Comparative study between pile plication technique and open hemorrhoidectomy in the management of noncomplicated second-degree and third-degree hemorrhoids

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Received: 25 October 2022
Revised: 16 November 2022
Accepted: 20 November 2022
Published: 28 April 2023

The Egyptian Journal of Surgery 2023, 41:1563–1571

Background
Hemorrhoids are a common clinical condition affecting half of the population. It is estimated that 58% of people aged over 40 years have the disease in the USA. Milligan–Morgan hemorrhoidectomy is considered the gold standard for the surgical treatment of hemorrhoids. However, these procedures are associated with significant postoperative complications, including pain, sepsis, anal stenosis, bleeding, and incontinence. The pile plication technique is based on the fact that the hemorrhoidal vessels have a constant anatomical location. They penetrate the hemorrhoid at its base. Sutures applied at the base of the hemorrhoid cushion can diminish the blood flow to the hemorrhoidal plexus and control the prolapse as well.

Patients and methods
This randomized prospective study was conducted at Ain Shams University hospitals from January 2020 to December 2021 and included 110 patients who presented with third-degree noncomplicated piles and second-degree noncomplicated piles after the failure of medical treatment. They were randomly allocated into two groups (group A: open hemorrhoidectomy and group B: plication group), and each group included 55 patients. In the plication group, the pile masses were plicated continuously just below the anorectal till the dentate line occluded the superior hemorrhoidal vessel. Postoperative follow-up visits were scheduled on the first and second week postoperatively, and then after 1, 3, and 6 months from the initial procedure. Careful postoperative assessment was carried out, including resolved clinical symptoms, bowel habits, complications, or recurrences, which were recorded and carefully assessed.

Results
Patients' age ranged from 35 to 54 years. Overall, 82% of patients presented with third-degree noncomplicated piles, and the remainder presented with second-degree noncomplicated piles. There was no statistically significant difference regarding patients' mean age, sex, and piles degree between both groups. The mean operative time for the open group was 41.85 min and for the plication group 29.4 min, with a clear statistical significance. There was a statistically significant difference regarding the mean hospital stay, postoperative visual analog scale score, and mean time to return to work, in favor of the plication group. There was no statistically significant difference regarding the early and late postoperative complications, except for urine retention, which was much higher among the open group.

Conclusion
Pile plication technique is a minimally invasive procedure, which is effective in controlling hemorrhoidal symptoms, thus improving the quality of life by preserving the rectal arterial flow and considerably avoiding postoperative complications in comparison with open hemorrhoidectomy.

Keywords:
hemorrhoids, open hemorrhoidectomy, piles, plication

Egyptian J Surgery 41:1563–1571
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1110-1121

Introduction

Hemorrhoids are a common clinical condition affecting half of the population. It is estimated that 58% of people aged over 40 years have the disease in the USA. Approximately one-third of the patients present to surgeons for treatment [1].

Clinically, hemorrhoids usually present with bleeding, prolapse, pain (with thrombosis or ulceration), perianal mucous discharge, or pruritus. The complications of hemorrhoids are thrombosis, infection with inflammation, ulceration, and anemia. The initial treatment for symptomatic first-degree and second-

degree hemorrhoids with a short history of bleeding, prolapse, or itching and pain is directed to control constipation with dietary measures like a high-fiber diet, sitz bath, stool softeners, laxatives, and different topical creams. It has now been widely accepted that piles are sliding downward of part of the anal canal lining. Treatment measures have to address the reduction of the prolapse as well as the reduction of blood flow to the hemorrhoid mass. When medical treatment fails, ambulatory treatment is advised [2].

The treatment of hemorrhoids is as old as the age of man, and many different treatments have been described, but none of them are entirely satisfactory. Open hemorrhoidectomy is the most commonly used technique and is widely considered to be the most effective surgical technique for treating hemorrhoids [1].

Milligan–Morgan hemorrhoidectomy is considered the gold standard for the surgical treatment of hemorrhoids. However, these procedures are associated with significant postoperative complications, including pain, sepsis, anal stenosis, bleeding, and incontinence [3].

Triple pedicle hemorrhoidectomy, as described by Milligan and Morgan, is the reference technique in Europe, where three wounds are left open. This causes pain that can be intense and requires daily care. Initial hospitalization and absence from work for 2–4 weeks are unavoidable in most cases [4].

The pile plication technique is based on the fact that the hemorrhoidal vessels have a constant anatomical location. Usually, they penetrate the hemorrhoid at its base. A stitch at the base of the hemorrhoid cushion can diminish the blood flow to the hemorrhoidal plexus significantly. In addition, if complete ligation of all the visible hemorrhoid cushions is performed, along with ligation of the base, it will control the prolapse as well [5].

This procedure of ligation of hemorrhoidal cushions has a long history and has various names like 'pile suture,' 'obliterative suture technique,' 'ligation and mucosal plication under vision,' and 'suture ligation.' The rationale of the technique is based on the fact that hemorrhoid prolapse is the result of sliding down of the anal mucosa caused by attenuation of the anchoring elastic tissue system and fixing this sliding mucosa will restore both the cushion to its original position and minimize the blood flow to the plexus [5].

In this study, we evaluated a simple plication procedure by suture-fixation of anal cushion to manage prolapsing hemorrhoids in comparison with the conventional Milligan–Morgan hemorrhoidectomy.

Patients and methods

This randomized prospective study was conducted at Ain Shams University hospitals from January 2020 to December 2021 and included 110 patients randomly allocated into two groups using the SPSS program (group A: open hemorrhoidectomy and group B: plication group). Each group included 55 patients.

This research was performed at the Department of General Surgery, Ain Shams University Hospitals. Ethical Committee approval and written, informed consent were obtained from all participants.

Inclusion criteria

Patients with symptomatic second-degree and third-degree noncomplicated piles after the failure of medical treatment were included.

Exclusion criteria

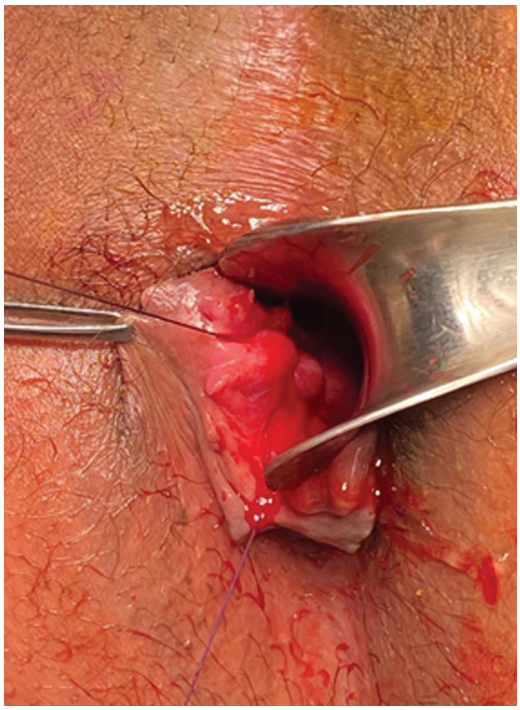
Patients with complicated, thrombosed or grade IV piles, patients with portal hypertension, patients using anticoagulants, and patients with piles secondary to anal pathology as anal fissure were excluded from the study. Any patient with a septic anal condition was not included in the study as well.

The surgical procedures were clearly explained to the patients, and informed written consent was obtained. All patients were subjected to detailed clinical examinations, including history, local and general examination, and per rectal examination. Routine preoperative investigations were performed, including complete blood picture, coagulation profile, fasting blood sugar, and liver and kidney function tests. Any further investigation required after anesthesiologist consultation was performed and evaluated.

The procedure was performed with the patient in the lithotomy position (tilt around 25–30° Trendelenburg position). Anal dilatation was done to decrease the spasm and helps in diminishing thrombosis and postoperative pain. Allis forceps are applied in the mucocutaneous junction opposite to the common sites of piles (3, 7, and 11 o'clock).

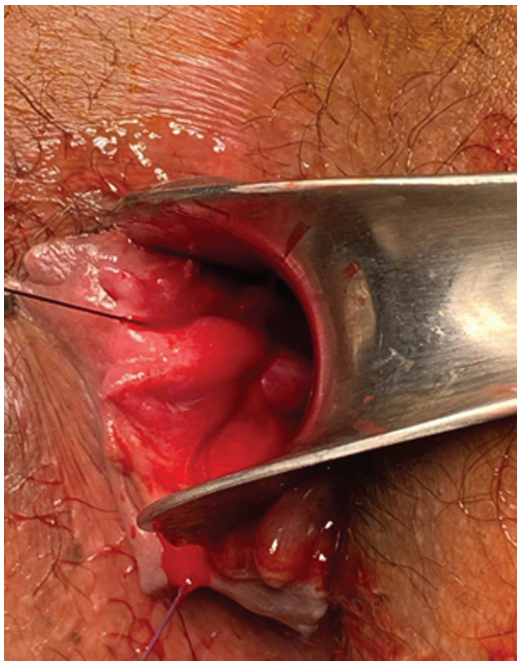
With the help of an anal speculum and long tissue forceps, the pile masses were plicated in continuous

Figure 1



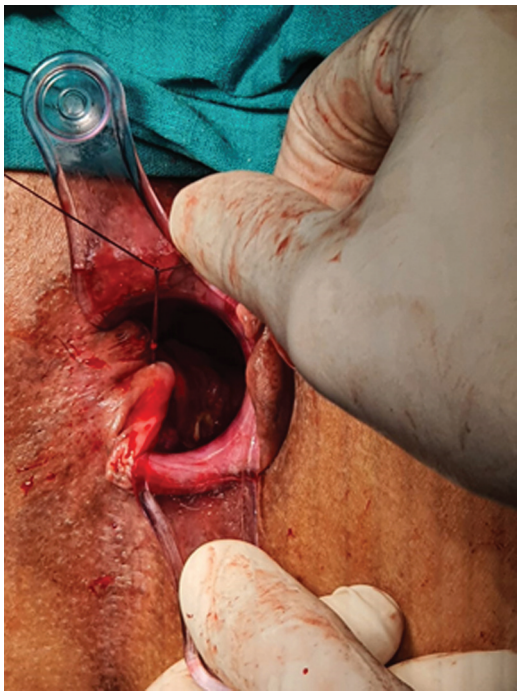
Sutures are placed from the anorectal junction to the dentate line.

Figure 2



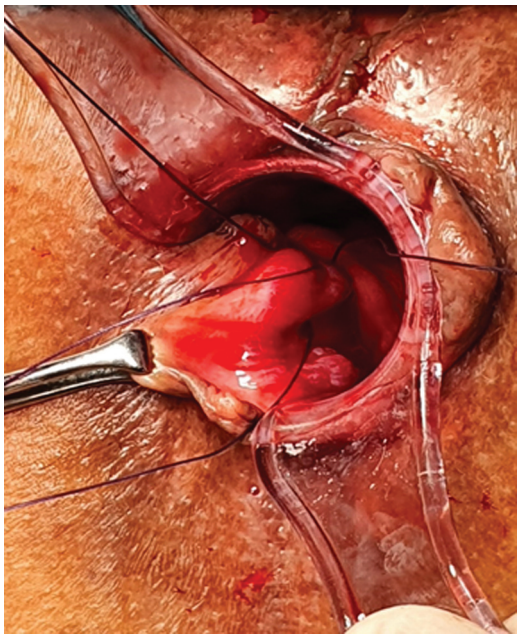
Sutures are placed from the anorectal junction to the dentate line.

Figure 3



The sutures are passed continuously and the knot is tied at the level of the dentate line.

Figure 4



The sutures are passed continuously and the knot is tied at the level of the dentate line.

method with vicryl (polyglactin 910) 2-0 needle (26 mm, 5/8 circle) suture just below the anorectal junction with the first suture in a figure-of-eight patterns (Figs 1 and 2). The sutures are passed continuously till the dentate line, and a knot is tied to occlude the superior hemorrhoidal vessel as they enter the internal hemorrhoids (Figs 3 and 4).

A similar procedure was done for the other two pile masses. Minor bleeding was controlled by gentle

pressure with a piece of gauze. No packing was done after the procedure, with only external dressing.

Strict postoperative follow-up was conducted, with monitoring of the vital data, pain, bleeding, bowel movements, and need for analgesics. Patients were discharged within 48 h of the procedure, and instructions were given to the patients regarding their home treatments and wound care. Postoperative pain was assessed using a 10-cm linear visual analog scale (VAS) in which 0 corresponded to 'no pain' and 10 to 'maximum pain.'

Postoperative follow-up visits were scheduled on the first and second week postoperatively, and then after 1, 3, and 6 months from the initial procedure. Careful postoperative assessment was carried out, including resolved clinical symptoms, bowel habits, complications, or recurrences, which were recorded and carefully assessed.

Statistical analyses were performed with aid of SPSS (version 26.0; SPSS IBM. Corp., and MINITAB, version 19, Armonk, NY: IBM Corp). Results were expressed as either mean and SD, frequency, or proportion. Between-group comparisons were performed using Student t test (normally distributed data) for continuous variables, and χ^2 test for categorical variables and comparisons between proportions for proportions. The hypotheses were either two-tailed or one-tailed, with P value less than 0.05 considered statistically significant.

Results

This randomized prospective study included 110 patients randomly allocated into two groups: group A was the open hemorrhoidectomy group and group B was the plication group. Each group included 55 patients.

Patients' age ranged from 35 to 54 years. A total of 71 (64.5%) patients were male, whereas 39 (34.5%) patients were female. No statistical significance was encountered between both groups. Age and sex characteristics are shown in Tables 1 and 2.

Table 1 Age among the patient population

	Group A	Group B	*P* value
Mean age	44.15	43.82	0.727

Table 2 Sex incidence among the patient population

	Male [*n* (%)]	Female [*n* (%)]	*P* value
Group A	36 (65.5)	19 (34.5)	0.84
Group B	35 (63.7)	20 (36.3)	
Total	71 (64.5)	39 (34.5)	

A total of 82 patients were complaining of third-degree noncomplicated piles, whereas 28 patients presented with second-degree noncomplicated piles. No statistical significance was found between both groups (P=0.662) (Table 3).

The mean operative time and the mean hospital stay were shorter in the plication group, with clear statistical significance, as shown in Table 4.

Analysis of the early postoperative complications revealed comparable findings, with no statistically significant difference between both groups, apart from urinary retention, which was higher among the open group, with statistical significance (P=0.017) (Table 5, Fig. 5).

Regarding postoperative pain which was assessed using the VAS score, open-group results were higher than the plication group, with notable statistical

Table 3 Clinical presentations among the patient population

Degree of piles	Group A (open hemorrhoidectomy group) [*n* (%)]	Group B (plication group) [*n* (%)]	Total [*n* (%)]
Second degree	13 (23.6)	15 (27.2)	28 (25.5)
Third degree	42 (76.4)	40 (72.8)	82 (74.5)

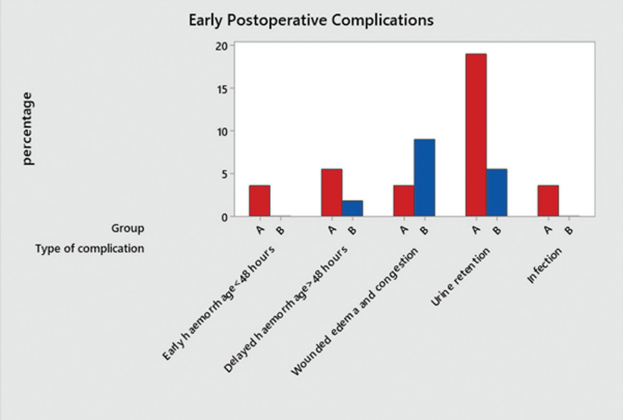
Table 4 Mean operative time and hospital stay in both groups

	Group A	Group B	*P* value
Mean operative time	41.85	29.4	<0.0001
Mean hospital stay	1.16	1.00	0.005

Table 5 Early postoperative complications

Type of complication	Group A (open hemorrhoidectomy group) [*n* (%)]	Group B (plication group [*n* (%)]	*P* value
Early hemorrhage <48 h	2 (3.6)	0	0.150
Delayed hemorrhage >48 h	3 (5.5)	1 (1.8)	0.306
Wound edema and congestion	2 (3.6)	5 (9)	0.238
Urine retention	10 (19)	3 (5.5)	0.017
Infection	2 (3.6)	0	0.15

Figure 5



Early postoperative complications in both groups.

Table 6 Visual analog scale scores among the patient population

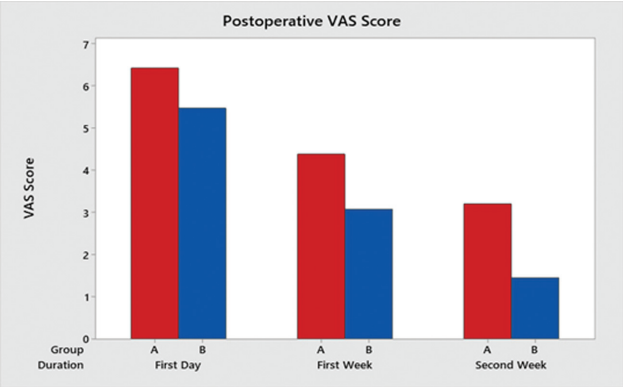
VAS score	Group A	Group B	*P* value
First day	6.42	5.47	<0.0001
First week	4.38	3.07	<0.0001
Second week	3.20	1.45	<0.0001

VAS, visual analog scale.

Table 7 Mean time to return to work in both groups

	Group A	Group B	*P* value
Mean time to return to work (in weeks)	4.91	3.51	<0.0001

Figure 6

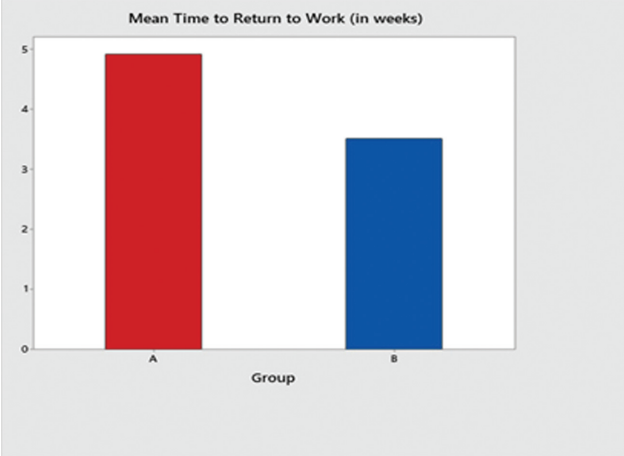


Postoperative VAS score in both groups. VAS, visual analog scale.

significance. The mean time to return to work showed similar results (Tables 6 and 7 and Figs 6 and 7).

Comparable results of late postoperative complications were recorded, with no statistical significance between both groups. The only case of postoperative anal fistula among the plication group was treated by simple lay open with a smooth postoperative period and no recurrence (Table 8 and Fig. 8).

Figure 7

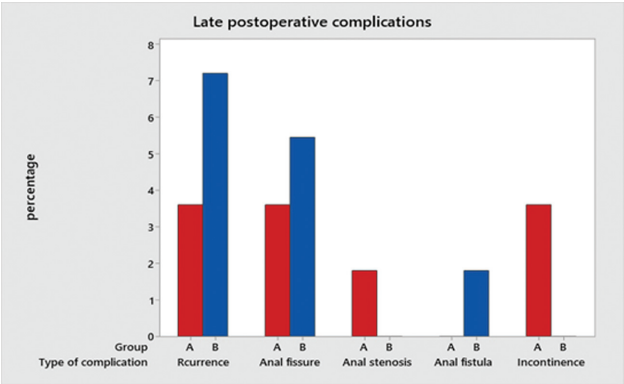


Mean time to return to work (in weeks) in both groups.

Table 8 Late postoperative complications

Type of complication	Group A (open hemorrhoidectomy group) [*n* (%)]	Group B (plication group) [*n* (%)]	*P* value
Recurrence	2 (3.6)	4 (7.2)	0.400
Anal fissure	2 (3.6)	3 (5.45)	0.647
Anal stenosis	1 (1.8)	0	0.313
Anal fistula	0	1 (1.8)	0.313
Incontinence	2 (3.6)	0	0.15

Figure 8



Late postoperative complications in both groups.

Discussion

Surgical hemorrhoidectomy involving excision of the hemorrhoidal cushions is the traditional surgical approach used for treating hemorrhoids. The Milligan–Morgan technique was first described in 1937 and involves the dissection of the hemorrhoid of the underlying anal sphincter complex and ligation of the vascular pedicle. The resulting mucosal defects are left open to granulate by secondary intention [6].

The treatment of prolapsing hemorrhoids of grades II–III varies, ranging from office-based procedures to surgical excision, and the choice of intervention can depend on patient or surgeon preference. The decision regarding the treatment of hemorrhoids depends on patient or surgeon preference and the availability of resources [7].

Unfortunately, there is significant morbidity associated with surgical hemorrhoidectomy. It has a reputation for being an extremely painful procedure for a benign condition. Other significant short-term complications include urinary retention (20.1%), bleeding (secondary or reactionary) (2.4–6%), and abscess formation (0.5%), whereas documented long-term complications include anal fissure (1–2.6%), anal stenosis (1%), incontinence (0.4%), fistula (0.5%), and recurrent hemorrhoidal symptoms (20%) [6]. A systematic review and meta-analysis of 98 trials comprising 7827 patients and 11 surgical treatments for grades III and IV hemorrhoids found that open and closed hemorrhoidectomies resulted in more postoperative complications and slower recovery than nonexcision procedures [8].

Aibuedefe and colleagues performed a systemic review including 26 studies with 3137 participants and 14 surgical treatments for grade III/IV hemorrhoids. They found that conventional hemorrhoidectomies (closed and open) have the worst outcomes for postoperative pain. More patients experienced mild, moderate, and severe pain and for a long period with conventional hemorrhoidectomies. A random effect model shows that open hemorrhoidectomy takes longer for patients to recover from and get back to work [9].

The sliding theory, popularized by Thomson, proposes that hemorrhoids are a result of sliding or displacement of the lining mucosa of the anal cushions. As hemorrhoids develop in patients with collagen fragmentation of the extracellular matrix and ligament of Treitz, mucosal prolapse usually occurs before hemorrhoidal bleeding [10].

The plication technique is developed based on this theory, especially to address the increased laxity of the supportive structures that leads to prolapse. The sutures may also decrease the blood flow to hemorrhoid cushions, contributing to the declined size of hemorrhoids. Sutures are introduced well above the dentate line to minimize postoperative pain. The procedure is minimally invasive, does not involve tissue excision, and is simple to perform [11].

Pattanayak and colleagues conducted a study that included 1014 patients scheduled for plication on classic hemorrhoidectomy. They found that 708 (69.82%) patients who underwent piles procedure (both plication and conventional) were from the age group 31–50 years, whereas 636 (62.72%) patients were male. In their study, 484 (95.47%) patients got relieved from postoperative pain by 72 h, whereas in the classic technique only 178 (35.10%) patients got relief from postoperative pain by 72 h. During plication, Intraoperative and postoperative bleeding occurred in 1.37%, in contrast to 13.4% of cases of bleeding using the classic method [12].

Pattanayak and colleagues found that all the patients who underwent plication stayed in the hospital for 1–2 days and were able to carry out their daily work after 5–7 days, but in the classic method the hospital stay ranges from 5 to 9 days, and patients were able to carry out their daily work after 14–26 days. After plication, 492 (97%) patients had a normal anal function, only 15 (2.95%) had incontinence to flatus, and none of them had incontinence to feces and anal stenosis, whereas after the classic method, 447 (88.6%) patients had a normal anal function, 33 (6.50%) had incontinence to flatus, 18 (3.55%) had incontinence to feces, and nine (1.77%) had anal stenosis. A total of 496 (97.8%) patients had no long-term complications, only 11 (2.16%) patients had long-term recurrent bleeding, and no patients had incontinence to feces/flatus, anal stenosis, and recurrence after plication; however, after the conventional method, 384 (95.4%) patients had no long-term complications, 39 (7.69%) patients had recurrent bleeding, 35 (6.90%) had incontinence to feces/flatus, 12 (2.36%) had anal stenosis, and 37 (7.29%) had recurrence as long-term complications [12].

Pattanayak and colleagues concluded that plication of piles can be performed in second-degree and third-degree piles; this procedure takes relatively shorter operative time without the need for any expensive instruments and can be done on elderly patients, and therefore, it is a suitable technique for developing and underdeveloped countries [12].

Parashar and colleagues conducted a study on the plication of hemorrhoids without intra-anal packing on 50 patients. Patients tolerated the procedure, with 3% cases of urine retention and 4% developed early and 16% developed late postoperative hemorrhage, which was managed successively by medical treatment. Overall, 6% of patients developed a postoperative infection, which required treatment and managed by

antimicrobial therapy. After 6 months of follow-up, 90% of the patients were satisfied with the procedure and no cases developed anal strictures or recurrences [1].

Parashar and colleagues concluded that the plication of hemorrhoids is a simple procedure, is cost-effective, has less postoperative discomfort, has less chance of catheterization and their consequences, and has minimal postoperative complications and recurrence rate [1].

Spasm of the internal anal sphincter appears to play a significant role in the origin of pain following hemorrhoidectomy. To relieve this spasm, techniques have included surgical sphincterotomy, reversible chemical sphincterotomy using topical application of 0.2% glycerol-trinitrate ointment or 2% Diltiazem cream, and injection of botulinum toxin. Lateral sphincterotomy can be performed through one of the hemorrhoidectomy wounds but is associated with a risk of significant long-term sequelae, including symptoms of incontinence of flatus and difficulty with perianal hygiene after defecation in up to 20% of patients. Plication procedures remarkably show declined incidence of internal sphincter spasms and subsequent fissures with all the resultant needed surgical or medical interventions with their recorded hazards [6].

Saxena and Bhakuni conducted a study using the plication technique on 64 patients. Postoperative complications included pain (18.75%), bleeding (7.8%), prolapsed hemorrhoids (3.12%), fistula formation (1.56%), and recurrence (6.25%). They concluded that hemorrhoid ligation with mucopexy is a simple, safe, and cost-effective ambulatory treatment for patients with symptomatic hemorrhoids. It can be performed to control bleeding and prolapsing hemorrhoids. Overall results were satisfactory with good control of patients' complaints. Most complications are minor and self-limiting; they can be managed on an outpatient basis [2].

Our study included 110 patients who presented with noncomplicated grades II and III hemorrhoids and were randomly allocated into two groups, each containing 55 patients. The first group underwent Milligan–Morgan hemorrhoidectomy, and the second group underwent the described plication technique. Our results showed no statistical significance regarding early and postoperative complications except for urinary retention which was much higher among the Milligan–Morgan group compared with the plication group. There is no doubt that postoperative urinary retention is a common highly distressing complication following open hemorrhoidectomy. Mean operative time, VAS score, mean hospital stay, and return to work parameters showed better results in the plication group compared with Milligan–Morgan group, with clear statistical significance.

Our results were comparable with the studies by Pattanayak and colleagues, Parashar and colleagues, and Saxena and Bhakuni regarding low postoperative complications in plication groups. We encountered a 1.8% incidence of bleeding among the plication group compared with 1.37% in the Pattanyak series, 20% in the Parashar series, and 7.8% in the Saxena series. No cases of incontinence were noticed in our plication group compared with 9.45% on short-term follow-up and no cases on the long-term follow-up in the study by Pattanayak and colleagues. No cases of postoperative infection were encountered in our study compared with 6% cases in the study by Parashar and colleagues.

We encountered 7.2% cases of recurrence compared with 6.25% cases of recurrences in the study by Saxena and Bhakuni, and no cases of recurrence in the studies by Pattanayak and colleagues and Parashar and colleagues. One case of postoperative anal fistula (1.8%) and no cases of anal stenosis were countered in our plication group compared with the 1.56% fistula incidence in the study by Saxena and Bhakuni. No cases of anal stenosis were also found in the study by Pattanayak and colleagues. Our plication group showed better results in the view of hospital stay and return to work compared with the study by Pattanayak and colleagues. Similarly, the comparison between the open and the plication group outcomes was in favor of the plication group in agreement with the results of the study by Pattanayak and colleagues.

Demir and colleagues described a similar pile ligation [ligation under vision (LUV)] technique and compared it with Ferguson hemorrhoidectomy (FH). The study included 375 patients, and their results showed a low complication rate (6.7%). No cases of postoperative thrombosis or perianal fistula or anal incontinence were encountered in the ligation technique compared with the 1.3% rate of each of the previous complications in the FH group. Other postoperative complications included mucosal prolapse (1.7% in the ligation group compared with 5.8% in the FH group) and anal fissure [13].

Demir and colleagues noticed that none of the chronic complications such as anal incontinence and perianal fistula occurred after the LUV procedure. Furthermore, the need for second and third surgical interventions was less after the LUV procedure than after the FH [13].

They found that none of their patients developed anal stenosis owing to the fact that they avoided unnecessary ligation sutures around the whole rectal column that will affect rectal arterial flow. Most complications such as anal fissure, thrombosed external hemorrhoids, and prolonged pain may be the result of declined blood circulation within the mucosa of the anal canal. Thus, ligation of only the supplying arteries of the hemorrhoidal tissue is more effective than ligating all rectal arteries in the rectal column [13].

Demir and colleagues found that another factor that may prevent the occurrence of anal stenosis after the LUV procedure is to leave the hemorrhoidal tissue behind after transfixion sutures. This leads to spontaneous shrinkage of the hemorrhoidal piles without developing a mucosal tissue defect and makes LUV more favorable than excisional hemorrhoidectomies [13].

Demir and colleagues concluded that LUV is a safe and practical procedure. Routine ligation of all arteries in the rectal column may be unnecessary, and ligation of only the visible hemorrhoidal cushions seems to be advised. The outcome is similar both after LUV and FH. LUV may be preferred to excisional hemorrhoidectomies if three or four quadrants of the anal canal are involved with hemorrhoids, as to reduce mucosal defect-related possible complications [13].

Doppler-guided hemorrhoidal artery ligation (DGHAL and RAR) is also a minimally invasive technique for the treatment of symptomatic hemorrhoids that has been applied successfully for grades II and III hemorrhoids and sometimes in grade IV hemorrhoids. However, it needs costly Doppler ultrasound with probes and a special proctoscopy that allows the combination of hemorrhoidal artery ligation with transanal rectoanal repair (mucopexy) [11].

The role of DGHAL has been questioned by recent randomized controlled studies showing that the rate of complications or recurrence or changes in vascular anatomy of the anal canal did not differ significantly between mucopexy plus DGHAL and non-Doppler-guided mucopexy. It is difficult to achieve a complete and sustained loss of Doppler vein signal in DGHAL alone, which may explain the difficulty to reduce the prolapse. This is supported by many studies that showed branches of the superior rectal artery coursing in the outer layers of the rectal wall and entering the rectal wall above the levator ani muscle to supply the corpus cavernosum recti. Although ligation of the main trunk of the superior rectal artery is possible with DGHAL, continuous hyperplasia of the branches of the superior rectal artery may be responsible for the persistent hemorrhoids and remarkable recurrent rate [11].

Pile plication technique is a minimally invasive procedure that is effective in controlling hemorrhoidal symptoms, thus improving the quality of life and preserving the anatomy and physiology of the anal canal. As we avoid unnecessary ligation sutures around the entire rectal column, no disturbances in the rectal arterial flow occur which if happened can result in complications such as anal fissure, thrombosed external hemorrhoids, and prolonged pain.As there are no skin defects or external wounds, the patients' follow-up showed more tolerance to the procedure and a less painful postoperative period compared with open hemorrhoidectomy. Patients experienced a better ability to resume life and work activities with considerably low postoperative complications with high safety profile and a low recurrence rate. We suggest another application of the proposed plication technique is its combined use with the classical Milligan–Morgan hemorrhoidectomy to preserve the skin bridges, avoiding anal stenosis and controlling any encountered daughter piles.

Coronavirus disease 2019 (COVID-19), caused by a single-stranded enveloped RNA virus called severe acute respiratory syndrome coronavirus 2, originated in Wuhan province in China in December 2019. COVID-19 later progressed into a global pandemic. High infectivity and transmission through asymptomatic patients have led to rapid transmission across geographical borders. COVID-19 has affected healthcare and socioeconomics worldwide. COVID-19 infection has not only affected public health and economics but also the management of acute and chronic medical conditions and throws more attention on cost-effective surgical procedures with relatively lower postoperative complications, shorter hospital stays, and rapid return to daily activities [14].

The previous overall benefits in addition to the effect of the current pandemic may raise attention to the considerable benefits of the plication procedure in comparison with the traditional open

hemorrhoidectomy and enlighten its value among more expensive nonexcisional hemorrhoidectomies.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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