Doppler-guided hemorrhoidal artery ligation with recto-anal repair versus Milligan Morgan hemorrhoidectomy for grade IV hemorrhoids

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Background
Milligan Morgan (MM) hemorrhoidectomy is associated with significant postoperative pain and late return to daily activities. Doppler-guided hemorrhoid artery ligation with recto-anal repair (DG-HAL with RAR) is a minimal-invasive surgical treatment for hemorrhoids that has been used as an alternative method in order to reduce these inconveniences.

Objective
The aim of this study was to compare the results of the two procedures in the management of grade IV hemorrhoids.

Methods
This prospective, randomized, clinical study was carried out between June 2011 and June 2015. It included 126 patients with grade IV hemorrhoids, who were divided into two equal groups: group A, in which 63 patients were operated for DG-HAL with RAR; and group B, in which 63 patients were operated for MM hemorrhoidectomy. Patients were evaluated preoperatively and postoperatively at 1 week, 1 month, 6 months, and 1 year. The follow-up period was 1 year.

Results
The mean age was higher in group A patients ($P = 0.003$). The operative time was significantly longer in group A ($P > 0.001$). The first defecation occurred sooner in group A ($P = 0.006$) than in group B. The mean hospital stay was significantly shorter in group A ($P > 0.001$). Moreover, the return to work was achieved significantly earlier in group A ($P > 0.001$). The postoperative pain score (visual analog scale) was significantly less in group A patients, especially during defecation ($P > 0.001$). The postoperative consumption of class II and III analgesics was significantly less in group A than in group B ($P > 0.005$). After 1 year of follow-up, there were no significant differences between the two groups as regards postoperative complications, recurrent prolapse, anorectal function, and fecal continence.

Conclusion
DG-HAL with RAR is an effective minimal-invasive procedure with results comparable to MM hemorrhoidectomy for the treatment of grade IV hemorrhoids with fewer complications, less postoperative pain, shorter hospital stay, and earlier return to work.

Keywords:
hemorrhoidal artery ligation, hemorrhoidectomy, hemorrhoids, recto-anal repair

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Introduction

Hemorrhoids are highly vascularized tissues located in the submucosa of the anal canal that help in maintaining the fecal continence [1]. Hemorrhoid disease can be defined as the symptomatic enlargement and protrusion of normal anal cushions [2]. Milligan Morgan (MM) hemorrhoidectomy is considered the gold standard for the surgical treatment of hemorrhoids [3]. However, this procedure is associated with significant postoperative complications including pain, sepsis, anal stenosis, bleeding, and incontinence [4]. In an effort to decrease postoperative pain, two new techniques have been proposed in the last two decades: stapled hemorrhoidopexy and Doppler-guided hemorrhoidal artery ligation (DG-HAL). Both techniques result in less postoperative pain, a shorter hospital stay, and greater patient satisfaction [5–11]. Numerous case reports have exposed some of the potential risks with stapled hemorrhoidopexy, including bleeding, large bowel obstruction, retroperitoneal sepsis, recto-vaginal fistula, and rectal perforation [12,13]. DG-HAL was first described by Morinaga *et al.* [14]. It has been shown to be safe and effective in the treatment of hemorrhoids and to be associated with a small learning curve [15]. From the time of its introduction, numerous devices have been developed. The most recent modification of selective hemorrhoidal artery ligation method, the recto-anal repair (RAR), combines selective DG-HAL with plication of the

prolapsed rectal mucosa, using the specially designed proctoscope (A.M.I. Trilogy) (Fig. 1). The aim of this procedure is to reduce the enlarged hemorrhoids by ligation of the hemorrhoidal arteries and to restore the anatomical position of the prolapsed mucosa instead of excision of the hemorrhoids [16–19].

Methods

This prospective, randomized, clinical study was carried out in Al Ahli Hospital, Qatar and Al Amiri Hospital, Kuwait, between June 2011 and June 2015. It included 126 patients with grade IV hemorrhoids, who were divided into two equal groups: group A, in which 63 patients were operated for DG-HAL with RAR; and group B, in which 63 patients were operated for MM hemorrhoidectomy. The follow-up period was 1 year.

The protocol was approved by an ethics committee. A written consent and IRB forms were obtained from all patients for the surgery after they had been explained in detail the procedures to be used in the study, and their possible complications and postoperative symptoms.

The main inclusion criteria were grade IV hemorrhoid disease and age between 20 and 70 years. Exclusion criteria were elderly individuals above 70 years, pregnancy, inflammatory bowel diseases, rectal malignancy, acute hemorrhoid episodes with thrombosis, prior hemorrhoidectomy, and intercurrent anal pathology (fistula and/or fissure). The main end point was a comparison of the two groups with respect to postoperative pain. Secondary end points included outcome in the mid-term (after 1 year).

Preoperatively, all patients underwent full clinical examination including digital rectal examination and proctoscopy, as well as complete blood count, prothrombin time, partial thromboplastin time, and international normalized ratio. All patients above 40 years underwent full colonoscopy before the operation to exclude any colonic pathology.

On the day of surgery, all patients received 2 g ceftriaxone and 500 mg metronidazole intravenously and a fleet enema was given 3 h before the operation. Both procedures were carried out under general anesthesia in the lithotomy position.

Doppler-guided hemorrhoidal artery ligation with recto-anal repair procedure

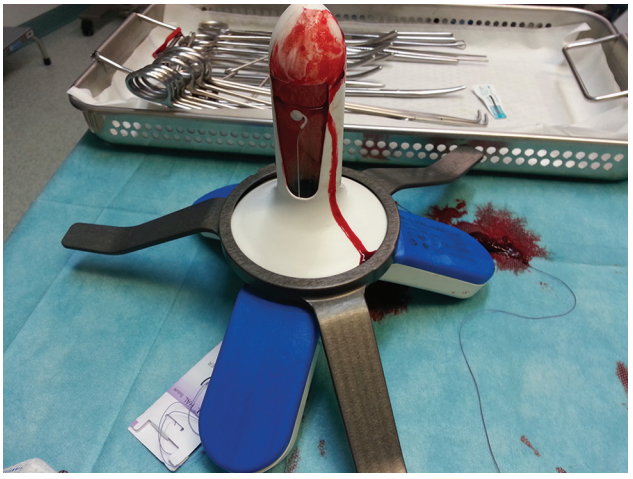
The first stage of the operation consisted of standard DG-HAL using an A.M.I. Trilogy (Austria) DGHAL-RAR proctoscope, (Figs. 1 and 2). Then, the Doppler probe was placed around 3–5 cm above the dentate line to identify the branch of the superior rectal artery (Fig. 3). The accurate detection of the branches of the superior rectal artery was confirmed via Doppler sound. Subsequently, a figure of eight suture was conducted using vicryl 2-0 at the rectal mucosa where the artery had been identified using the proctoscope (Fig. 4). After accurate ligation had been confirmed via loss of the doppler vein signal, it was firmly ligated using a knot pusher (Fig. 5).

The second stage, after the hemorrhoidal mass had been exposed between the proctoscope and the sleeve by rotating the proctoscope, RAR was conducted in a way that hemorrhoidal mass was sequentially sutured from the artery ligation site to 5 mm above the dentate line by using the vicryl used for artery ligation, and was firmly ligated in place on the rectal mucosa (Fig. 6). The aforementioned procedure was performed on six sites (toward 1, 3, 5, 7, 9, and 11 o'clock) starting from the lower middle of the anus and going clockwise.

Figure 1

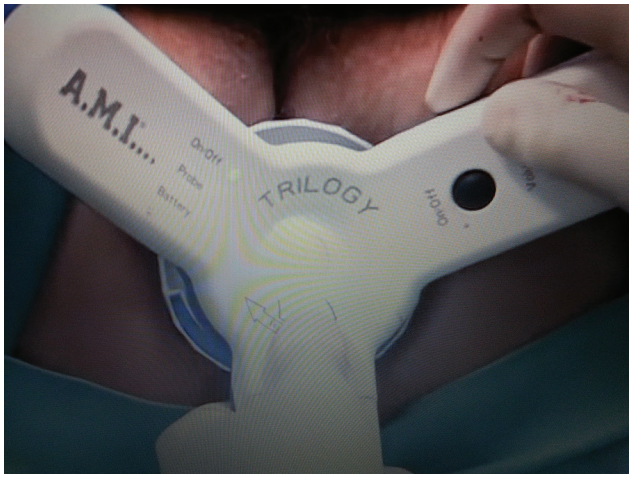
A.M.I. Trilogy proctoscope.

Figure 2



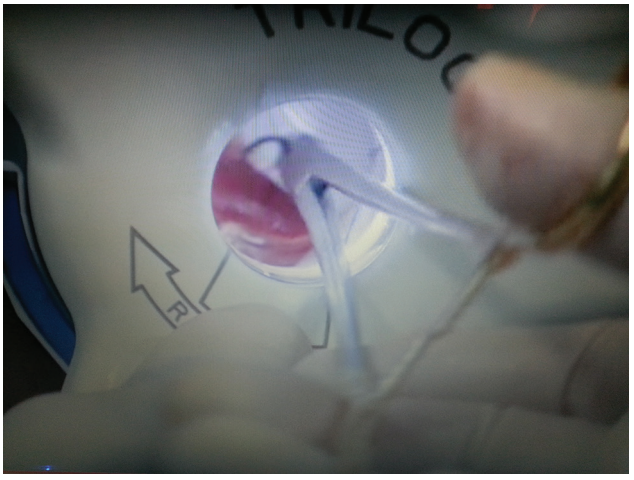
The built-in Doppler ultrasound sensor in the A.M.I. proctoscope.

Figure 3



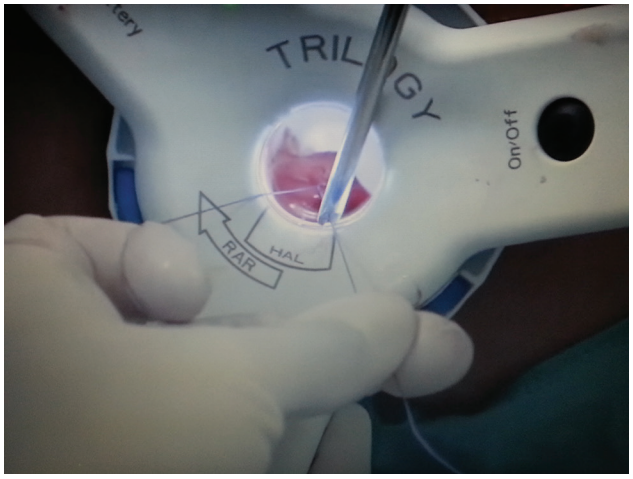
Insertion of the A.M.I. Trilogy proctoscope into the anal canal.

Figure 4



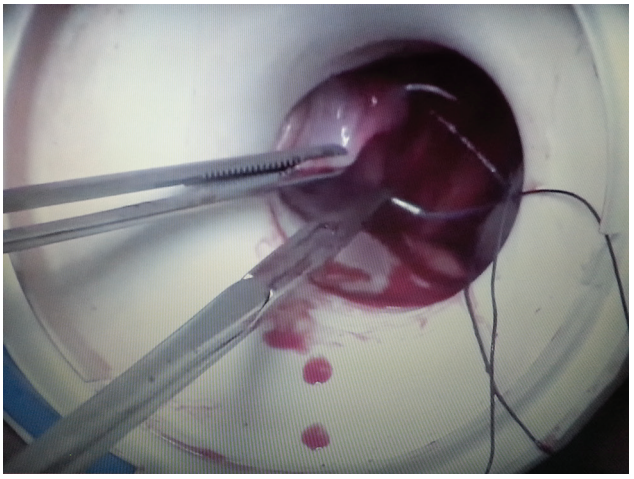
Ligation of one of the branches of the superior rectal arteries.

Figure 5



Tying the suture using the knot pusher.

Figure 6



Recto-anal repair (RAR) using vicryl 2-0.

The surgery was completed when no more prolapsed hemorrhoid or artery signal was found.

Milligan Morgan hemorrhoidectomy procedure

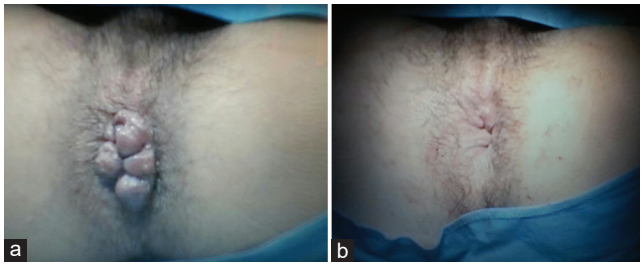
Perianal infiltration with 10 ml of 0.25% bupivacaine before dissection was carried out. The hemorrhoids were retracted and dissected from the internal anal sphincter with the help of diathermy. The pedicles were transfixed using vicryl (0) ligatures, and then the dissected hemorrhoids were excised distal to the ligatures. Wounds were left open to granulate with adequate skin bridges. The three hemorrhoidal cushions at 3, 7, 11 o'clock were excised. Xylocain gel and hemostatic sponge were applied in the anal canal (Figs. 7–9).

Data collected included patients' demographics and the main presenting symptoms, operative time of the procedure, postoperative pain, postoperative consumption of analgesics, duration of hospital stay, duration to return to work, and postoperative complications. All the patients fulfilled the 1 year of follow-up period at intervals of 1 week, 1 month, 6 months, and 1 year.

Postoperative pain was managed according to the guidelines of the French Anesthesiology Society [20]. Pain was assessed using a visual analog scale (VAS) in which 0 corresponds to 'no pain' and 10 to 'maximum pain'. The aim was to keep the pain down to a VAS score of less than 3 at all times. Prescribed analgesics were classified using the WHO system. During the operation and immediately after patient recovery, the analgesic regimen included a systematic anti-inflammatory medication and subcutaneous morphine in case of pain. While the patient was hospitalized, analgesics were administered on the basis of the VAS score in the following way: VAS less than 3, a WHO class I analgesic (paracetamol); between 3

and 5, a WHO class II analgesic (paracetamol codeine, dextropropoxyphene–paracetamol); and a VAS greater than 5, a WHO class III analgesic (morphine administered systematically with paracetamol). If a given analgesic was having an inadequate but partial effect, an analgesic of the next class was prescribed. While hospitalized, patients were systematically administered an anti-inflammatory drug (300 mg ketoprofen per day), laxatives, and topical anesthetic cream. Patients were discharged once their pain was being effectively managed with oral analgesics.

Figure 7

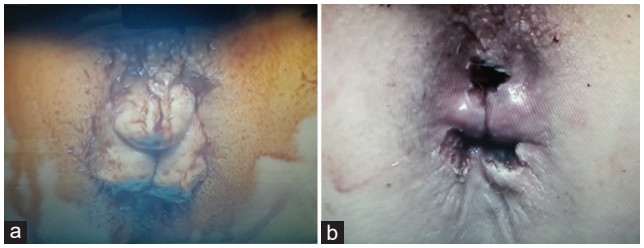


(a) Grade IV hemorrhoids before DGHAL with RAR. (b) After DGHAL with RAR. DGHAL with RAR, Doppler-guided hemorrhoid artery ligation with recto-anal repair.

Figure 8

Milligan Morgan (MM) hemorrhoidectomy.

Figure 9



(a) Grade IV hemorrhoids before MM hemorrhoidectomy. (b) After MM hemorrhoidectomy. MM, Milligan Morgan.

Statistical analysis

The two different groups were compared using the χ^2-test for qualitative variables and a parametric t-test to compare the means for quantitative variables. Performance and safety were evaluated using the χ^2-test. The software used was SPSS, version 11.0 for Windows (SPSS Inc., Chicago, Illinois, USA).

Results

There were no significant differences between the two groups with respect to sex, weight, history, or risk factors. The mean age in the group A was higher than in the group B (51.2 vs. 44.4 years; $P = 0.003$). Clinical data were comparable in both groups except for the skin tags before the operation (33% in group A versus 65% in group B; $P = 0.001$) (Table 1).

The most common complain reported by the patients before the operation was the impression of a protruding anal mass (100%). Other problems included constipation (50%), frequent bleeding (47%), itching (37%), discharge and soiling (31%), and pain (30%) (Table 2).

The operative time was significantly longer in group A than in group B (32 ± 10.3 vs. 18 ± 9.1 min) ($P > 0.001$). The first defecation occurred sooner in group A than in group B (1.6 ± 1.0 vs. 2.1 ± 1.1 days) ($P = 0.006$). The mean hospital stay was significantly shorter in group A than in group B ($P > 0.001$). In addition, the return to work and normal activity was achieved significantly earlier in group A than in group B ($P > 0.001$) (Table 3).

The VAS scores for pain were significantly higher in the MM hemorhoidectomy group during the hospital stay, especially during defecation (2.66 ± 2.19 in group A vs. 5.20 ± 2.24 in group B; $P > 0.001$). The consumption of class I analgesics during the hospital

Table 1 Patients demographics

Items	Group A (*n*=63)	Group B (*n*=63)	*P*
Age (mean±SD) (years)	51.2±14.97	44.4±13.95	0.003
Males (*n* (%))	53 (84.1)	43 (68.3)	NS
Females (*n* (%))	10 (15.9)	20 (31.7)	NS
Skin tags (*n* (%))	21 (33)	41 (65)	0.001

NS, not significant.

Table 2 Presenting symptoms

Items	Group A (*n*=63)	Group B (*n*=63)	*P*
Urine retention (no)	1	8	0.033
Fecal impaction (no)	0	2	0.225
Fresh bleeding (no)	0	1	0.477
Anal stenosis (no)	0	2	0.225
Recurrent prolapse (no)	2	0	0.225

stay was higher in group B than in group A ($P = 0.199$), and the consumption of class II and class III analgesics were significantly higher in group B than in group A ($P > 0.005$) (Table 4).

There was no significant difference between the two groups in the postoperative complications and in recurrent prolapse after 1 year. Nine patients developed urine retention in the early postoperative period: one from group A and eight from group B; all of them were improved conservatively except the two cases in the group B that required urethral catheterization.

Three patients from the MM group were readmitted to the hospital within 1 week after discharge, two of them with fecal impaction, which necessitated manual evacuation under anesthesia, and one patient with fresh bleeding per rectum following an episode of constipation and passage of hard fecal matter; the bleeding was mild and improved with conservative measures and packing with hemostatic sponge without surgical intervention.

Two patients from the MM group presented with symptomatic anal stenosis during the routine follow-up in the outpatient clinic, which improved with regular anal dilatation. After 1 year, recurrent prolapse was detected in two patients (3%) of group A, and no recurrent prolapse was detected in group B ($P = 0.225$) (Table 5).

During the follow-up, patients' questionnaire showed transient impairment of the anorectal functions in 12 patients (19%) in group A in the form of urgency in seven patients, flatus incontinence in two patients, tenesmus in one patients, and discrimination problems in two patients, and in 15 patients (23.8%) in group B in the form of urgency in four patients, flatus incontinence in six patients, tenesmus in two patients, and discrimination problems in three patients. These complications improved spontaneously within 6 weeks after surgery. There was no statistical significant difference between the two groups as regards any of these complications (Table 6).

Discussion

Many theories have coined the etiology of hemorrhoids, including venous varicosities, vascular hyperplasia in the hemorrhoidal vascular tissue, and mucosal prolapse of the recto-anal mucosa resulting in the elongation and kinking of the hemorrhoidal vessels [21]. Although many surgical methods have been proposed, the ideal treatment for hemorrhoidal disease remains a subject of debate [22]. Hundreds of studies have been published comparing the surgical treatments available for grade III and IV hemorrhoids, including open hemorrhoidectomy and transanal hemorrhoidal dearterialization (THD) [23]. The ligation of the hemorrhoidal arteries (dearterialization) can provide a significant reduction of the arterial overflow to the hemorrhoidal vessels. Plication of redundant rectal mucosa (mucopexy) can provide repositioning of the prolapsed tissue to the anatomical site [24]. It can be performed in the day care unit under epidural anesthesia [25].

Our study included 126 patients with grade IV hemorrhoids and 1 year follow-up period. De Nardi *et al.* [26] conducted a similar study on 50 patients with grade III hemorrhoids and 2 years of follow-up. Denoya *et al.* [3] conducted another similar study on 40 patients with grade III and IV hemorrhoids and 3 years of follow-up. Elshazly *et al.* [27] compared ligation anopexy with hemorrhoidectomy in 200 patients with grade II and III hemorrhoids, and 26 months of median follow-up period. LaBella *et al.* [28] evaluated THD in 108 patients with grade II, III, and IV hemorrhoids and 1 year of follow-up.

Table 3 Operative time, first defecation, hospital stay, and return to work

Items	Group A (n=63)	Group B (n=63)	P
Urgency	7	4	0.524
Flatus incontinence	2	6	0.290
Tenesmus	1	2	1.000
Discrimination problems	2	3	0.610

Table 4 VAS scores for pain and consumption of analgesics

Items	n (%)		P
	Group A (n=63)	Group B (n=63)	
Protruding mass	63 (100)	63 (100)	NS
Constipation	32 (50.8)	31 (49.2)	NS
Bleeding	29 (46)	30 (47.6)	NS
Itching	22 (34.9)	24 (38)	NS
Discharge	20 (31.7)	19 (30.2)	NS
Pain	19 (30.2)	19 (30.2)	NS

NS, not significant; VAS, visual analog scale.

Table 5 Postoperative complications

Items	Mean±SD		P
	Group A (n=63)	Group B (n=63)	
Operative time (min)	32±10.3	18±9.1	>0.001
First defecation (days)	1.6±1.0	2.1±1.1	0.006
Hospital stay (days)	1.2±0.8	3.1±1.7	>0.001
Return to work (days)	8±5	21±10	>0.001

Table 6 Adverse effects on the anorectal function after 1 year

Items	Mean±SD		P
	Group A (n=63)	Group B (n=63)	
VAS	2.66±2.19	5.20±2.24	>0.001
Class I analgesic doses	5.89±8.24	7.86±8.83	0.199
Class II analgesic doses	2.9±7.7	11.7±12.6	>0.005
Class III analgesic doses	2.5±3.6	5.3±6.1	>0.005

VAS, visual analog scale.

There were no significant differences between the two groups of our study with respect to sex, weight, history, or risk factors, and the common presenting symptoms of the patients before the operation were protruding anal mass, constipation, frequent bleeding, itching, discharge, and pain. This is in agreement with the results obtained in many similar studies [18,26,29].

The operative time was significantly longer in the DG-HAL with RAR group of our study, which is in contrast to other studies proving the shorter operative time of DG-HAL with RAR than the open hemorrhoidectomy [3,27,30]. This could be due to the learning curve and our early experience with the procedure.

Patients in the DG-HAL with RAR group in our study experienced significantly less postoperative pain, significantly less consumption of class II and III analgesics in the postoperative period, and also had significantly earlier passage of stool than patients in the hemorrhoidectomy group. The same results were obtained in most of the similar studies [29,30].

We found that the mean hospital stay was significantly shorter for patients in the DG-HAL with RAR group and their return to work and normal activity was achieved significantly earlier than for patients in the hemorrhoidectomy group. This is in agreement with the results obtained by Denoya and colleagues [18,26] in their respective studies.

Our results showed that there was no significant difference between the two groups as regards postoperative complications and recurrent prolapse after 1 year; we had two recurrent prolapses in group A (3.2%). The same results were found in different studies evaluating DG-HAL with RAR [31–33]. But in their study, Kjaer *et al.* [34] found high failure rate (36%) after THD after 2 years of follow-up.

Impairment of the anorectal function in the form of urgency, tenesmus, flatus incontinence, and discrimination problems were higher in the hemorrhoidectomy group in our study but with no statistical importance, and spontaneously improved within 6 weeks after surgery. The same results were obtained by other similar studies [3,27].

Conclusion

DG-HAL with RAR is an effective minimal-invasive procedure with results comparable to MM hemorrhoidectomy for the treatment of grade IV hemorrhoids with fewer complications. Moreover, it is associated with less postoperative pain, shorter hospital stay, and earlier return to work. Longer periods of follow-up are needed to prove its long-term effectiveness.

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Nil.

Conflicts of interest
There are no conflicts of interest.

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