

Advantages and limits of hemorrhoidal dearterialization in the treatment of symptomatic hemorrhoids

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Abstract

In the last two decades, hemorrhoidal dearterialization has become universally accepted as a treatment option for symptomatic hemorrhoids. The rationale for this procedure is based on the assumption that arterial blood overflow is mainly responsible for dilatation of the hemorrhoidal plexus due to the absence of capillary

interposition between the arterial and venous systems within the anal canal. Dearterialization, with either suture ligation (Doppler-guided hemorrhoid artery ligation/transanal hemorrhoidal dearterialization) or laser (hemorrhoidal laser procedure), may be successfully performed alone or with mucopexy. Although the added value of Doppler-guidance in association with dearterialization has recently been challenged, this imaging method still plays an important role in localizing hemorrhoidal arteries and, therefore, minimizing the effect of anatomic variation among patients. However, it is important to employ the correct Doppler transducer. Some Doppler transducers may not easily detect superficial arteries due to inadequate frequency settings. All techniques of dearterialization have the advantage of preserving the anatomy and physiology of the anal canal, when compared to other surgical treatments for hemorrhoids. This advantage cannot be underestimated as impaired anal function, including fecal incontinence and other defecation disorders, may occur following surgical treatment for hemorrhoids. Furthermore, this potentially devastating problem can occur in patients of all ages, including younger patients.

Key words: Dearterialization; Laser dearterialization; Hemorrhoids; Mucopexy

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Core tip: This editorial analyzes the techniques of dearterialization for hemorrhoids. The advantages and pitfalls of the various techniques of dearterialization are reported, with specific attention given to the role of Doppler ultrasound and technical tips on the various procedures. Finally, the author reports the efficacy of dearterialization based on data in the literature as well as personal experience in this field.

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INTRODUCTION

The surgical treatment of hemorrhoids has evolved over the last three decades. Significant postoperative pain as well as changes to the anatomy of the anal canal leading to impaired defecation has led surgeons to adopt new procedures that are less invasive than traditional surgical hemorrhoidal excision.

A variety of surgical procedures are currently available for the treatment of hemorrhoids, however no single technique has been universally accepted as superior. Theoretically, surgical procedures should be tailored to individual patients. In reality, the choice of the surgical technique is often based upon the surgeon's preference or the availability of specialized equipment.

Hemorrhoidal disease has a multifactorial etiology and theories on its actual pathogenesis are still being debated. Symptoms related to hemorrhoidal disease may vary substantially among patients. An accurate preoperative evaluation is therefore mandatory and extremely useful in selecting the most appropriate surgical approach. Rectal mucosal prolapse is one among many potential anatomical alterations related to hemorrhoidal disease that impairs a patient's quality of life. In addition, bleeding, pruritus, pain, soiling, and recurrent thrombosis of piles cannot be underestimated.

The Goligher classification^[1] is commonly used to grade the severity of hemorrhoids and, consequently, indicates the modality of surgical treatment. However, the grade of prolapse and hemorrhoidal symptoms are often poorly correlated^[2]. Tolerance to hemorrhoidal symptoms varies among patients. Therefore the surgeon should be prepared to consider not only the anatomical aspects of the anal canal but also the patient's characteristics and symptoms. In particular, successful treatment should focus on the cure of symptoms affecting the patient's quality of life. In this regard, studies related to surgical treatment of hemorrhoids should include a thorough evaluation of the patient's quality of life as it represents one crucial aspect of successful therapy.

With this in mind, the current trend is to give preference to less invasive procedures with the aim of minimizing postoperative pain, providing relief of symptoms, and reducing the risk of anatomical alterations and dysfunction of the anal canal.

In the last two decades, hemorrhoidal artery ligation (HAL) has become universally accepted for the treatment of hemorrhoids. The rationale for this procedure is based on the assumption that arterial blood overflow is mainly responsible for dilatation of the hemorrhoidal plexus due to the absence of capillary interposition between the arterial and venous systems within the anal canal. This has been clearly demonstrated in anatomical studies^[3,4].

Both the mean caliber and blood flow of the arterial branches of the superior rectal artery (SRA) were found to be significantly higher in patients with hemorrhoids than in a control group^[5]. Closure of the terminal branches of the SRA is therefore expected to shrink the hemorrhoidal piles and alleviate symptoms, and even possibly reduce hemorrhoidal prolapse. Closure of the terminal branches of the SRA can also be performed in combination with plication of the prolapsing mucosa in cases of large and symptomatic prolapse [transanal hemorrhoidal dearterialization (THD) + mucopexy].

A systematic review of 17 case series that included 1996 patients reported satisfactory overall results in grade II and III hemorrhoids with mean recurrence rates of 11% for prolapse, 9% for pain at defecation, and 10% for bleeding at an average of 1-year follow-up after Doppler-guided hemorrhoidal dearterialization^[6]. In another recent review^[7], 2904 patients from 28 studies were included in the final analyses. Overall recurrence rates varied among studies with a pooled rate of 17.5% and an overall reintervention rate of 6.4%. In both of these systematic reviews, it was concluded that Doppler-guided hemorrhoidal dearterialization can be safely considered for primary treatment of grade II and III hemorrhoids. Grade IV hemorrhoids, however, had the highest recurrence rate at long-term follow-up. It is interesting to note that not all patients included in these reviews underwent a mucopexy in addition to dearterialization.

A recent multicenter trial including 803 patients who underwent Doppler-guided THD reported an overall success rate of 90.7% after a mean follow-up of 11.1 + 9.2 mo. These authors also reported a recurrence of hemorrhoidal prolapse, bleeding, or both in 6.3%, 2.4% and 0.6% of patients, respectively^[8].

The advantage of HAL/THD when compared to excisional methods is the absence of anal wounds, which significantly reduces the patient's postoperative pain and discomfort. In addition, preservation of the anal anatomy and physiology cannot be underestimated^[9]. In this regard, it must be stressed that one of the primary causes of fecal incontinence is anorectal surgery^[10].

The anticipated reduction of postoperative pain and alleviation of symptoms makes these procedures the most favored by patients. Early and mid-term results have shown high success and patient satisfaction rates^[11]. When compared to other non-excisional procedures for hemorrhoids such as stapled hemorrhoidopexy (PPH), dearterialization may have the added advantage of reducing the incidence of serious or life-threatening complications^[12]. Despite these advantages, long-term results may be associated with higher recurrence rates compared to conventional hemorrhoidectomy^[13]. In addition to the advantages of shorter-term decreased pain and quicker return to daily activities, patients should be informed of this potential eventuality, especially in case of 4th degree hemorrhoids.

Recent studies have called into question the true value of Doppler-assisted localization of the terminal

branches of the SRA in the HAL/THD procedures^[14]. According to this theory, the efficacy of artery ligation in all six of the odd-numbered clock positions around the anus (1, 3, 5, 7, 9 and 11 o'clock in the lithotomy position) followed by mucopexy would be equal to the same operation performed with Doppler-assistance. This would then suggest that there is no real need for the costly Doppler instruments. Conversely, it has been demonstrated that one-third of the population has at least one artery in an even-numbered clock position, and for this reason Doppler-assisted localization is important in correctly locating the arteries^[15].

Some studies have shown good overall success rates when hemorrhoidopexy is performed without dearterialization^[16]. Skepticism over the true value of dearterialization might therefore be justified. However, hemorrhoidopexy, beyond the treatment of mucosal prolapse, can most likely be considered an empiric form of de-arterialization, although the closure of underlying arteries cannot be proven by Doppler ultrasound. In fact, the running sutures placed on the redundant mucosa may include the underlying arteries. In this regard, there are some important issues regarding the anatomy of the anal canal and the type of Doppler device used for HAL/THD that need to be addressed.

Aigner *et al*^[3] and Schuurman *et al*^[4] have described in detail the vascular pattern of the anal canal. At approximately 2-3 cm above the dentate line, the terminal branches of the superior rectal arteries become superficial (2 mm deep) and thin (0.6-2 mm). These terminal branches may be directly responsible for blood overflow into the hemorrhoidal piles due to the lack of capillary interposition between the arterial system and the hemorrhoidal plexus. However, the Doppler transducers used by the majority of DGHAL and THD equipment operate at 7-8 MHz. At these frequency settings, Doppler probes can only detect deep arteries that may not directly contribute to the hemorrhoidal pile overflow.

In addition, in commonly used equipment, suture ligation is placed approximately 1 cm above the point where the arterial pulse is located by Doppler ultrasound, which may not succeed in closing the artery.

In this regard, dearterialization with laser [hemorrhoidal laser procedure (HeLP)] seems to be more precise and effective^[17]. This procedure uses a 20 MHz Doppler-transducer, which is more accurate in detecting superficial arteries at approximately 2 cm above the dentate line. In addition, diode laser energy delivered at 980 nm of wavelength causes shrinkage of the mucosa and submucosa to a depth of 4 mm, which can easily include the underlying superficial arteries. The efficacy of arterial shrinkage is in fact improved by the selective action of laser energy on hemoglobin at that specific wavelength. Furthermore, in the HeLP procedure, the laser fiber is placed in contact with the mucosa exactly at the same point where the Doppler signal locates the artery. By doing so, the risk of missing the artery is minimized.

Laser treatment may also have the added advantage of closing a larger number of arteries (12 instead of 6) and being less invasive than artery ligation, therefore requiring neither anesthesia nor sedation^[18]. However, one pitfall associated with this procedure is the low success rate of curing severe mucosal prolapse. In fact, the standard HeLP procedure does not address the issue of prolapsed mucosa. Nevertheless, in cases of concomitant severe and symptomatic prolapse, a mucopexy can easily be incorporated into the same procedure, following the laser treatment (HeLP + rectoanal repair)^[19].

The number of arteries closed as well as the level at which the arteries are located might also play a significant role in the clinical success of techniques that employ dearterialization. In order to optimize the results of THD, Ratto *et al*^[20] modified their technique of dearterialization by performing a "distal" ligation, rather than the original technique of closing the arteries approximately 4-5 cm above the dentate line, located by Doppler signal.

The terminal branches of the SRA multiply and become more superficial as they get closer to the dentate line. This explains the fact that 20 MHz Doppler probes, as seen in the HeLP procedure^[16], can easily identify and locate at least 12 arteries, compared to only 6 as has been previously described in other procedures employing different Doppler probes.

IN SUMMARY

The techniques of dearterialization for symptomatic hemorrhoids seem to have maintained the encouraging early results, despite a progressive increase in long-term recurrence rates that have been reported in some studies, especially for grade III and IV hemorrhoids. The rationale for this procedure seems to be valid, as demonstrated not only by anatomical studies but also by clinically successful results reported in numerous series in the literature, even when no additional mucopexy is performed.

Dearterialization, either with suture ligation (DGHAL/THD) or laser (HeLP), may be successfully performed alone or in association with mucopexy, when necessary.

Mucopexy improves resolution of short- and long-term symptoms when significant prolapse altering the patient's quality of life is present in grade III hemorrhoids. Dearterialization plus mucopexy should be indicated only in very selected cases of grade IV hemorrhoids. Mucopexy alone can be performed when prolapse is the only symptom, but this procedure may fail to control bleeding and recurrent acute symptoms in the long-term.

Although the added value of Doppler-guidance in association with dearterialization has recently been challenged, this imaging method still plays an important role in localizing hemorrhoidal arteries, and minimizing the effect of anatomic variation among patients.

Some Doppler transducers may not easily detect

superficial arteries due to inadequate frequency settings (7-8 MHz). In HAL/THD procedures, dearterialization may be empirically effective in that the arteries may be successfully closed because the width of the suture ligation would close a larger quantity of tissue, thus incorporating the underlying arteries regardless of Doppler-guidance. Unfortunately, these results may not be easily reproducible.

Finally, all techniques of dearterialization have the advantage of preserving the anatomy and physiology of the anal canal, when compared to other surgical treatments for hemorrhoids. This advantage cannot be underestimated as impaired anal function, including fecal incontinence and other defecation disorders, may occur following surgical treatment for hemorrhoids. Furthermore, this potentially devastating problem can occur in patients of all ages, including younger patients.

REFERENCES

- Goligher JC.** Hemorrhoids or piles. In: Surgery of the Anus Rectum and Colon, 4th edition (ed Goligher JC). London: Bailliere Tindall, 1980: 96
- Gerjy R, Lindhoff-Larson A, Nyström PO.** Grade of prolapse and symptoms of haemorrhoids are poorly correlated: result of a classification algorithm in 270 patients. *Colorectal Dis* 2008; **10**: 694-700 [PMID: 18294262 DOI: 10.1111/j.1463-1318.2008.01498]
- 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 [PMID: 14706597 DOI: 10.1016/j.amjsurg.2002.11.003]
- Schuurman JP, Go PM, Bleys RL.** Anatomical branches of the superior rectal artery in the distal rectum. *Colorectal Dis* 2009; **11**: 967-971 [PMID: 19175645 DOI: 10.1111/j.1463-1318.2008.01729]
- Aigner F, Bodner G, Gruber H, Conrad F, Fritsch H, Margreiter R, Bonatti H.** The vascular nature of hemorrhoids. *J Gastrointest Surg* 2006; **10**: 1044-1050 [PMID: 16843876]
- 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]
- Pucher PH, Sodergren MH, Lord AC, Darzi A, Ziprin P.** Clinical outcome following Doppler-guided hemorrhoidal artery ligation: a systematic review. *Colorectal Dis* 2013; **15**: e284-e294 [PMID: 23489678 DOI: 10.1111/codi.12205]
- Ratto C, Parello A, Veronese E, Cudazzo E, D'Agostino E, Pagano C, Cavazzoni E, Brugnano L, Litta F.** Doppler-guided transanal hemorrhoidal dearterialization for hemorrhoids: results from a multicentre trial. *Colorectal Dis* 2015; **17**: O10-O19 [PMID: 25213152 DOI: 10.1111/codi.12779]
- Ratto C, Parello A, Donisi L, Litta F, Doglietto GB.** Anorectal physiology is not changed following transanal hemorrhoidal dearterialization for hemorrhoidal disease: clinical, manometric and endosonographic features. *Colorectal Dis* 2011; **13**: e243-e245 [PMID: 21689336 DOI: 10.1111/j.1463-1318.2011.02665.x]
- Muñoz-Yagüe T, Solís-Muñoz P, Ciriza de los Ríos C, Muñoz-Garrido F, Vara J, Solís-Herruzo JA.** Fecal incontinence in men: causes and clinical and manometric features. *World J Gastroenterol* 2014; **20**: 7933-7940 [PMID: 24976729 DOI: 10.3748/wjg.v20.i24.7933]
- 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]
- 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]
- 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]
- 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; **15**: 439-444 [PMID: 22033542 DOI: 10.1007/s10151-011-0110-780-7]
- 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 DOI: 10.1007/s10151-011-0801-6]
- Tagliabue M, Cusumano C, Kechoud ES, Paternicò D, Rasini M, Carriero D, Paladino FP.** Hemorrhoidopexy with the HemorPex system. *Tech Coloproctol* 2015; **19**: 255-257 [PMID: 25612565 DOI: 10.1007/s10151-015-1268-7]
- Giamundo P, Cecchetti W, Esercizio L, Fantino G, Geraci M, Lombezzi R, Pittaluga M, Tibaldi L, Torre G, Valente M.** Doppler-guided hemorrhoidal laser procedure for the treatment of symptomatic hemorrhoids: experimental background and short-term clinical results of a new mini-invasive treatment. *Surg Endosc* 2011; **25**: 1369-1375 [PMID: 20976499 DOI: 10.1007/s00464-010-1370-x]
- Giamundo P, Salfi R, Geraci M, Tibaldi L, Murru L, Valente M.** The hemorrhoid laser procedure technique vs rubber band ligation: a randomized trial comparing 2 mini-invasive treatments for second- and third-degree hemorrhoids. *Dis Colon Rectum* 2011; **54**: 693-698 [PMID: 21552053 DOI: 10.1007/DCR.0b013e3182112d58]
- Giamundo P, Geraci M, Tibaldi L, Esercizio L, Agostini S, Testore P, Valente M.** Laser hemorrhoidal arterial closure (HeLP) with recto-anal-repair (RAR): a novel procedure for the treatment of advanced hemorrhoidal disease (Abstract). *Colorectal Dis* 2014; **16** Supp 3: 21-36
- Ratto C, Donisi L, Parello A, Litta F, Zaccone G, De Simone V.** 'Distal Doppler-guided dearterialization' is highly effective in treating hemorrhoids by transanal hemorrhoidal dearterialization. *Colorectal Dis* 2012; **14**: e786-e789 [PMID: 22731786 DOI: 10.1111/j.1463-1318.2012.03146.x]

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