids**

An anatomical and clinical study aimed at uncovering factors likely to be helpful in understanding the true nature of haemorrhoids is described. The main finding was of specialized 'cushions' of submucosal tissue lining the anal canal; it is argued that piles are merely the result of their displacement.

THD S.p.A.
Via Industria 1, 42015, Correggio (RE), Italy
Tel +39 0522 634311 **Fax** +39 0522 634371
www.thdlab.com