Doppler-guided hemorrhoidal artery ligation versus digital-guided ligation in management of second-degree and third-degree hemorrhoids

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Background
Hemorrhoids are veins normally located in the lower part of the rectum and anus of the human body that assist in continence. Hemorrhoidal disease is a common anorectal disorder. It is estimated that 39% of the general population is affected.
Aim
To compare the results of Doppler-guided hemorrhoidal artery ligation and digital-guided ligation in the management of second-degree and third-degree hemorrhoids and their early and late complications.
Patients and methods
This is a comparative randomized prospective study. The required sample size was estimated to be 80 patients complaining of second-degree or third-degree hemorrhoids according to the Goligher classification. They were divided into two groups: group A (Doppler-guided group) included 40 patients, and group B (digital-guided group) included 40 patients. The patients were assigned to either of the group in a random manner using the sealed envelope system.
Results
In our study, the rate of bleeding recurrence in Doppler-guided hemorrhoidal artery ligation group was 2.5% and the rate of prolapse recurrence was 5% compared with 5% bleeding recurrence and 7.5% prolapse recurrence in the finger-guided group. There was no significant difference between the two groups in early or late postoperative complications, as well as in patient satisfaction or visual analog scale of pain after surgery.
Conclusion
There was no significant difference between Doppler-guided hemorrhoidal artery ligation and finger-guided ligation of the hemorrhoidal artery. Both methods are feasible and could be applied as an alternative to the standard hemorrhoidectomy with great clinical outcome.

Keywords:
hemorrhoidal artery ligation, digital-guided ligation, hemorrhoids

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Introduction

Hemorrhoids are veins normally located in the lower part of the rectum and anus of the human body that assist in continence. Hemorrhoidal disease is a common anorectal disorder. It is estimated that 39% of the general population is affected [1].

There are internal and external hemorrhoids, which are classified according to their location to the dentate line; internal hemorrhoids are above it and external hemorrhoids are below it. Hemorrhoids are further classified into four categories according to the Goligher classification.

Grade I hemorrhoids prolapse past the dentate line when straining, grade II hemorrhoids prolapse through the anus when straining and reduce spontaneously, grade III hemorrhoids prolapse through the anus but need to be manually reduced, and finally grade IV hemorrhoids prolapse through the anus but cannot be reduced [2].

Other scores have also been introduced trying to take into consideration the patient symptoms to be included along with the clinical findings, for example, hemorrhoid severity score and the Sodergren score [3].

The treatment of hemorrhoids varies according to grade. Grades II–III range from procedures in the office to surgical excision in the operation theater. The interventional procedure choice can depend on patient or surgeon preference. However, surgical excisions like Milligan–Morgan (open)

hemorrhoidectomy or Ferguson (closed) hemorrhoidectomy remain the gold standard treatment for grade IV hemorrhoids. These open techniques can cause a lot of pain and take time and many dressings to heal compared with nonexcisional or closed methods [3].

Doppler-guided ligation of the hemorrhoidal arteries was a new nonexcisional method that Morinaga presented in 1995 in an effort to lower the risk of complications [4].

The Doppler-guided ligation procedure consists of the ligation of terminal branches of submucosal superior hemorrhoidal artery with the guidance of Doppler ultrasound mounted to a proctoscope designed in a special way [5].

The initial approach has been modified in a number of ways, and other techniques including digitally palpating the arteries to guide ligation without using a Doppler equipment have also been employed. To reduce hemorrhoidal prolapse and preserve the anatomical integrity of the hemorrhoidal piles, the endorectal plication of superfluous and prolapsing mucosa and submucosa has also been developed [6].

Aim

The aim was to compare the results of Doppler-guided hemorrhoidal artery ligation and digital-guided ligation in the management of second-degree and third-degree hemorrhoids and their early and late complications.

Patients and methods

Type of the study

This is a comparative randomized prospective study. The required sample size was estimated to be 80 patients complaining of second-degree and third-degree hemorrhoids according to the Goligher classification. The patients were divided into two groups: group A (Doppler-guided group) included 40 patients, and group B (digital-guided group) included 40 patients. The patients were assigned to either of the groups in a random manner using the sealed envelope system. Approval of the Ethical Committee and written informed consent from all participants were obtained.

Inclusion criteria

Patients with second-degree and third-degree hemorrhoids were included.

Exclusion criteria

The following were the exclusion criteria:

(1) Acute massive bleeding per rectum.
(2) Colorectal malignancy.
(3) Gastrointestinal inflammatory diseases.
(4) Pregnancy.
(5) Previous radiotherapy or chemotherapy.
(6) Previous anal surgeries.
(7) Renal and liver failure.
(8) Serious cardiovascular complications.

Study settings

All patients included in the study were candidates for the following:

(1) Clinical assessment
Detailed medical and family history, general examination, anorectal examination, and classification according to the Goligher's classification.
(2) Investigations
Routine laboratory and preoperative investigations, computed tomography scan, and/or colonoscopy in suspected cases to rule out other pathologies, especially cancer.
(3) Intervention
(a) Preoperative medications:
(1) Laxatives and clear fluids 1 day preoperatively.

Figure 1

Inspection of anal canal.

(2) Procedure
(3) Surgery was performed under general or spinal anesthesia.
(4) Patient was placed in the lithotomy position, prepared, and draped (Fig. 1).

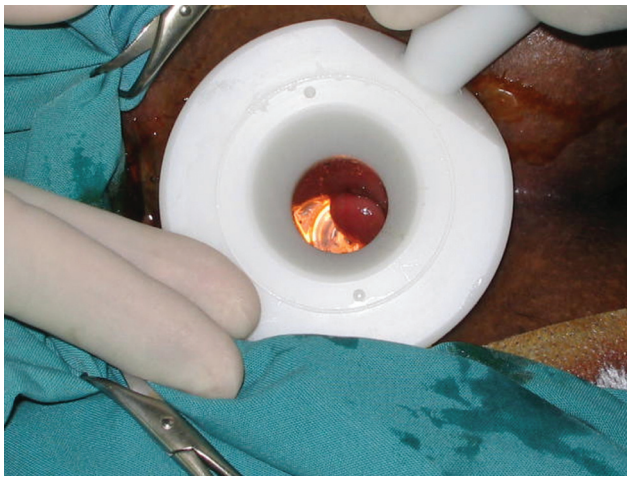
(b) Doppler-guided technique: the transanal hemorrhoidal dearterialization device's tip is coated with lubricant before a proctoscope is inserted into the anal canal. Doppler signals are used to locate the terminal branches of the superior rectal artery, which are then stitched shut with a Z-shaped stitch using 2 : 0 braided polyglycolic acid suture. Mucopexy is then applied to the ligated hemorrhoid (Figs 2–4).

(c) All terminal branches of the superior rectal artery were palpated intraoperatively all around the anal canal, 2–3 cm above the anorectal junction, to execute finger-guided hemorrhoidal artery ligation without Doppler assistance. After that, arteries are tied off with 2 : 0 braided polyglycolic acid Z-shaped sutures. The ligated hemorrhoid is then treated with mucopexy (Figs 5–8).

(5) Follow-up:

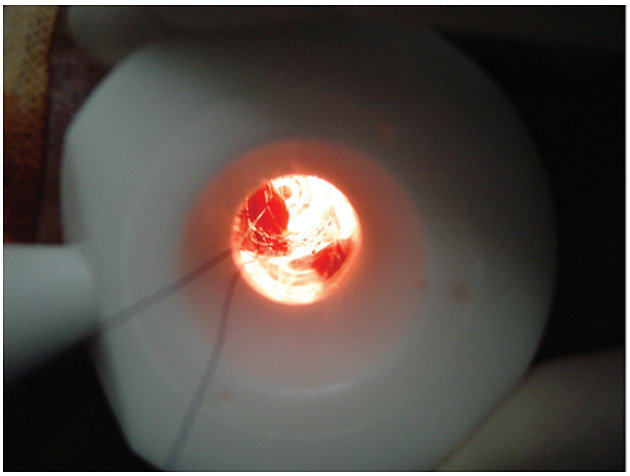
(a) Early postoperative follow-up:
It is defined as the time period from completion of the surgery up to 30 days after the surgery. Follow-up vital data, fluid diet for the first day postoperative, and postoperative bleeding (soaked dressings, bleeding requiring blood transfusion, or bleeding requiring surgical intervention) were observed. Postoperative regimen of

Figure 2



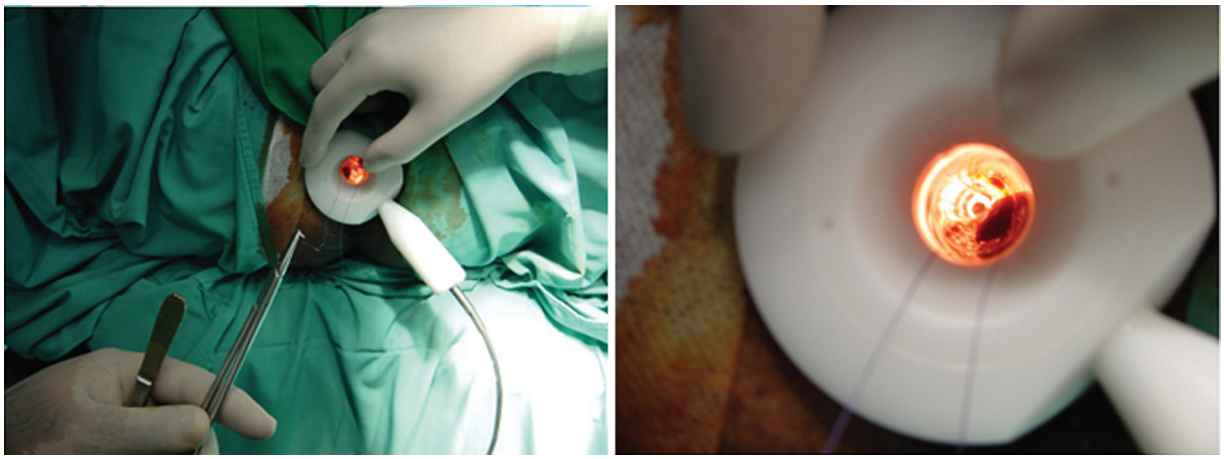
Introduction of Doppler device.

Figure 3



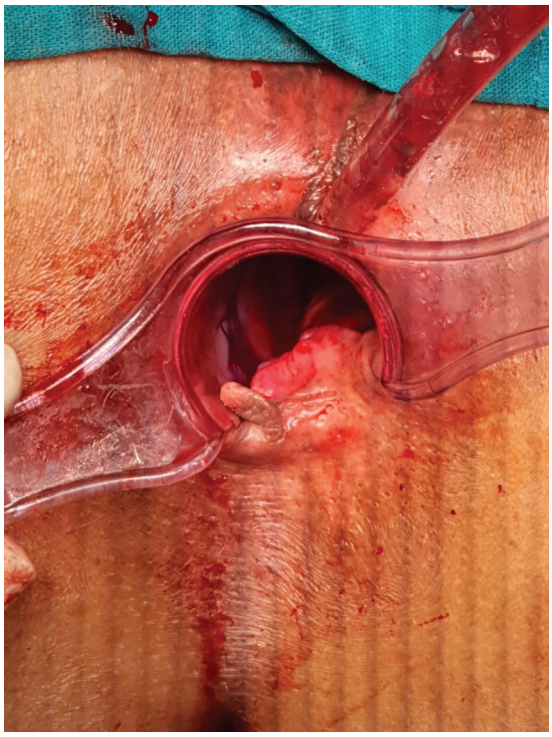
Ligation of hemorrhoidal artery.

Figure 4



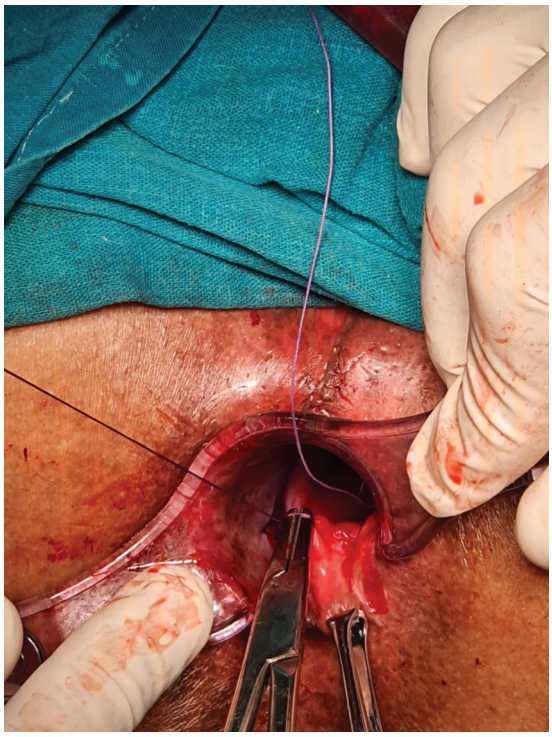
Mucopexy.

Figure 5



Inspection of anal canal.

Figure 6



Ligation of the hemorrhoidal artery.

analgesia was prescribed for each patient, which includes nonsteroidal analgesics, paracetamol, and topical symptomatic drugs.

Figure 7

Tying the knot.

Pain was noted according to the visual analog scale (VAS) for pain.

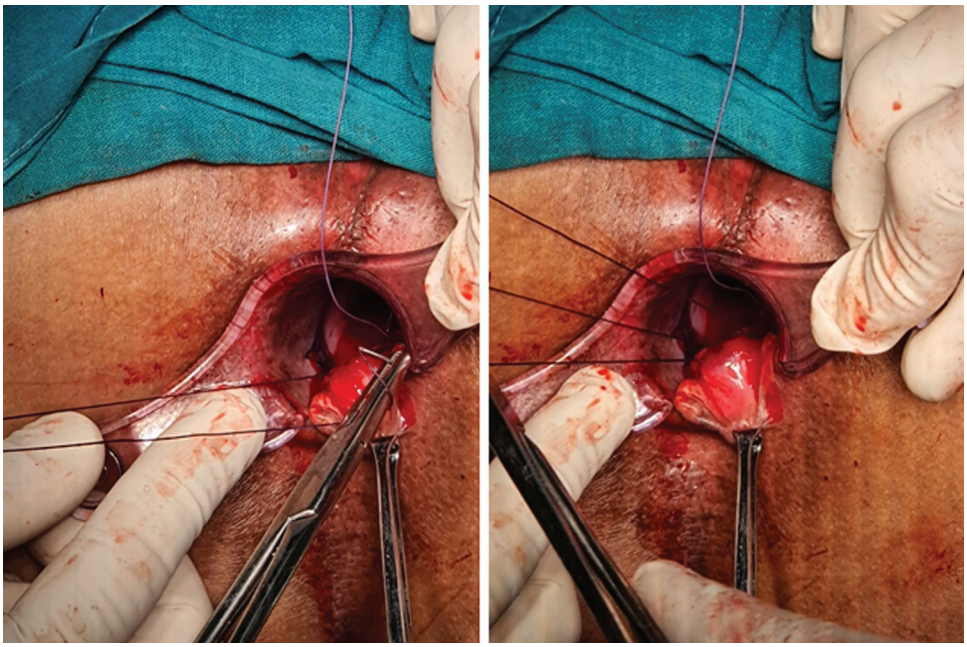
(b) Late postoperative follow-up: it is defined as the time period starting from the 31st day after the surgery.

Patients were followed up after the procedure at regular intervals by clinical assessment and anorectal examination for pain and bleeding. Routine follow-up visits were scheduled at 2 weeks, 1 month, and 3 months postoperatively. Patients were asked to rate their own satisfaction of the procedure on a scale from 1 to 10 (with 10 being the best) and were asked whether the procedure helped their symptoms in 6 months and 1 year after surgery. Follow-up to 1 year for recurrence was defined as the presence of recurrent bleeding or recurrent hemorrhoidal prolapse requiring medical or surgical therapy after the first surgery.

Results

A total of 82 patients were eligible for this research. They were divided into two groups, with 40 patients each, but two patients were lost to follow-up. Group A included the Doppler-guided hemorrhoidal artery ligation, and group B included the digital-guided

Figure 8



Running sutures mucopexy.

Table 1 Age

	Number of patients	Minimum age	Maximum age	Mean	SD
Age	40	22.00	64.00	39.8500	10.58434

Table 2 Visual analog scale pain

	Number of patients	Minimum VAS score	Maximum VAS score	Mean	SD
VAS pain	40	4.00	9.00	6.7000	1.24447

VAS, visual analog scale.

ligation of the artery. Group A included 23 males and 17 females. The mean age of this group was ~40 years old (Table 1). The average VAS score for pain in the early postoperative period for group A was 6.7 (Table 2). Early postoperative bleeding occurred in only one patient in group A and was managed conservatively by packs without the need for blood transfusion or going back to operative theater. Regarding late postoperative period, the average overall patient satisfaction from the surgery was 7.77, with only one patient having recurrence of bleeding per annum and two patients having recurrence of prolapse (Tables 3–5).

In group B (finger-guided ligation of hemorrhoidal artery), there were 30 males and 10 females. The mean age of this group was ~37 years (Table 6). In the early postoperative period in group B, only one patient had an early bleeding, which was also managed conservatively by packs without blood transfusion or reoperating. In group B, the VAS score for pain was on an average of 6.625 (Table 7).

Regarding patient satisfaction in this group, it was 7.5 on average (Table 8).

Table 3 Patient satisfaction

	Number of patients	Minimum	Maximum	Mean	SD
Patient satisfaction	40	6.00	9.00	7.7750	0.89120

Table 4 Recurrence bleeding

Recurrence bleeding	Frequency	Percent
No	39	97.5
Yes	1	2.5
Total	40	100.0

Table 5 Recurrence prolapse

Recurrence prolapse	Frequency	Percent
No	38	95.0
Yes	2	5.0
Total	40	100.0

Table 6 Descriptive statistics

	Number of patients	Minimum	Maximum	Mean	SD
Age	40	21.00	68.00	36.7250	11.72328

Table 7 Visual analog scale score for pain

	Number of patients	Minimum	Maximum	Mean	SD
VAS pain	40	4.00	9.00	6.6250	1.46213

VAS, visual analog scale.

Table 8 Patient satisfaction

	Number of patients	Minimum	Maximum	Mean	SD
Patient satisfaction	40	6.00	9.00	7.5750	0.95776

Table 9 Recurrence bleeding

Recurrence bleeding	Frequency	Percent
No	38	95.0
Yes	2	5.0
Total	40	100.0

Table 10 Recurrence prolapse

Recurrence prolapse	Frequency	Percent
No	37	92.5
Yes	3	7.5
Total	40	100.0

During the late postoperative period follow-up, two patients had recurrent bleeding and another three patients had a recurrence in prolapse (Tables 9 and 10).

In comparing the two groups and calculating the Pearson correlation, the results were as follows: *P* value of the VAS of pain between the two groups was 0.574 (Table 11).

P value of the early bleeding was 0.875 (Table 12).

In comparing the recurrence of bleeding, the *P* value was 0.822 (Table 13).

Regarding patient satisfaction between the two groups, the *P* value was 0.480 (Table 14).

Lastly, the recurrence of prolapse between the two groups had a *P* value of 0.689 (Table 15).

Table 11 Correlations

	VAS pain	VAS pain Doppler
VAS pain		
Pearson correlation	1	0.092
Sig. (2-tailed)		0.574
N	40	40
VAS pain Doppler		
Pearson correlation	0.092	1
Sig. (2-tailed)	0.574	
N	40	40

VAS, visual analog scale.

Table 12 Correlations

	Early bleeding	Early bleeding Doppler
Early bleeding		
Pearson correlation	1	–0.026
Sig. (2-tailed)		0.875
N	40	40
Early bleeding Doppler		
Pearson correlation	–0.026	1
Sig. (2-tailed)	0.875	
N	40	40

Table 13 Correlations

	Recurrence bleeding	Recurrence bleeding Doppler
Recurrence bleeding		
Pearson correlation	1	–0.037
Sig. (2-tailed)		0.822
N	40	40
Recurrence bleeding Doppler		
Pearson correlation	–0.037	1
Sig. (2-tailed)	0.822	
N	40	40

Table 14 Correlations

	Patient satisfaction	Patient satisfaction Doppler
Patient satisfaction		
Pearson correlation	1	–0.115
Sig. (2-tailed)		0.480
N	40	40
Patient satisfaction Doppler		
Pearson correlation	–0.115	1
Sig. (2-tailed)	0.480	
N	40	40

Discussion

Different treatment modalities are present nowadays for the management of hemorrhoids, of which surgical excision of hemorrhoids is still the gold standard treatment for hemorrhoidal disease but is associated with postoperative pain and complication rates of up to 15%, ranging from bleeding to fecal incontinence [7].

Table 15 Correlations

	Recurrence prolapse	Recurrence prolapse Doppler
Recurrence prolapse		
Pearson correlation	1	−0.065
Sig. (2-tailed)		0.689
N	40	40
Recurrence prolapse Doppler		
Pearson correlation	−0.065	1
Sig. (2-tailed)	0.689	
N	40	40

The hemorrhoidal artery ligation-recto anal repair concept uses a different modality to approach the problem of hemorrhoidal disease. The goal is to treat the symptoms of the patient without the destruction of the tissues. A probe of Doppler is used to ligate selectively the terminal branches of the superior hemorrhoidal artery, thus reducing the blood supply causing atrophy of the hemorrhoidal plexus. The next step is to perform a mucopexy or recto anal repair to reposition and fix the hemorrhoids into the anal canal. Early complications of the hemorrhoidal artery ligation-recto anal repair technique are minor and rare [8].

Bleeding can occur in a small number of cases but neither reoperation nor transfusion is mandatory. In the literature, numerous studies have compared the efficacy of Doppler-guided hemorrhoidal artery ligation with or without mucopexy to hemorrhoidectomy or stapled hemorrhoidopexy. These studies did not show that one technique is superior than the other. The sole difference is between the immediate postoperative symptom, which is less in Doppler-guided hemorrhoidal artery ligation than with hemorrhoidectomy, or stapled hemorrhoidopexy [9,10].

Doppler-guided hemorrhoidal artery ligation was shown to achieve better results on pain in the short term, and similar results in the long term. Another favor of Doppler-guided hemorrhoidal artery ligation is that anal physiology is not altered, which is beneficial for all patients and especially patients with previous anal surgeries or incontinence [11].

Our study included patients with hemorrhoidal symptoms complaining of second-degree and third-degree hemorrhoids. Mucopexy was performed routinely using 2 : 0 braided polyglycolic acid sutures to standardize the technique for all patients and to compare the results. We defined recurrence as the reappearance of symptoms after a period of improvement; in some studies, recurrence is defined only as retreatment.

Dal Monte and colleagues and Ratto and colleagues had average follow-up periods of 46 and 44 months, respectively [3,12].

Data from the papers that report Doppler-guided hemorrhoidal artery ligation with a follow-up period longer than 12 months revealed that recurrent prolapse was observed in 2.7–16.7% of patients and recurrent anal pain was reported in 10–16.6% of patients. As far as what is the ideal surgery to treat recurrences after Doppler-guided, there is still no consensus. As Doppler-guided hemorrhoidal artery ligation treatment does not damage the lower rectum, it can be redone, but other techniques can also be used. Regarding complications after Doppler-guided hemorrhoidal artery ligation, no cases of mortality have been reported in the literature, and no serious complications or long-term functional sequelae have been reported after application of this technique, unlike with hemorrhoidopexy and hemorrhoidectomy [13].In other research studies using finger-guided ligation or non-Doppler-guided ligation of the hemorrhoidal artery, no significant difference and no advantage of the Doppler-guided hemorrhoidal artery ligation have been reported [14–16].

In our study, which included 80 patients who were divided into two equal groups, the rate of bleeding recurrence in the Doppler-guided hemorrhoidal artery ligation group was 2.5% and the rate of prolapse recurrence was 5% compared with 5% bleeding recurrence and 7.5% prolapse recurrence in the finger-guided group. There was no significant difference between the two groups in early or late postoperative complications and also no significant difference in patient satisfaction or VAS of pain after surgery. Thus, it confirms previous research studies in the literature that there is no advantages of Doppler-guided technique over other non-Doppler-guided techniques.

There are some limitations in the research, which consists of sample size and follow-up of patients only to a period of 1 year. Long-term follow-up of patients and a large number of candidates are to be further researched. Moreover, this treatment modality should be compared with other treatment options and surgeries for hemorrhoids.

Conclusion

There is no significant difference between Doppler-guided hemorrhoidal artery ligation and finger-guided ligation of the hemorrhoidal artery. Both methods are feasible and could be applied as an alternative to the standard hemorrhoidectomy with great clinical outcome.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Riss S, Weiser FA, Schwameis K, Riss T, Mittlböck M, Steiner G, Stift A. The prevalence of hemorrhoids in adults. Int J Colorectal Dis 2012; 27:2.

2 Aibuedefe B, Kling SM, Philp MM, Ross HM, Poggio JL. An update on surgical treatment of hemorrhoidal disease: a systematic review and meta-analysis. Int J Colorectal Dis 2021; 36:9.

3 Jin J, Xia W, Connolly A, Hill AG. Symptom-based scoring for haemorrhoidal disease: a systematic review. Colorectal Dis 2020; 22:1518–1527.

4 Morinaga K, Hasuda K, Ikeda T. A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. Am J Gastroenterol 1995; 90:610–613.

5 Yilmaz I, Sücüllü I, Karakaş DÖ, Özdemir Y, Yücel E, Akin ML. Doppler-guided hemorrhoidal artery ligation: experience with 2 years follow-up. Am Surg 2012; 78:344–348.

6 Ratto C, Campennì P, Papeo F, Donisi L, Litta F, Parello A. Transanal hemorrhoidal dearterialization (THD) for hemorrhoidal disease: a single-center study on 1000 consecutive cases and a review of the literature. Tech Coloproctol 2017; 21:953–962.

7 Hardy A, Chan CL, Cohen CR. The surgical management of haemorrhoids e a review. Dig Surg 2005; 22:26–33.

8 Figueiredo MN, Campos FG. Doppler-guided hemorrhoidal dearterialization/transanal hemorrhoidal dearterialization technical evolution and outcomes after 20 years. World J Gastrointest Surg 2016; 8:232–237.

9 Giordano P, Nastro P, Davies A, Gravante G. Prospective evaluation of stapled haemorrhoidopexy versus transanal haemorrhoidal dearterialisation for stage II and III haemorrhoids: three year outcomes. Tech Coloproctol 2011; 15:67–73.

10 Denoya P, Tam J, Bergamaschi R. Hemorrhoidal dearterialization with mucopexy versus hemorrhoidectomy: 3-year follow-up assessment of a randomized controlled trial. Tech Coloproctol 2014; 18:1081–1085.

11 Lehur PA, Didnée AS, Faucheron JL, Meurette G, Zerbib P, Siproudhis L, *et al.* Cost-effectiveness of new surgical treatments for hemorrhoidal disease a multicenter randomized controlled trial comparing transanal doppler guided hemorrhoidal artery ligation with mucopexy and circular stapled hemorrhoidopexy. Ann Surg 2016; 264:710–716.

12 Dal Monte PP, Tagariello C, Giordano P, Shafi A, Cudazzo E, Franzini M. Transanal haemorrhoidal dearterialisation: nonexcisional surgery for the treatment of haemorrhoidal disease. Tech Coloproctol 2007; 11:333–339.

13 Hoyuela C, Carvajal F, Juvany M, Troyano D, Trias M, Martrat A, *et al.* HAL-RAR (Doppler guided haemorrhoid artery ligation with recto-anal repair) is a safe and effective procedure for haemorrhoids. Results of a prospective study after two-years follow-up. Int J Surg 2016; 28:39–44.

14 Qamar Naqvi SR, Qamar Naqvi SS, Rashid MM, Sheikh IA, Ali M, Ala Nafees AU. Haemorrhoidal artery ligation operation without Doppler guidance. J Ayub Med Coll 2018; 30:S664–S667.

15 Bagus BI. IDDF2022-ABS-0092 The feasibility of modified haemorrhoid artery ligation – recto anal repair (HAL-RAR) with no doppler guided technique on grade iii of internal haemorrhoid disease. Gut 2022; 71:A128.

16 Sobrado CW, Sobrado LF, Nahas SC, Cecconello I. A new approach for hemorrhoidal disease: selective dearterialization and mucopexy without doppler guidance. Arq Brasil Cirurg Dig 2021; 34:1.