

# Doppler-Guided Hemorrhoidal Artery Ligation and Rectoanal Repair (HAL-RAR) for the Treatment of Grade IV Hemorrhoids: Long-Term Results in 100 Consecutive Patients

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**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) ligations 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.

**KEY WORDS:** Hemorrhoids; Rectal bleeding; Hemorrhoidal prolapse; Hemorrhoidal artery ligation; Rectal mucopexy; Rectoanal repair.

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Surgery is the treatment of choice for hemorrhoids that have failed to respond to conservative measures. Doppler-guided hemorrhoidal artery ligation (HAL), first described by Morinaga,<sup>1</sup> is an alternative to hemorrhoidectomy or hemorrhoidopexy for grade II and grade III hemorrhoids. However, HAL alone has proven less effective in the case of grade IV hemorrhoids.<sup>2</sup> To address this shortcoming, a new proctoscope was designed to allow a combination of classical HAL with a transanal rectal mucopexy that serves to lift and secure the protruding hemorrhoids in place.<sup>3,4</sup> The term rectoanal repair (RAR) has been used to designate either the combined procedure,<sup>3,4</sup> or as in the present report and others,<sup>5-7</sup> the mucopexy step alone.

We report here our initial experiences with the HAL-RAR procedure for grade IV hemorrhoids.

## PATIENTS AND METHODS

Consecutive patients with grade IV hemorrhoids treated with the HAL-RAR procedure from April 28, 2006, to December 12, 2008, were included in the study. The indication for the HAL-RAR procedure was the presence of permanent prolapsed hemorrhoids, with or without bleeding or pain.

The operation was performed under general or spinal anesthesia, with the patient in the lithotomy position. After the anal canal had been lubricated with electroconductive gel, the special proctoscope (A.M.I. Agency for Medical Innovations Ltd, Feldkirch, Austria), which was equipped with a Doppler transducer and attached to the HAL unit (A.M.I. HAL II Doppler Unit), was inserted into the rectum to search for branches of the distal rectal arteries. Once located, each artery was ligated through the proctoscope's lateral ligation window positioned just above the Doppler transducer. The window was illuminated by a built-in light source, allowing for the easy placement of sutures at a depth of 3 mm to 6 mm from the surface under clear vision. The specially designed needle holder and knot pusher were used to place a "figure-of-eight" stitch and then tie the knot, as described previously.<sup>2</sup> After each ligation, the proctoscope was rotated slowly to locate further rectal arteries approximately 3 to 4 cm above the dentate line. Once a full rotation had been made, the procedure was repeated approximately 15 mm below the first series of sutures. The ligations were performed using a special, slowly resorbable stitch (A.M.I. HAL Suture, 2/0 polyglycolic acid, tapered needle, 5/8 circumference, reinforced needle-thread connection). The position of each ligation was reported on the unit's screen, and a full list of all ligations was printed at the end of each procedure.

After the ligations were made, the RAR procedure was performed at the positions where a hemorrhoidal prolapse had been identified. A detailed description of procedure was reported previously by Satzinger et al<sup>4</sup> Briefly, this

transanal mucopexy was carried out using the same, specially designed proctoscope as used for the HAL procedure. Continuous running sutures were applied longitudinally in a proximal-to-distal direction in the lower part of the rectum, just above the prolapsed hemorrhoid. The number of mucopexies depended on the number of prolapsed hemorrhoids and ranged from 1 to 4. Care was taken to remain above the dentate line with the last 3 bites of the running suture to avoid postoperative pain. Tying the 2 ends of the suture together served to lift the prolapsing mucosal tissue back up into the anal canal. No tissue was excised.

Data such as operating time, number of ligations, and number of mucopexies and associated procedures were collected prospectively. Postoperative symptoms (pain, bleeding, fever, rectal discomfort, etc) were also documented immediately following the operation. Patients were discharged according to French day-case hospitalization criteria. Clinical follow-up examinations were scheduled on an outpatient basis for all patients at 2, 6, and 12 months, and annually thereafter.

Each time patients reported having pain, the severity was graded on a visual analog scale ranging from 0 (no pain) to 10 (the worst pain imaginable), whereby we considered a score of 3 or more to be significant (scores of 1 or 2 did not require medication). Hemorrhage was defined as any bleeding that was considered significant by the patients themselves. According to French healthcare system guidelines for ambulatory surgery, patients were instructed to call the colorectal nurses in case of any abnormality due to pain, bleeding, fever, or other complication. Such patients then received prompt examination by a surgeon in the outpatient clinic.

Results were recorded as the mean (range), median, or percentage of the total number of cases analyzed.

## RESULTS

From April 28, 2006, to December 12, 2008, the HAL-RAR procedure was performed on 100 consecutive patients with grade IV hemorrhoids (64 women and 36 men). The mean age was 50 (range, 21-85) years. All patients had a history of persistent symptoms despite having undergone conservative treatment measures ( $n = 100$ ), instrumental treatment such as rubber band ligation, photocoagulation with or without injection sclerotherapy ( $n = 58$ ), or previous surgery ( $n = 19$ ). In the 19 patients who had previously had surgery, a Milligan-Morgan hemorrhoidectomy had been performed in 3, a Longo hemorrhoidopexy in 9, and a HAL procedure in 7 patients (5 of whom were included in our previously published report on HAL<sup>2</sup>).

All 100 patients had permanent prolapsed hemorrhoids, associated with bleeding in 80 patients and with pain in 71 patients (Table 1). Most of the patients also

**TABLE 1.** Patient symptoms before operation and at end of follow-up

Preoperative symptoms	Total	Symptoms at end of follow-up			
		None	Prolapse	Bleeding	Prolapse + Bleeding
Prolapse alone	3	2	1	0	0
Prolapse + bleeding	26	24	0	1	1
Prolapse + pain	17	15	1	1	0
Prolapse + bleeding + pain	54	45	0	3	6
Total	100	86	2	5	7

presented with skin tags, which were seldom the main complaint.

Forty-four patients had had symptoms for more than 10 years, 18 patients for 5 years to 10 years, and 38 patients for less than 5 years. Eight patients had suffered from hemorrhoidal thrombosis in the past, and 4 had undergone surgery for an anal fissure.

The mean operating time was 35 minutes (range, 17–60). General anesthesia was used in 29 patients. A mean of 9 ligations were placed per patient (range, 4–14). The number of mucopexies performed was 1 in 47 patients, 2 in 39 patients, 3 in 11 patients, and 4 in 3 patients. Twenty-four patients underwent an associated procedure: excision of skin tags in 23 patients and treatment of an anal fissure in 1 patient. In 84 patients, the HAL-RAR procedure was performed on an outpatient basis with discharge on the day of the operation; 11 patients remained hospitalized for 2 days, 3 patients for 3 days, and 2 patients for 4 days. Hospitalization was necessary because of unfavorable social conditions in 9 patients and for medical reasons in 7 patients (frailty in 6; psychiatric reasons in 1). It should be noted that 9 patients underwent surgery while being treated with vitamin K antagonists or platelets inhibitors.

Nine patients (9%) developed early postoperative complications. Six patients called the nurse because of pain (pain scores on the visual analog scale: 5, 4, 4, 4, 3, and 3); pain relief was obtained with paracetamol (3,000 mg per day) in 6 patients, with the addition of ketoprofen (200 mg per day) in 4 patients. Four patients presented with episodes of bleeding, but none were returned to surgery or transfused, and rectal examination indicated no abnormalities. Dyschezia was reported by 1 patient and was managed conservatively with paraffin oil and suppositories. Thrombosis of residual hemorrhoids occurred in 3 patients, who were also treated conservatively. All patients recovered fully and had no further complaints at the 2-month follow-up visit.

The mean follow-up was 34 (range, 14–42; median, 32) months for the whole series of 100 patients. No patient was lost to follow-up. Late complications occurred in 4 patients (4%): dyschezia lasting for 31 months in 1 patient, temporary urgency without anal incontinence at 4 months in 1, thrombosis of residual piles at 4 months in 1, and anal fissure at 12 months in 1. All were managed conservatively

with success. Eight patients requested that 1 or 2 skin tags be removed. Surgery was performed on these patients under local anesthesia at a mean time of 5.5 (range, 2–14) months after the HAL-RAR procedure, and no further complaints were noted.

As shown in Table 1, some form of re-bleeding occurred in 12 patients. Of these, 5 did not request particular treatment and showed no abnormalities on rectal and anal examination. Seven of the patients with re-bleeding also had recurrent hemorrhoidal prolapse and 2 further patients had recurrence of prolapse without bleeding, at a mean postoperative time of 10.9 (range, 3–23) months, yielding a recurrence rate of 9%. Although HAL-RAR was considered to have failed in these patients, further treatment was carried out with success (repeat HAL-RAR procedure in 3 patients, Milligan-Morgan hemorrhoidectomy in 3 patients, and conservative measures in the remaining 3 patients).

## DISCUSSION

Hemorrhoidectomy is considered to be a radical, definitive technique for treatment of hemorrhoids<sup>8</sup> and is regarded as the gold standard against which all other procedures must be measured. However, the morbidity rate after hemorrhoidectomy is between 10 and 15%.<sup>9</sup> Hemorrhoidopexy aims to restore the natural relationship between anal mucosa and the internal sphincter and to reduce the prolapse and interrupt the vascular supply to the plexuses.<sup>10</sup> In almost every prospective randomized trial, results of stapled hemorrhoidopexy show a significant reduction of postoperative pain, a considerably shorter hospital stay, and an earlier return to work.<sup>11–13</sup> However, early experiences with stapled hemorrhoidopexy described severe complications such as persistent pain, pelvic sepsis, hemorrhage, rectal obstruction, rectal perforation, rectovaginal and rectourethral fistulas, peritonitis, and fecal incontinence.<sup>14–21</sup> Moreover, long-term follow-up of patients who have undergone hemorrhoidopexy has demonstrated increasing problems of recurrence.<sup>22</sup>

Doppler-guided HAL is a minimally invasive technique that is virtually painless for the patient, is easy for the surgeon to learn and to perform, and offers an effective alternative to other surgical treatments of symptomatic

**TABLE 2.** Results of studies carried out with the Doppler-guided HAL-RAR technique

Study	Year	n	Hemorrhoid grade %	Ligations n (range)	Mucopexy n	Duration of operation min	Early complications n	Hospital stay days	Recurrence %	Follow-up mo
Theodoropoulos et al <sup>5</sup>	2008 <sup>a</sup>	46	III, 33 IV, 67	10 (6–16)	1 to 4	NS	Bleeding, 1 Tenesmus, 1 Prolapse, 1	1	8.6	15
Infantino et al <sup>25</sup>	2009 <sup>a</sup>	112	II, 35 III, 65	7 (4–11)	3 to 5	34	Bleeding, 1 Thrombosis, 3 Urinary retention, 1	1	13	15
Walega et al <sup>6</sup>	2009 <sup>a</sup>	29	III+IV, 100	5 (4–9)	1 to 4	35	Bleeding, 1	2	NS	3
Satzinger et al <sup>4</sup>	2009	83	III, 90 IV, 10	6 (3–11)	1 to 6	27	Pain, 1 Thrombosis, 2 Urinary retention, 3 Abscess, 1	3	6	12
Ratto et al <sup>26</sup>	2010	56	II, 9 III, 82 IV, 9	6	NS	30	Bleeding, 2 Thrombosis, 4	1	4	11.5
Present series	2010	100	IV, 100	9 (4–14)	1 to 4	32	Bleeding, 4 Thrombosis, 3 Pain, 6 Dyschezia, 1	1	9	34

HAL-RAR = hemorrhoidal artery ligation with rectoanal repair (mucopexy); NS = not specified.  
<sup>a</sup>Date refers to electronic publication ahead of print. Year of print publication is 2010.

hemorrhoids. By means of the Doppler proctoscope, the HAL-RAR method serves to interrupt the arterial blood supply to the anal cushions and to lift the prolapse by gathering up the mucosa. Subsequently the connective tissue in the collapsed hemorrhoid regenerates, and in time, the prolapse is completely resolved. Early complications reported for Doppler-guided HAL are rare, and minor in nature. Most patients can be discharged as outpatients on the day of surgery. Of our first series of patients treated with HAL,<sup>2</sup> 21% were suffering from grade IV hemorrhoids, and most of them presented with recurrent symptoms within 3 years of follow-up. In the largest series published to date, Scheyer et al<sup>23</sup> observed a recurrence rate of 15.6%, with most cases of residual prolapse occurring in patients treated for grade IV hemorrhoids.

Supplementing ligation of the rectal arteries with RAR, i.e., segmental mucopexy of prolapses, may allow a more effective cure for grade IV hemorrhoidal disease, and hence a reduction in the recurrence rate. The 9% recurrence rate observed in our study, with a mean follow-up of 34 months, was lower than recurrence rates in our previously published series of patients treated with the HAL procedure alone.<sup>2</sup>

The Goligher classification<sup>24</sup> is the most commonly used guideline for suggesting treatment, comparing series, and following up patients in prospective studies of hemorrhoidal disease. However this classification can never be exact, as hemorrhoidal disease is a fluctuating condition that may change from one period to another, and grade IV disease includes a very broad range of external hemorrhoids (from a single limited prolapsed hemorrhoid to a

circumferential hemorrhoidal prolapse). A hemorrhoidectomy provides treatment suitable for a circumferential hemorrhoidal prolapse in all instances, even if the prolapse in question is only minor, while a hemorrhoidectomy aims to treat the prolapse in the 3 most common positions, even if the venous distension is circular. One of the advantages of the HAL-RAR procedure is that it can be tailored to best treat each individual case, because the number of arterial ligations depends on the blood pulsations detected, and the number of mucopexies depends on the number of prolapses identified. Particularly in this respect, the HAL-RAR technique would appear to be more suitable than many other methods.

Interestingly, HAL-RAR was performed in the present series with no complications in 9 patients who were being treated with vitamin K antagonists or antiplatelets medication at the time of surgery. This observation represents another advantage of the technique, as in most cases the risk of severe bleeding dictates that such medication be stopped if a patient is considering undergoing a hemorrhoidectomy or hemorrhoidopexy.

HAL-RAR is a relatively new technique and, to our knowledge, only 5 series have been published to date<sup>4–6,25,26</sup> (Table 2). In addition, Conaghan and Farouk<sup>7</sup> reported on 8 patients who had recurrent hemorrhoidal disease after undergoing the HAL procedure alone and were subsequently treated with HAL-RAR. In the present series, we also performed HAL-RAR on 7 patients who had previously been treated with the HAL procedure. Thus, repeating the procedure does not seem to present any particular difficulty, and this observation represents a further

advantage of HAL-RAR over hemorrhoidectomy or hemorrhoidopexy. In the published series, the mean number of ligations per patient ranged from 5 to 10, while the number of mucopexies per patient ranged from 1 to 6. The duration of the operation was approximately 30 minutes. Complications were rare and in most cases did not delay patient discharge. Most patients were treated as outpatients, with the exception of the series reported by Satzinger et al,<sup>4</sup> in which 87% of patients were hospitalized for 3 days as required by the Austrian healthcare system. In the present series, the very few patients who requested hospitalization for more than 1 day did so for social or medical reasons. The French healthcare system covers these costs.

As the new equipment designed especially for the HAL-RAR procedure has only been available from 2005 onwards, the mean follow-up in the various series published is short (Table 2). Our series is the first to document a mean long-term follow-up of 34 months, and the results suggest that symptoms and recurrence rates remain stable over time. This may seem surprising when one considers that the mucosa has simply been sutured and subsequently healed, without an incision being made. The mucopexy is based on the theory that hemorrhoidal disease stems from an increased laxity of the connective tissue and an increased arterial inflow, as supported by findings reported by Aigner et al<sup>27</sup> Running sutures can be placed to lift all the corresponding hemorrhoidal prolapses. After 2 to 4 months, the sutures have been resorbed, and scar tissue remains where the hemorrhoidal plexuses were treated. Ligation of the distal branches of the rectal arteries during the HAL procedure (step 1), with the subsequent mucopexy or RAR (step 2), reduces but never totally blocks the blood inflow to the hemorrhoidal cushions. Therefore, necrosis of the hemorrhoidal tissue has never been reported. However, because the hemorrhoidal plexuses remain in place and the network of arteries and veins above them is partially blocked, secondary thrombosis may occur, as was the case in the present study and in other reports.<sup>4,25</sup>

The 2 main weaknesses of the present study are the lack of very long-term results and the absence of a comparison among this procedure, hemorrhoidectomy, and hemorrhoidopexy regarding technical and functional results. A prospective, multicenter French study is currently in progress, with the aim of partially addressing this issue and answering the economic question of which procedure is the most cost effective.

## CONCLUSION

Doppler-guided HAL-RAR is safe, easy to perform, and can be tailored to suit each individual case. This procedure should be considered as an effective treatment option for grade IV hemorrhoids.

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