

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

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### 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

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**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.

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## INTRODUCTION

For over 60 years, since the description of hemorrhoidectomy by Milligan and Morgan *et al.*<sup>[1]</sup> and Ferguson *et al.*<sup>[2]</sup>, 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<sup>[3,4]</sup>. 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.*<sup>[3]</sup> 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.*<sup>[5]</sup> described the successful use of Doppler-guided location of hemorrhoidal vessels for phenol injection for treatment of 1<sup>st</sup> grade hemorrhoids.

Hemorrhoidal vessels are usually found in the mucosa within 2 cm up from the anorectal junction<sup>[6]</sup>

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.*<sup>[3]</sup> 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<sup>[7]</sup>. Morinaga *et al.*<sup>[3]</sup> 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.*<sup>[8]</sup> 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.*<sup>[9]</sup> 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<sup>[10]</sup>. 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*<sup>[7]</sup> 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*<sup>[11]</sup> 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%<sup>[12-15]</sup>.

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<sup>[12-14,16-24]</sup>. Scheyer *et al*<sup>[25]</sup> 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*<sup>[26]</sup> 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*<sup>[19]</sup> 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*<sup>[22]</sup> 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*<sup>[27]</sup> 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*<sup>[28]</sup> published a series comparing 18 patients submitted to stapled hemorrhoidopexy 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<sup>[28]</sup>.

Three studies found that THD patients had an earlier return to normal activities<sup>[29-31]</sup>. Tsang *et al*<sup>[31]</sup> 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*<sup>[32]</sup> 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*<sup>[33]</sup> 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*<sup>[13]</sup> showed that patients misreported skin tags for prolapse, after a physical examination took place.

As in the study by Infantino *et al*<sup>[34]</sup>, Lucarelli *et al*<sup>[33]</sup> 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<sup>[30,31,35]</sup> while in some it was a trend in the group submitted to THD but did not reach statistical significance<sup>[28,29,32]</sup>.

Giordano *et al*<sup>[29]</sup> 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<sup>[36]</sup>.

## COMPARISON WITH CH

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

In a non-blind randomized study, Elmér *et al.*<sup>[37]</sup> 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.*<sup>[38]</sup> 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 ( $P > 0.05$ )<sup>[39]</sup>.

Denoya *et al.*<sup>[40]</sup> 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.*<sup>[41]</sup>, 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.*<sup>[29]</sup>, 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.*<sup>[31]</sup> 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.*<sup>[9]</sup> the overall incontinence rate after THD was 0.4%.

## IMPORTANT CONSIDERATIONS

Morinaga *et al.*<sup>[3]</sup> 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.*<sup>[7]</sup> were the first to publish a modification on the described technique, including anopexy in order to better treat prolapse for 3<sup>rd</sup> and 4<sup>th</sup> grade hemorrhoids. With this, treatment of prolapse associated with 3<sup>rd</sup> and 4<sup>th</sup> 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 seen in comparative studies<sup>[37,38,40]</sup>. In a systematic review concerning THD, 18.5% of patients suffered from pain in the first operative day<sup>[9]</sup>. 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<sup>[10,42,43]</sup>, 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<sup>[42]</sup>. 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<sup>[4]</sup> 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<sup>[44]</sup>. 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<sup>[29]</sup>.

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.*<sup>[13]</sup>, 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<sup>[41]</sup>.

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.

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