Doppler-guided hemorrhoidal artery ligation

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Abstract

Background: In 1995, Morinaga [1] reported a new technique for the treatment of hemorrhoids, hemorrhoidal artery ligation (HAL), which uses a specially designed proctoscope coupled with a Doppler transducer for identification and ligation of hemorrhoidal arteries.
Methods: Because the arteries carrying the blood inflow are ligated, internal pressure of the plexus hemorrhoidalis is decreased.
Results: We report the results of the first 308 patients (189 male and 119 female; median age 50.1 years) who have been treated at our department since 2002 and followed-up for a median period of 18 months. Eighty-nine patients had grade II, 192 patients had grade III, and 27 patients had grade IV hemorrhoids. The acute symptoms of hemorrhoids were treated immediately by performing HAL.
Conclusions: Our study showed that HAL is painless, effective, and has a low rate of complications. It can be applied in an outpatient setting and is an good alternative to all other hemorrhoid treatment methods. © 2006 Excerpta Medica Inc. All rights reserved.

Keywords: Doppler-guided hemorrhoidal artery ligation; Hemorrhoidal artery ligation; Internal hemorrhoids; New technique

With an incidence of approximately 50%, enlarged hemorrhoidal piles are the most common disease of the rectum. Exact figures are not known because patients usually do not seek early treatment given the nature of the disease. The term "hemorrhoids" describes a plexus of veins located between the lamina muscularis mucosa and sphincter muscle structures. This plexus is supported by elastic tissue and the muscular structure of Treitz (m. canalis ani) and consists of a superior (inner) and inferior (external) part divided by the dentate line. Because of arterial shunts and an extension of veins, this plexus becomes enlarged and plays an important role in fine continence of the anal canal. The system, which is also called the "corpus cavernosum recti," is complex, and some of its functions are still unknown [2]. Hemorrhoids are physiologic and represent a part of the anal sphincter system. Nonphysiologic enlargement and displacement of this anorectal plexus, together with discomfort, must be considered a disease. Although the discussion on the etiology of this disease remains controversial, the 2 different theories often discussed do not exclude each other and may together eventually provide an answer to the etiology of this disease.

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Mechanical Explanation

The muscular fibroplastic supportive tissue of the inferior hemorrhoidal plexus (Parks ligament) degenerates with a patient's age. As a result, the mobility of the plexus increases in relation to the intrarectal pressure. At the same time, the vessels of this plexus become enlarged. The enlarged plexus hemorrhoidalis, plus the increased mobility caused by insufficient supportive structures, are the reason for prolapsing piles. The mucosa becomes more fragile, and bleeding occurs.

Dysfunction of Arteriovenous Shunts

Arteriovenous shunts are usually closed, thus enabling capillary blood exchange. Specific irritation can cause such shunts to open and tissue drops to perfuse. As a result, spasms of the precapillary sphincters occur, and flow through the shunts increases. This leads to high interior pressure and dilation of the hemorrhoidal venous plexus. It also explains the bright red color of the blood presented by bleeding hemorrhoids.

Today, hemorrhoidal disease is considered a typical "civilization" disease, and nutrition, hygiene, and constitution play an important role in its development. The main pathogenetic cause for hemorrhoidal disease is increased intralu-

minal blood pressure of the distal rectum. This results in an unbalance between arterial inflow and venous return. Reasons for the increase in intraluminal blood pressure are multifactorial and most probably individually different. Fiber-free food, high tonus rates of the sphincter apparatus, stress, and anatomic and physiologic factors are currently considered possible causes.

The current well-accepted grading of hemorrhoids [3] is based on the morphology of the piles: grade I = enlarged hemorrhoidal plexus, without prolapse, but with bleeding; grade II = prolapsing piles with spontaneous repositioning of piles; grade III = manual repositioning of piles possible and required; grade IVa = prolapsing piles with acute incarceration and thrombosis; and grade IVb = repositioning of piles impossible; fibrotic prolapse occurs. Other groupings, such as grading symptoms rather than morphology, are not very common today [4].

Modalities of Treating Hemorrhoids

Therapeutic treatment of hemorrhoidal disease ranges from diet to medication. For example, the literature [5, 6] shows that Daflon has a positive influence on the bleeding tendency of grade I hemorrhoids. According to Blaisdell [7] and Barron [8], infrared coagulation [4], sclerotherapy, and, particularly, rubber-band ligation are generally accepted and popular procedures that have generated good results and low complication rate in grades II and III hemorrhoids. The disadvantages of these methods include necessity of several sessions for successful results, impaired sense of well-being caused by foreign-body sensation or pain (10% in the case of rubber-band ligation), occurrence of necrosis, or allergic reactions to the sclerosant. Laser therapy with neodymium: yttrium aluminum garnet or carbon dioxide lasers is an alternative, but not widely accepted, treatment because the equipment is expensive. Furthermore, the success of all conservative therapies is directly related to the stages of the piles treated. In most cases several sessions are required, and recurrence rates are relatively high.

Conventional surgical hemorrhoidectomy according to Milligan and Morgan [9] or the one modified by Parks [10] represent the most effective treatments of inferior hemorrhoids currently available. These surgical interventions usually require several days of inpatient treatment and may lead to severe postoperative pain. Longo's [11] technique, resection of the mucosal prolapse and the possibility of severe complications, can be considered moderately invasive. Other techniques, such as the one described by Whitehead, are obsolete today [12]. In the case of all techniques, it must be remembered that the plexus hemorrhoidalis (corpus cavernosum recti) plays an important role within the anal sphincter apparatus and that there is a fine line between successful treatment and the risk of damaging the anal sphincter.
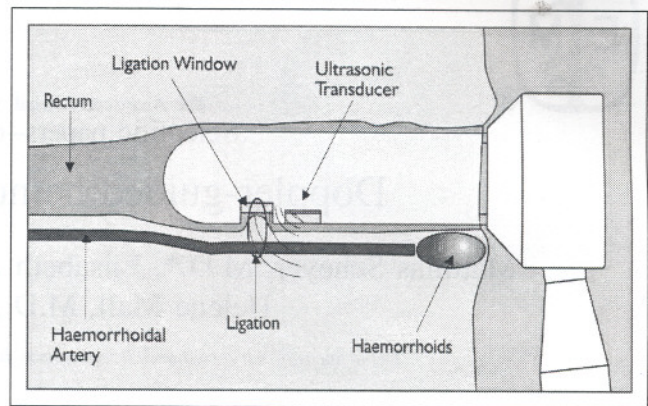

Fig. 1. Schematic illustration of the HAL-Doppler proctoscope in the anal canal during ligation.

Methods

In 1995, Morinaga described a new technique for the treatment of hemorrhoids [1]. The intraluminal arteries are located 2 cm proximal to the dentate line and ligated by means of a special proctoscope, which contains an integrated Doppler transducer and a lateral ligation window. The Doppler transducer is located distal to the lateral ligation window. With the applied frequency of 8.2 Mhz and an introduction angle of approximately 60°, a screening depth of approximately 7 mm is provided. Because the arteries carrying the blood inflow are ligated, the internal pressure of the plexus hemorrhoidalis is decreased, and the typical symptoms of hemorrhoids disappear. We preferred spinal anesthesia when we started using this method, but it soon became obvious that this kind of therapy can be offered under local anesthesia as well. One hour before the procedure, we apply Emla gel (Astra Zeneca, Vienna, Austria) to the perineal region. Putting the patient in the lithotomy position works best. After cleaning the perineal skin region and covering the patient with sterile draping, the perineal area is locally infiltrated at 3 and 9 o'clock with 2% Xylocaine (Astra Zeneca). Simultaneously, the patient is intravenously sedated with 5 mg Midazolam. Subsequently, the anal canal is gently dilated to a width of 2 fingers. The special proctoscope (A.M.I.-HAL Doppler II, which was provided to us by A.M.I. Austria for the duration of this study) is inserted, and the arteries are located and then ligated (Fig. 1). A.M.I. HAL sutures (2/0 synthetic braided absorbable) are attached to a 5/8 needle to facilitate easy passage through the ligation window of the proctoscope. The localized arteries are double ligated in a figure-of-eight shape. This facilitates the lifting of the mucosa into the anal canal, and one can also see if the first ligation throw caught the located artery by listening for the Doppler signal to disappear when the suture is carefully pulled tight. The figure-of-eight ligature also facilitates secure hemostasis of bleeding that may occur with the first stitch. Typically, the circumferential intraluminal arteries are located in the right posterior lateral, right middle lateral, right anterior lateral,

Table 1
Preoperative symptoms

Symptoms	All	II*	III	IV
Anal pain	150	46	86	18
Hemorrhage	241	72	144	25
Prolapse	165	33	105	27
Anal itching	73	24	38	11
Discharge	47	16	23	8

* Hemorrhoid grade.

left anterior lateral, left middle lateral, and left posterior lateral positions (1, 3, 5, 7, 8, and 11 o'clock). Once all arteries are located and ligated, an anal sponge covered with Xylocaine gel is inserted into the anal canal. The patient is discharged after the first painless defecation. A 6-week postoperative check-up by rectoscopy is scheduled. Patient inquiry by telephone was conducted with all patients treated up to June 2001. In addition, a standardized questionnaire was used. We asked for any present proctologic problems as well as each patient's opinion about this type of treatment. Patients mentioning any kind of symptoms were asked to present to us for a proctologic diagnosis.

Results

From January 2000 through December 2002, 308 patients were treated by Doppler-guided HAL. The group consisted of 189 male and 119 female patients (age 22 to 84 years; median age 50.1 years). Main symptoms when consulting a physician were anal pain, bleeding, and prolapsing piles (Table 1). A positive Hemoccult test led to the transfer of 1 patient to our surgical department.

The method was applied to 89 patients with grade II, to 192 patients with grade III, and to 27 patients with grade IV hemorrhoids. Patients with grade I hemorrhoids were treated conservatively by diet, normalization of stool consistency, oral therapy with micronized purified flavonoid fraction (Daflon), and local applications with suppositories.

When we first started using this therapy, we performed it with the patient under spinal anesthesia. Because of the problems we experienced with this kind of analgesia—such as contraindications because of spinal disorders, headache, or urinary retention—we started a trial with soft sedation and perianal infiltration with 2% Xylocaine. This proved to be sufficient without compromising patient comfort.

On average, 6 ligatures were placed. Pulsation was no longer detected in 66 patients after as few as 2 to 4 ligatures. In 25 patients, >10 ligatures were required until the Doppler signal was no longer detectable. We view this latter result as a sign of the high variety of arterial blood supply in this region. In contrast, difficulties in handling the system during the learning curve should also be considered. Furthermore, there seems to be a correlation between grade of hemorrhoids treated and number of ligatures applied.

Table 2
Postoperative complications

Complications	All = 308	*II = 89	III = 192	IV = 27
Residual protrusion	48 (15.6)†	6.7‡	13.5	59.3
Bleeding	15 (4.8)	2.2	6.8	3.7
Thrombosis	9 (2.9)	1.1	4.2	0
Defecation pain	5 (1.6)	1.1	2.2	0
Fissure	4 (1.3)	1.1	1.0	3.7
Urinary retention	4 (1.3)	0	1.6	3.7
Urinary infection	2 (0.6)	0	1.0	0
Stool retention	1 (0.3)	1.1	0	0
Fistula	1 (0.3)	0	0.5	0
Proctitis	1 (0.3)	0	0.5	0

* Hemorrhoid grade.
† n (%).
‡ %.

Only 15% of all patients required pain relief therapy with Diclofenac, 3×50 mg/d, for a period of 3 days. Additionally, we prescribed Daflon for all patients, 2×50 mg/d orally for a period of 14 days [6].

Average length of hospitalization was 2 days. Twenty-five patients were treated and released on the same day, which caused some reimbursement problems for the hospital. This administrative issue was the reason why 167 patients were discharged on the postoperative day 1. Simultaneous procedures, such as fissurectomies, resection of skin tags, and herniorraphies, were conducted in 23 patients, which caused a longer hospital stay for this group.

The acute symptoms of hemorrhoids were treated immediately by HAL. The final success of the therapy, however, was seen 6 weeks after surgery. By then, the retrieval and shrinking of the piles was finished, a fact that was easily confirmed by control rectoscopy.

Recurrence of piles in 15.6 of patients was the main complication (Table 2). However, the remaining piles in grade IV patients lead to this high rate of recurrent piles and to the question of whether this method is indicated for treatment at this stage. We also decided to apply HAL for the redo procedures. If piles still remained after the second HAL procedure, they were finally treated by a Milligan/Morgan hemorrhoidectomy. In these patients, we noticed that the required area of resection was much smaller compared with primary Milligan/Morgan hemorrhoidectomies. As a result of pretreatment with HAL, the risk of complications of surgical hemorrhoidectomy was significantly decreased. Because 40% of our grade IV patients also benefited from HAL, we propose the following strategy: (1) first procedure HAL–postoperative check-up after 6 weeks; (2) second procedure HAL, possibly combined with Milligan/Morgan–postoperative check-up after 6 weeks; and (3) third procedure Milligan/Morgan.

The technique PPH-stapler hemorrhoidectomy according to Longo [11] is still being discussed. Because we have had patients with severe complications, such as a high transsphincter fistula and bleeding, this method is seldom applied at our clinic. Randomized studies are needed to evaluate

Table 3
Questionnaire: symptoms after 18 months

Symptoms*	Sometimes	Yes	No
No. defecation pain (%)	7 (8.75)	9 (11.25)	64 (80)
hemorrhage	8 (10)	9 (11.25)	63 (78.75)
	16 (20)	21 (26.25)	43 (53.75)
proctoscopy	9 (11.25)	12 (15)	
anal itching	7 (8.75)	8 (10)	65 (81.25)
discharge	6 (7.5)	7 (8.75)	67 (83.75)
constipation	2 (7.5)	25 (31.25)	53 (66.25)

* Fifteen patients (18.75%) needed drugs or ointments, and 5 patients had anal incontinence.

whether the primary application of the Longo technique [11], when considering the possible serious complications associated with it, offers advantages compared with HAL.

We observed minor postoperative bleeding and oozing from the ligation areas, but this could easily be stopped by rectoscopy and the injection of adrenaline. Three patients, however, developed low blood pressure symptoms because continuous oozing was not identified at other outpatient departments. Thromboses of the hemorrhoids (2.9%), caused by the closure of the venous return, were easy to treat by incisions with the patient under local anesthesia. We still do not know what caused the proctitis observed in 1 patient who required treatment, but we assume it was the result of an allergic reaction to Xylocaine gel or the suture material (2/0 braided polyglycolic acid). A submucosal fistula was diagnosed postoperatively in 1 patient. This fistula was dissected during a second session and healed without any further problems. The postoperative check-up conducted 6 weeks after the procedure revealed therapeutic success in 96% of patients who presented with hemorrhoidal bleeding. Prolapse was no longer observed in 75% of patients, and 95% of patients experienced no pain after the procedure.

Up to June 2001, a total of 133 patients had been treated by HAL. Eighty patients (60.1%) responded to our inquiry conducted at the beginning of 2003 (Table 3). Eighty percent of these patients confirmed that they no longer experienced any bleeding or pain during defecation, but 46% of patients contacted reported recurrent hemorrhoidal piles. After we made a proctologic diagnosis of these patients' problems, it became obvious that 20% of them considered the remaining skin tags after HAL to be prolapsing piles. We offered to remove the skin tags with the patient under local anesthesia. Of the patients contacted, 18.75% required pharmaceutical therapy. Five patients reported symptoms of grade II fecal incontinence. A preoperative anal sphincter function diagnosis was not conducted. Therefore, it is impossible for us to know whether this anal sphincter dysfunction was already present preoperatively and if the symptoms of incontinence were compensated for by prolapsing hemorrhoidal piles. We do not see a direct relation to the procedure as such. When asked for their opinion, 55% of patients reported no pain after the procedure, 22.5% felt pain for 1 to 3 days, 16.25% felt pain for ≤1 week, and 6.25% reported pain for >1 week. When asked for their timeline to normal activities, 32.5% of patients returned immediately to normal life-style; 55% needed ≤1 week to return to normal life-style; and 12.5% returned to normal-life style in >1 week. The stress induced by the procedure was considered to be minor by 90% of patients and 71.25% of patients were satisfied with the results of the HAL procedure; 91.25% of patients would again ask for HAL treatment if necessary; and 93.75% of patients would recommend HAL to a friend.

Comments

We believe that Doppler-guided HAL is a painless, easily learned, and minimally invasive therapeutic technique that offers a good alternative to all other known treatments of symptomatic hemorrhoids. All stages of hemorrhoidal disease can be treated using HAL. There is always the possibility of revascularization and recurrence of symptomatic hemorrhoids, but this procedure can be repeated at any time. Furthermore, it is possible at any time after HAL to switch to another procedure such as rubber-band ligation, Longo, or hemorrhoidectomy. During the postoperative check-up 6 weeks after the procedure, scar tissue that had been firmly connected to the underlying tissue structure was seen in areas where ligatures had been placed. Using HAL, decreased arterial inflow and fixation of the mucosa, after some lifting into the anal canal (figure-of-eight ligature), are achieved. The complications are comparable with those associated with other methods, but no severe complications were observed. The HAL procedure is synonymous with a high level of patient comfort and is perfect for outpatient treatment, as has been shown in the first prospective studies [13].

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