Comparative study between Milligan-Morgan hemorrhoidectomy, stapled hemorrhoidopexy, and laser hemorrhoidoplasty in patients with third degree hemorrhoids: a prospective study

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Context
Hemorrhoids are dilated blood vessels under the anal mucosa. Hemorrhoids are classified into four degrees. The third and fourth include severe prolapse requiring surgical intervention. Many methods of treatment are available.
Aim
This study aimed to compare Milligan-Morgan hemorrhoidectomy, stapling hemorrhoidopexy, and laser hemorrhoidoplasty (LHP) in patients with third degree hemorrhoids.
Settings and design
This is a prospective randomized comparative study.
Materials and methods
A total of 120 patients were included. The study took place from April 2017 till October 2019. The patients were allocated into three groups, with 40 patients each: groups A (Milligan-Morgan hemorrhoidectomy), B (stapling hemorrhoidopexy), and C (LHP). Operative time, hospital stay, return to daily activities, postoperative pain, urinary retention, postoperative hemorrhage, recurrence, and anal stenosis were assessed.
Statistical analysis
Continuous variables were expressed as mean and SD. Categorical variables were expressed as frequencies and percentage.
Results
The operative time was 27.5±5.3, 25.9±4.7, and 22.8±3.9 min in groups A, B, and C, respectively; the hospital stay was 2.1±0.6, 1.1±0.3, and 0.7±0.3 days, respectively; and time to return to activity was 26.2±4.3, 17.2±4.5, and 11.3±2.4 days, respectively. Postoperative pain (visual analog scale) on day 1 was 6.9±1.1, 4.5±0.8, and 2.8±0.5 in groups A, B, and C, respectively; on week 1 was 5.2±0.9, 2.5±0.8, and 0.8±0.5, respectively in groups A, B, and C, respectively; and on week 2 was 4.1±0.8 and 0.7±0.6 in groups A and B, respectively. On week 3, it was 2.9 ±0.7, on week 4 was 1.2±0.7, and on week 8 was 0.4±0.5 in group A. On week 1, postoperative bleeding occurred in 27, eight, and three patients in groups A, B, and C, respectively. On week 2, postoperative bleeding was seen in 15 and two patients in groups A and B, respectively. On week 3, postoperative bleeding was seen in 12 patients and on week 4 in one patient in group A. Urine retention occurred in three and two patients in groups A and B, respectively. Recurrence occurred in one, three, and four patients in groups A, B, and C, respectively. Anal stenosis occurred in two patients in group A.
Conclusions
This study clarified that LHP is the most suitable technique for primary third degree hemorrhoids. However, a large-scale study has to be carried out for clarification of the minor differences.

Keywords:
hemorrhoids, laser hemorrhoidoplasty, Milligan-Morgan hemorrhoidectomy, piles, stapled hemorrhoidopexy

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Introduction

Hemorrhoids are usually considered the most troublesome anal diseases. They can slide down, prolapse, dilate, and bleed occasionally [1].

Millions of people are affected around the world. It is a major medical and socioeconomic problem. The etiology of hemorrhoids includes many factors such as constipation and prolonged straining [2]. The commonest symptom of third degree hemorrhoids is

bright red blood covering the stool or found on toilet paper after defecation or in the toilet bowl. Other symptoms include sensation of a hard lump around the anus, protrusion, and/or mucous discharge. Frequent rubbing of the anus causes exacerbation of the symptoms with vicious cycle of irritation, itching, and bleeding, which is called pruritus ani. They are liable to thrombosis, causing severe pain [3].

Hemorrhoids are classified into four degrees. The first and second degrees require conservative or semiconservative methods. The third and fourth degrees include severe prolapse and usually require surgical intervention. The traditional surgical operation is excision according to Milligan-Morgan technique. Till 1990s, this operation was considered the gold standard treatment. Then a newer technique, which is the stapled hemorrhoidopexy, was introduced. This is usually reserved for third and fourth degrees [1,4].

The most recent laser ablation is now considered the minimally invasive procedure for the treatment of hemorrhoids. Carbon dioxide, argon, and Nd : YAG lasers are the commonest lasers used in medicine, such as in laser hemorrhoidoplasty (LHP) [5].

The aim of this study was to compare the conventional Milligan-Morgan hemorrhoidectomy (MMH), stapling hemorrhoidopexy (SHP), and LHP in patients with primary third-degree hemorrhoids.

Materials and methods

This study was designed as a comparative prospective randomized clinical trial in which 120 patients recruited from the outpatient clinic in Ain Shams University Hospitals experiencing third degree hemorrhoids were included.

The study took place from April 2017 till October 2019 with a minimal of 12-month follow-up postoperatively for each patient. The patients were randomly allocated by computer into three groups (each containing 40 patients) with standardization of the surgical technique for each group and the team that carried out the procedure. Of these 120 patients, 40 patients underwent conventional hemorrhoidectomy by Milligan-Morgan technique (MMH), 40 patients underwent SHP using PPH stapler (PROXIMATE PPH Hemorrhoidal Circular Stapler Set; Ethicon US, LLC, Subsidiary of Johnson & Johnson, Somerville, New Jersey, United States), and 40 patients were operated upon with LHP using Ceralas Diode Laser Biolitic system (Biolitec, Bonn, Germany).

The patients were recruited from the outpatient clinic. Full detailed history was obtained from all patients, and full physical examination was carried out. An informed consent was obtained from the patients for the participation in the study as approved by the Ethical Committee of the Faculty of Medicine, Ain Shams University, and the General Surgery Department.

Inclusion criteria

The following were the inclusion criteria:

(1) Patients with third degree hemorrhoids.
(2) Patients with American Society of Anesthesiologists scores I and II.
(3) Age greater than 18 years.

Exclusion criteria

The following were the exclusion criteria:

(1) Patients with debilitating diseases such as liver cirrhosis and bleeding tendencies.
(2) Patients with previous anal surgeries.
(3) Patients with hemorrhoids accompanied by other anal conditions such as fissure, fistula, or anal stenosis.
(4) Patients with impaired anal sphincter function or fecal incontinence.
(5) Patients with recurrent hemorrhoids.
(6) Patients with thrombosed hemorrhoids.
(7) Patients with American Society of Anesthesiologists scores III and IV.
(8) Patients less than 18 years or virgin female patients.

Surgical technique

All operations were performed under regional (spinal) anesthesia, with the patient in the supine lithotomy position. A standardized procedure was followed for performing the surgery in each group.

Group A: Milligan-Morgan hemorrhoidectomy

A V-shaped incision was made using a cutting cautery device in the skin surrounding the base of the hemorrhoid. Then dissection in the submucous space was done by cautery to strip the hemorrhoid from its bed. The dissection was continued in the cranial direction up to the pedicle. The pedicle was then ligated with a 2/0 vicryl suture, and the distal part of the hemorrhoid was excised. Same steps were carried out regarding the other hemorrhoids, leaving a skin bridge between them to avoid anal stenosis. The wounds were left open, and a hemostatic pack of gauze was left in the anal canal (Figs 1–2).

Figure 1

Dissection of third degree hemorrhoids with cautery.

Figure 2

After completion of Milligan-Morgan hemorrhoidectomy.

Figure 3

Transparent anoscope applied and fixed to cutaneous margin.

Group B: stapling hemorrhoidopexy

A gentle per rectal examination was done followed by gentle anal dilation. The external device (transparent anoscope) of PPH stapler (PROXIMATE PPH Hemorrhoidal Circular Stapler Set; Ethicon US, LLC) was applied and fixed to the cutaneous margin (Fig. 3). This was done to facilitate the reduction of the prolapsed hemorrhoids. The next step was to use a transparent retractor (Fig. 4) to insert a 2/0 propylene purse-string suture circumferentially, with submucosal bites of the lower rectum, about 2 cm above the dentate line (Fig. 5). The anvil (head) was inserted beyond the purse-string suture, and then the purse string was tied over the stem of the anvil firmly. The stapler was then closed to incorporate the prolapsing hemorrhoidal tissue in the cup of the stapler by gradually tightening the screw (Fig. 6). After confirmation that adequate tissue is incorporated and that the vaginal wall in female patients is free by PV examination, the stapler was fired and taken out with the doughnut. Hemostasis along the staple line was then ensured, and if required, cautery or a 3–0 vicryl suture was used in case of bleeding (Fig. 7).

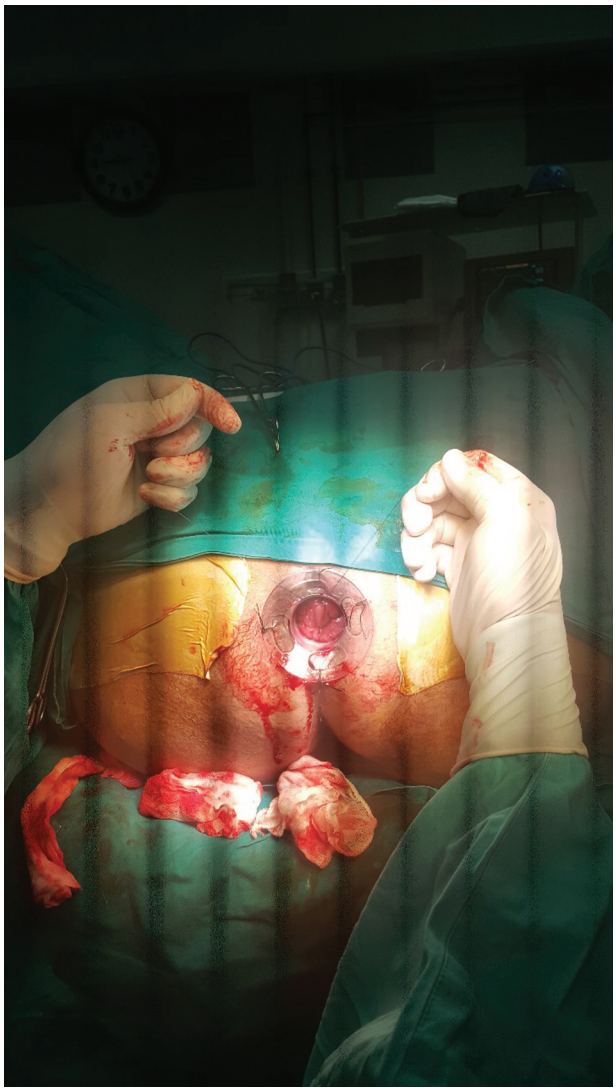
Group C: laser hemorrhoidoplasty

The laser procedure was performed using the Ceralas diode laser Biolitic system (Biolitec) (Fig. 8). The patient was placed in the lithotomy position (Fig. 9). A dedicated disposable proctoscope (23 mm in

Figure 4

Taking purse-string sutures using transparent retractor.

Figure 5



Completion of purse-string sutures.

diameter) was inserted in the anal canal. The procedure started via small incision at the base of each hemorrhoid by the laser port into the hemorrhoidal plexus taking into consideration not to injure or burn the mucosa or the internal sphincter (Fig. 10). Using a 1470 nm diode laser, laser shots were delivered through the optic fiber in a pulsed fashion to reduce undesired degeneration of the periarterial normal tissue. The depth of shrinkage can be controlled by the power and duration of the laser beam. Through the optic fiber, laser shots were generated with duration of 3 s each shot followed by a pause of 0.5 s caused shrinkage of tissues up to the depth of ~5 mm. After finishing each hemorrhoid, an ice finger was introduced intra-anally for 0.5–1 min to decrease the heat effect (Fig. 11). This procedure was repeated for each hemorrhoid (Fig. 12).

Outcomes in terms of operative time, hospital stay, return to daily activities, early postoperative pain, early postoperative urinary retention, major postoperative hemorrhage, recurrence within 1 year, and anal stenosis were assessed.

Assessment of postoperative pain

Postoperative pain was evaluated using the visual analog scale (VAS 0–10), where 0–1=no pain, 1.1–3=low pain intensity, 3.1–7=pain of medium intensity, 7.1–9=pain of high intensity, and 9.1–10=strong and unbearable pain. The VAS protocol was performed on day 1 and weeks 1, 2, 3, 4, and 8 after surgery.

The follow-up of the patient (with clinic visits or by phone) was carried out on 1, 2, 3, 4, and 8 weeks and again after 1 year of the operation for symptoms of recurrence or anal stenosis.

Statistical methods

All statistical analyses were performed using the SPSS 17 software package (SPSS Inc., Chicago, Illinois, United States). Statistical comparative analyses were performed using the χ^2 test and the t test.

Figure 6

Application of PPH stapler.

Figure 7

After completion of stapled hemorrhoidopexy.

Data management and analysis

The collected data were revised, coded, tabulated, and introduced to a PC using Statistical Package for the Social Sciences (SPSS 20). Data were presented, and suitable analysis was done according to the type of data obtained for each parameter.

(1) Descriptive statistics included the following:
   (a) Mean±SD), and range for parametric numerical data, whereas median and interquartile range for nonparametric numerical data.
   (b) Frequency and percentage for non-numerical data.
(2) Analytical statistics included the following:
   (a) Student *t*-test was used to assess the statistical significance of the difference between two study group means.
   (b) Analysis of variance (ANOVA) test was used to assess the statistical significance of the difference between more than two study group means.
   (c) Repeated measure ANOVA was used to assess the statistical significance of the difference between more than two means measured for the same study group.
   (d) Post-hoc test is used for comparisons of all possible pairs of group means.
   (e) The Cochran Q procedure tests the null hypothesis that multiple related proportions are the same.
   (f) χ^2-test was used to examine the relationship between two qualitative variables.
   (g) Fisher's exact test was used to examine the relationship between two qualitative variables when the expected count is less than 5 in more than 20% of cells.

A *P* value lower than 0.05 was considered to denote statistical significance. A *P* value lower than 0.001 was considered highly significant.

Results

Patients' demographics

This study included 120 patients, of which 85 (70.83%) were males and 35 (29.17%) were females (Table 1). The *P* value was 0.851 by chi-square test among the three groups, which was considered nonsignificant.

Figure 8

Ceralas diode laser Biolitic system.

Figure 9

Patient with third degree hemorrhoids in lithotomy position.

Fig. 10

Incision by the laser port.

The age among group A has a mean of 41±8.8 years, group B has a mean of 40.7±8.9 years, and group C has a mean of 40.8±8.8 (Table 2). The *P* value was 0.986 by ANOVA test among the three groups which was considered nonsignificant.

Preoperative complaints

Preoperatively, 60 (50%) patients complained of bleeding, 34 (28.33%) patients complained of mass protruding from the anus, and 26 (21.67%) patients complained of anal discomfort (Table 1). The *P* value was 0.994 by χ^2-test among the three groups, which was considered nonsignificant.

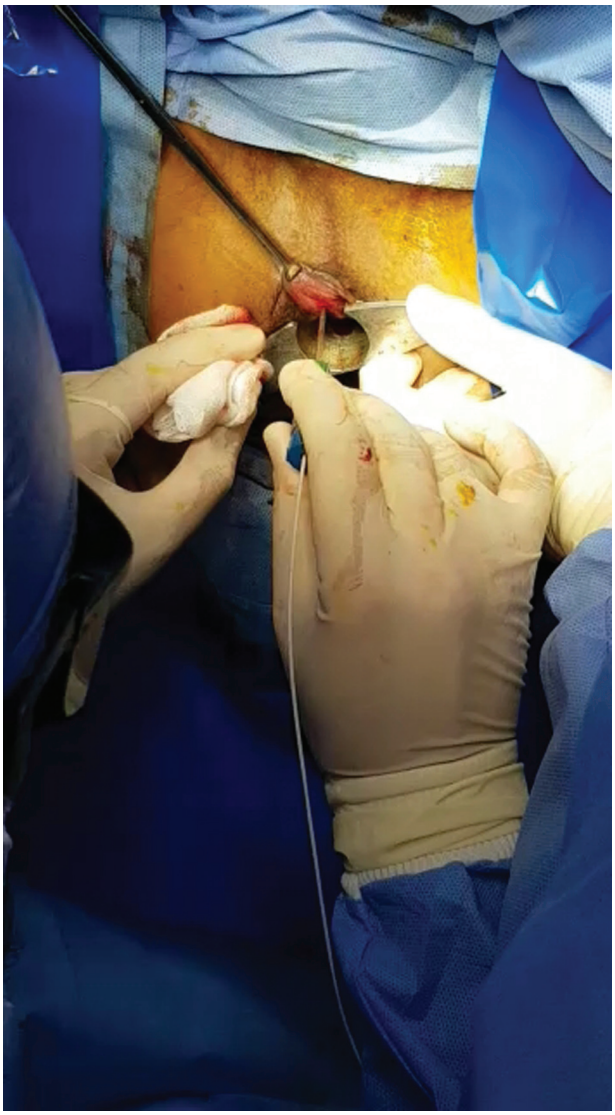
Operative time

The mean operative time in group A was 27.5±5.3 min, in group B was 25.9±4.7 min, and in group C was 22.8 ±3.9 min (Table 2). The *P* value was less than 0.001 by ANOVA test, which is considered highly significant.

Fig. 11

Application of pulses by laser port.

Fig. 12



After completion of laser hemorrhoidoplasty.

Table 1 Sex distribution and preoperative complaints among the three groups

	Group A [*n* (%)]	Group B [*n* (%)]	Group C [*n* (%)]	χ^2-test	
				P value	Significance
Sex					
Male	29 (72.5)	29 (72.5)	27 (67.5)	0.851	NS
Female	11 (27.5)	11 (27.5)	13 (32.5)		
C/O					
Bleeding	20 (50.0)	21 (52.5)	19 (47.5)	0.994	NS
Mass	11 (27.5)	11 (27.5)	12 (30.0)		
Discomfort	9 (22.5)	8 (20.0)	9 (22.5)		

The *P* value was calculated by χ^2-test.

The *P* value of post-hoc test regarding group A vs group B was 0.268, which was considered nonsignificant. The *P* value of post hoc test regarding group A vs group C was less than 0.001, which was considered highly significant. The *P* value of post-hoc test regarding group C vs group B was 0.009, which was considered significant.

Hospital stay

The mean hospital stay in group A was 2.1±0.6 days, in group B was 1.1±0.3 days, and in group C was 0.7

Table 2 Age, operative time, hospital stay, and return to activity in the three groups

	Group A		Group B		Group C		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	*P* value	Significance
Age	41.0	8.8	40.7	8.9	40.8	8.8	0.986	NS
Operative time	27.5	5.3	25.9	4.7	22.8	3.9	<0.001[a]	S
Hospital stay (day)	2.1	0.6	1.1	0.3	0.7	0.3	<0.001[b]	S
Return to activity (day)	26.2	4.3	17.2	4.5	11.3	2.4	<0.001[b]	S

The *P* value was calculated by ANOVA test. Post-hoc test was used in comparison between each two groups. ANOVA, analysis of variance; S, significance. [a]Group A vs group B (NS, *P*=0.268), group A vs group C (S, *P*<0.001), group C vs group B (S, *P*=0.009). [b]Group A vs group B (S, *P*<0.001), group A vs group C (S, *P*<0.001), group C vs group B (S, *P* <0.001).

Table 3 Pain visual analog scale score on day 1 and weeks 1, 2, 3, 4, and 8 in the three groups

Pain VAS score	Group A		Group B		Group C		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	*P* value	Significance
Day 1	6.9	1.1	4.5	0.8	2.8	0.5	<0.001[a]	S
Week 1	5.2	0.9	2.5	0.8	0.8	0.5	<0.001[a]	S
Week 2	4.1	0.8	0.7	0.6	0	0	<0.001[a]	S
Week 3	2.9	0.7	0	0	0	0	<0.001[b]	S
Week 4	1.2	0.7	0	0	0	0	<0.001[b]	S
Week 8	0.4	0.5	0	0	0	0	<0.001[b]	S
Repeated measure ANOVA								
P value	<0.001		<0.001		<0.001			
Significance	S		S		S			

The *P* value was calculated by ANOVA test. Repeated measure ANOVA was done in each group. Post-hoc test was used in comparison between each two groups. ANOVA, analysis of variance; S, significance; VAS, visual analog scale. [a]Group A vs group B (S, *P*<0.001), group A vs group C (S, *P*<0.001), group C vs group B (S, *P*<0.001). [b]Group A vs group B (S, *P*<0.001), group A vs group C (S, *P*<0.001), group C vs group B (NS, *P*=1).

±0.3 days (Table 2). The *P* value was less than 0.001 by ANOVA test, which is considered highly significant.

The *P* value of post-hoc test regarding group A vs group B, group A vs group C, and group C vs group B was less than 0.001, which was considered highly significant.

Return to activity

The mean time to return to activity in group A was 26.2 ±4.3 days, in group B was 17.2±4.5 days, and in group C was 11.3±2.4 days (Table 2). The *P* value was less than 0.001 by ANOVA test, which is considered highly significant.

The *P* value of post hoc test regarding group A vs group B, group A vs group C, and group C vs group B was less than 0.001, which was considered highly significant.

Pain visual analog scale score

Postoperative pain was evaluated using the VAS 0–10, where 0–1=no pain, 1.1–3=low pain intensity, 3.1–7=pain of medium intensity, 7.1–9=pain of high intensity, and 9.1–10=strong and unbearable pain. The VAS protocol was performed on day 1 and weeks 1, 2, 3, 4, and 8 after surgery.

For day 1, week 1, and week 2, the *P* value was less than 0.001 by ANOVA test among the three groups, which was considered statistically highly significant. The *P* value by post-hoc test was found to be less than 0.001 between each pair of the three groups, which was considered statistically highly significant (Table 3).

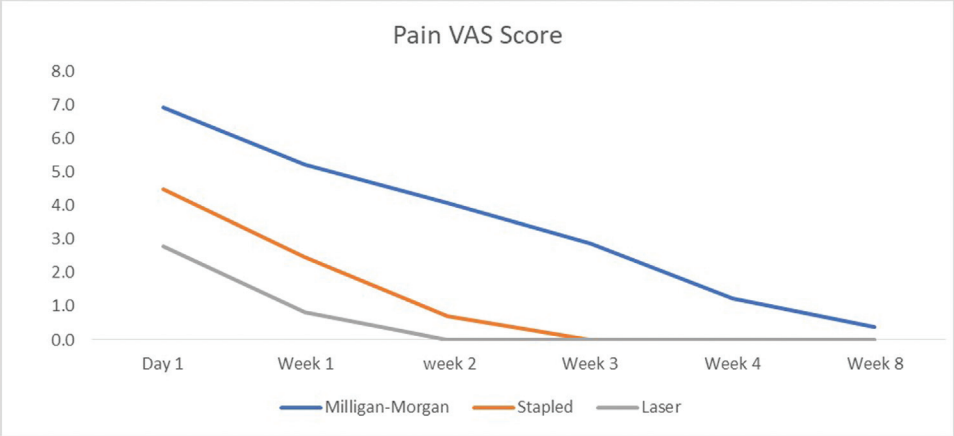
For week 3, week 4, and week 8, the *P* value was less than 0.001 by ANOVA test among the three groups, which was considered statistically highly significant. The *P* value by post-hoc test was found to be less than 0.001 between group A vs group B and group A vs group C, which was considered statistically highly significant. The *P* value by post-hoc test was found to be 1 between group C vs group B, which was considered statistically nonsignificant (Table 3).

Repeated measure ANOVA was found to be less than 0.001 in the three groups, which was considered statistically highly significant (Fig. 13).

Postoperative bleeding

For week 1 and week 2, the *P* value by χ^2-test was less than 0.001, which was statistically considered highly significant (Table 4).

Fig. 13



Graphic representation of postoperative visual analog scale score in Milligan-Morgan hemorrhoidectomy (group A) in blue, stapled hemorrhoidopexy (group B) in orange, and laser hemorrhoidoplasty (group C) in gray on day 1 and weeks 1, 2, 3, 4, and 8.

Table 4 Number of patients experiencing postoperative bleeding in groups A, B, and C on weeks 1, 2, 3, 4, and 8

Postoperative bleeding	Group A [*n* (%)]	Group B [*n* (%)]	Group C [*n* (%)]	Test of significance	
				P value	Significance
Week 1	27 (67.5)	8 (20.0)	3 (7.5)	<0.001[c]	S
Week 2	15 (37.5)	2 (5.0)	0	<0.001[c]	S
Week 3	12 (30.0)	0	0	<0.001[f]	S
Week 4	1 (2.5)	0	0	1	NS
Week 8	0	0	0		
Cochran *Q*					
P value	<0.001	<0.001	0.017		
Significance	S	S	S		

The *P* value was calculated by χ^2 test and Fisher exact test. Cochran *Q* test was done in each group. S, significance.

On week 3, the number of patients experiencing postoperative bleeding was 12 (30%) patients in group A and no patients in groups B and C (Table 4). The *P* value by Fisher exact test was less than 0.001, which was statistically considered highly significant.

On week 4, the number of patients experiencing postoperative bleeding was one (2.5%) patient in group A and no patients in group B and C (Table 4). The *P* value was 1, which was statistically considered nonsignificant.

On week 8, no patients of the study groups experienced postoperative bleeding.

The *P* value by Cochran *Q* test was less than 0.001 in group A and less than 0.001 in group B, which was statistically considered highly significant, and 0.017 in group C, which was statistically considered significant (Fig. 14).

Urine retention

Postoperative urine retention occurred in three (7.5%) patients in group A and two (5%) patients in group B (Table 5). The *P* value by Fisher exact test was 0.365, which was considered statistically nonsignificant.

Recurrence after 1 year

Recurrence of hemorrhoids (reappearance of previously operated hemorrhoids not appearance of de novo hemorrhoids at different sites) occurred in one (2.5%) patient in group A, three (7.5%) patients in group B, and four (10%) patients in group C (Table 5). The *P* value by Fisher exact test was 0.532, which was considered statistically nonsignificant.

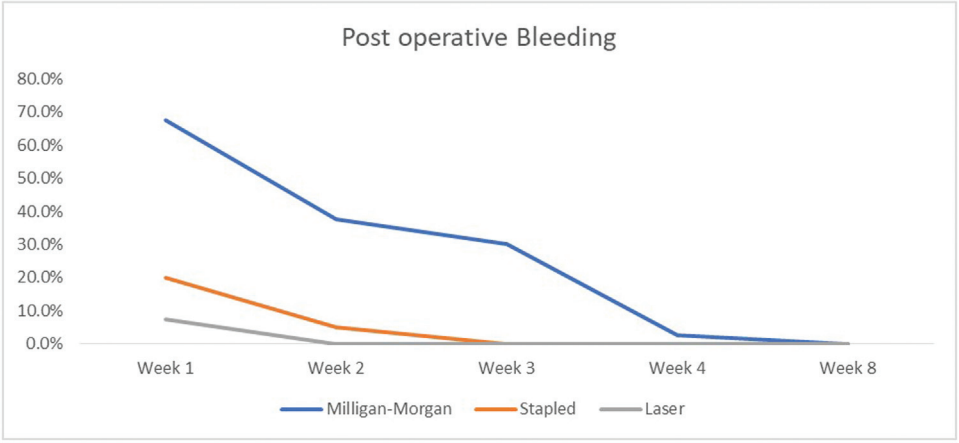
Anal stenosis after 1 year

Anal stenosis occurred in two (5%) patients in group A, with no patients affected in group B and group C (Table 5). The *P* value by Fisher exact test was 0.327, which was considered statistically nonsignificant.

Discussion

Hemorrhoids have a much higher incidence than rectum and colon diseases. Today, their prevalence is estimated to be between 2.9 and 27.9% among the

Fig. 14



Graphic representation of postoperative bleeding in Milligan-Morgan hemorrhoidectomy (group A) in blue, stapled hemorrhoidopexy (group B) in orange, and laser hemorrhoidoplasty (group C) in gray on weeks 1, 2, 3, 4, and 8.

Table 5 Postoperative complications in the three groups

	Group A [*n* (%)]	Group B [*n* (%)]	Group C [*n* (%)]	Fisher exact test	
				P value	Significance
Urine retention	3 (7.5)	2 (5.0)	0	0.365	NS
Recurrence	1 (2.5)	3 (7.5)	4 (10.0)	0.532	NS
Stenosis	2 (5.0)	0	0	0.327	NS

worldwide population, of which 4% are symptomatic [6].

Based on the Gauss method, the highest incidence is present in patients aged between 45 and 65 years. Men are more often affected than women [6].

Hemorrhoids are fibrovascular cushions containing arteriovenous communications present in the subepithelial space of the anal canal [2].

The standard classification for hemorrhoids is as follows: first degree=bleeding, second degree=protrusion with spontaneous reduction, third degree= protrusion requiring manual reduction, and fourth degree=permanent protrusion of hemorrhoids [2,7].

There are different modalities in the management of hemorrhoids. The treatment plan may include medical treatment or surgical treatment. The medical treatment is usually reserved for first and second degree hemorrhoids, whereas third and fourth degree usually require surgical intervention. Concerning third degree, the surgical options include the traditional method of MMH, SHP, or the most recent LHP.

Most patients after hemorrhoidal surgery complain of postoperative pain and postoperative bleeding. In addition, occurrence of urinary retention, anal stenosis, and hemorrhoidal recurrence that may occur after surgery are possible complications of utmost concern. In search for the most suitable surgical procedure, the patient requires one that provides cure from the hemorrhoids and has minimal pain and bleeding, with the least incidence of postoperative complications.

The aim of this study was to compare the three main surgical procedures, MMH, SHP, or the most recent LHP, as a method for the management of third-degree hemorrhoids.

There was no statistically significant differences among the three groups regarding the male/female ratio and age distribution. Preoperatively, 60 (50%) patients complained of bleeding, 34 (28.33%) patients complained of mass protruding from the anus, and 26 (21.67%) patients complained of anal discomfort. The *P* value was 0.994, which was considered statistically nonsignificant. In the study carried out by Kishore *et al.* [8], the most common complaint was bleeding per rectum followed by mass. Moreover, the same results were found in a study done by Naderan *et al.* [5].

The mean operative time in MMH was 27.5±5.3 min, in SHP was 25.9±4.7 min, and in LHP was 22.8

±3.9 min. The *P* value was less than 0.001, which was considered highly significant. There was a highly significant difference in the operative time between LHP and MMH in favor of the laser technique with shorter operative time. This was in agreement with Naderan *et al.* [5], with similar results. Moreover, there was a significant difference between LHP and SHP in favor of laser technique. There was no significant difference between MMH and SHP, although the stapled technique was somewhat faster. This was in agreement with Kishore *et al.* [8] and also with Agrawal and Chopra [2], with similar results. Moreover, Maloku *et al.* [9] compared MMH and LHP and found significant difference between them regarding operative time, with much shorter time in the laser group.

The mean hospital stay in MMH was 2.1±0.6 days, in SHP was 1.1±0.3 days, and in LHP was 0.7±0.3 days. The *P* value was less than 0.001, which was considered highly significant. These results show that the LHP can be performed as a day case with much significant shorter hospital stay than the other two procedures. These results were in concordance with Maloku *et al.* [6] This can be attributed to the fact that patients had less postoperative pain requiring analgesia with less postoperative bleeding requiring hospital admission, as will be clarified later.

The mean time to return to activity in MMH was 26.2 ±4.3 days, in SHP was 17.2±4.5 days, and in LHP was 11.3±2.4 days. The *P* value was less than 0.001, which was considered highly significant. These results are in concordance with Maloku *et al.* [6].

Postoperative pain was evaluated using the VAS 0–10 on day 1 and weeks 1, 2, 3, 4, and 8 after surgery. On day 1, pain VAS score had a statistically significant difference between the three groups, where the pain was at its highest in MMH, with a mean of 6.9±1.1; medium intensity in SHP, with a mean of 4.5±0.8; and at its lowest in LHP, with a mean of 2.8±0.5. This was in agreement with Ali *et al.* [10] and Naderan *et al.* [5] with similar results. This was attributed to the nature of each procedure, where in MMH, there was a large raw area after excision of the hemorrhoids with exposure of the nerve endings raising the intense sensation of pain. In SHP, the procedure involved resection of circular part of the mucosa and submucosa containing the hemorrhoids with primary edge to edge anastomosis decreasing the nerve endings exposure in respect to the MMH. In the LHP, the procedure involves minimal wounds in relation to the base of the hemorrhoids, thus minimal pain is present. In the study conducted by Aggrawal and Chopra [2], there was a reduction of pain by more than 50% in SHP than in MMH. Moreover, there was a significant difference between MMH and LHP in the study conducted by Maloku *et al.* [6] in favor of the LHP. In addition, another study by Maloku *et al.* [9] compared MMH and LHP and found significant difference between them regarding pain VAS score on day 1 and weeks 1, 2, 3, 4, 8, and 12, with mush less pain and early relief of pain in the laser group. A study conducted by Awazli [11] showed no pain in 64%, mild to moderate pain in 28%, and severe pain in 8% of cases.

This was further confirmed by the persistence of pain in the following weeks for a longer duration in MMH, as the wounds healed by secondary intention, having a mean of 5.2±0.9 in week 1, 4.1±0.8 in week 2, 2.9±0.7 in week 3, 1.2±0.7 in week 4, and 0.4±0.5 in week 8, taking a significantly longer duration of time than the other two groups.

In SHP, the pain persisted for a shorter duration of time, as the staple line healed faster than the MMH, yet longer than the LHP, with a mean of 2.5±0.8 in week 1, 0.7±0.6 in week 2, and disappeared starting from week 3 and onward, as the staple line healed by primary intention. This was in agreement with the data collected by Parker [3].

In LHP, the pain had a mean score of 0.8±0.5 on week 1 and disappeared by week 2. Thus, this procedure had the least intensity of pain on day 1 and faster relief of pain by week 2. This was owing to the minimal invasive nature of the LHP.

With respect to the postoperative bleeding, MMH had the highest rate of bleeding, being seen in 27 (67.5%) patients on week 1, 15 (37.5%) patients on week 2, 12 (30%) patients on week 3, and one (2.5%) patient on week 4. This is owing to the larger raw surface area in contact with the stool during defecation, resulting in prolonged bleeding. In SHP, the rate of bleeding was eight (20%) patients on weeks 1 and two (5%) patients on week 2, with stoppage of bleeding starting from week 3. In a study conducted by Pandey *et al.* [1] involving SHP, 4% of the patients had postoperative bleeding that persisted for 6 weeks. In the study conducted by Agrawal and Chopra [2], no significant difference was found in postoperative bleeding between MMH and SHP. In LHP, only three (7.5%) patients had bleeding on week 1, with no bleeding starting week 2. In the study by Maloku

et al. [6], there was a significant difference between MMH and LHP regarding postoperative bleeding in favor of the LHP, with high rate and prolonged bleeding in the MMH.The etiology of posthemorrhoidectomy bleeding was attributed to the speed by which the surgical site healed, being slowest in MMH and fastest in LHP.

Regarding postoperative complications, urinary retention occurred in three (7.5%) patients in MMH and two (5%) patients in SHP. In a study conducted by Pandey *et al*. [1] involving SHP, 2% of patients had urinary retention that was managed conservatively. These patients were managed conservatively by frequent evacuation of urine by catheterization till relief of symptoms. The incidence of retention correlates with the intensity of pain experienced by the patients. As a result, LHP had the least incidence of retention owing to low intensity of pain, although the results were statistically nonsignificant, with similar results in the study conducted by Agrawal and Chopra [2].

Recurrence of hemorrhoids (reappearance of previously operated hemorrhoids not appearance of de novo hemorrhoids at different sites) occurred in one (2.5%) patient in MMH, three (7.5%) patients in SHP, and four (10%) patients in LHP. In a study conducted by Pandey *et al*. [1] involving SHP, 0% of patients had recurrence, but the follow-up was for a short period (2 weeks). The higher incidence of recurrence in LHP was owing to recanalization of the respective veins, although the results were statistically nonsignificant.

Anal stenosis occurred in two (5%) patients in MMH with no patients affected in SHP and LHP. In a study conducted by Pandey *et al*. [1] involving SHP, only 2% of patients had anal stenosis, which was considered nonsignificant. This can be explained by the excessive fibrosis of the raw surface area at the surgical sites, leading to narrowing with absence of these effects in the other two groups. However, the difference among the three groups was found to be statistically nonsignificant.

Conclusion

This study clarified that the most suitable technique for the management of primary third degree hemorrhoids was LHP followed by SHP in comparison with the conventional MMH, with shorter operative time, less postoperative pain, shorter hospital stay, and less postoperative bleeding. The complication rate showed statistically nonsignificant difference with respect to the postoperative complications, such as urinary retention, anal stenosis, and recurrence rates. However, a large-scale study should be carried out for clarification of the minor differences.

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Conflicts of interest

There are no conflicts of interest.

References

1 Pandey A, Masood S, Chauhan S, Gupta A, Kulshrestha MR. Stapled haemorrhoidopexy in India – worthy of its cost?. Sch Acad J Biosci 2017; 5:178–182.

2 Agrawal S, Chopra S. Comparative study between conventional hemorrhoidectomy versus stapled hemorrhoidopexy at Ja Group of Hospitals Gwalior. IOSR J Dent Med Sci 2016; 15:69–94.

3 Parker GS. A new treatment option for grades III and IV hemorrhoids. J Fam Pract 2004; 53:799–804.

4 Caro A, Olona C, Vicente V, Goncalves C, Jimenez A. Grade 3 haemorrhoidal treatment: rubber band ligation or haemorrhoidectomy – a prospective study. Ambulatory Surg 2010; 16:56–61.

5 Naderan M, Shoar S, Nazari M, Elsayed A, Mahmoodzadeh H, Khorgami Z. A randomized controlled trial comparing laser intra-hemorrhoidal coagulation and Milligan-Morgan hemorrhoidectomy. J Invest Surg 2017; 30:325–331.

6 Maloku H, Lazović R, Terziqi H. Laser hemorrhoidoplasty versus Milligan-Morgan hemorrhoidectomy – short-term outcome. Vojnosanit Pregl 2019; 76:8–12.

7 Gagloo MA, Hijaz SW, Nasir SA, Reyaz A, Bakshi IH, Chowdary NA, *et al*. Comparative study of hemorrhoidectomy and rubber band ligation in treatment of second and third degree hemorrhoids in Kashmir. Indian J Surg 2013; 75:356–360.

8 Kishore P, Sruthi BM, Obulesu G. Comparative study between stapler and open hemorrhoidectomy in the management of grade III/IV hemorrhoids. IAIM 2016; 3:218–221.

9 Maloku H, Gashi Z, Lazovic R, Islami H, Juniku-Shkololli A. Laser hemorrhoidoplasty procedure vs open surgical hemorrhoidectomy: a trial comparing 2 treatments for hemorrhoids of third and fourth degree. Acta Inform Med 2014; 22:365–367.

10 Ali M, Rauf Khan MU, Akbar A, Bandeshah T. Comparison of the severity of postoperative pain in stapled vs open Milligan Morgan hemorrhoidectomy for hemorrhoids. Pak J Med Health Sci 2015; 9:469–472.

11 Awazli LG. Hemorrhoidectomy using (10600 nm) CO_2 laser. Iraqi J Laser 2014; 13:33–39.