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A Prospective Comparative Study: Stapler Hemorrhoidopexy vs Laser Hemorrhoidoplasty in the Treatment of Hemorrhoids

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Authors' contributions

This work is the brainchild of author AK and he has designed the study format. Author AA has been the backbone of the study. Author AA designed the allocation techniques, data collection forms, resources for data collection, statistical analysis and further publications. Author APK has contributed in validating the statistical results and comparing it with appropriate literature. Author RA has contributed to supervising the data collection. Author DNK has contributed with the article submission work. Author TKT has provided guidance in the subject and expert opinions in the significance of the results. All authors have read and approved the manuscript.

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ABSTRACT

Aims: Stapler hemorrhoidopexy (SH) has evolved over time as a procedure of choice over conventional surgery due to less postoperative pain. Laser hemorrhoidoplasty (LH) is a novel procedure aimed at shrinking the terminal branches of hemorrhoidal arteries with fewer complications. The present study is aimed to compare these procedures (SH and LH).
Study Design: Prospective comparative study.
Place and Duration of Study: Patients operated for hemorrhoids at the Department of General, MI & Bariatric Surgery, Artemis Hospitals, Gurgaon from April 2018 to March 2019.
Methodology: 50 patients with grade II-III hemorrhoids were allocated to two groups: Stapler hemorrhoidopexy (SH) and Laser hemorrhoidoplasty (LH) with 25 patients in each group. Results were compared and patients were followed up for minimum period of 3 months.

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Results: The mean operative time was 24.6 min (LH) and 28.6 min (SH) (P =.122). The average blood loss was 8.32 ml (LH) and 11.64 ml (SH) (P <.05). The mean hospital stay 21.44 hours (LH) and 32.64 hours (SH) (P <.05). Mean postoperative pain score (VAS) at 12 hours was 2.64 (LH) and 4.76 (SH) (P <.05), at 24 hours was 1.88 (LH) and 3.6 (SH) (P <.05), at 1 week was 0.36 (LH) and 0.88 (SH) (P =.054) and at 3 months 0.04 (LH) and 0.12 (SH) (P =.53). One patient in LH (4%) had postoperative bleeding on 4th postoperative day. In SH group, 2 (8%) had severe postoperative pain with VAS > 8, requiring longer hospital stay, 2 (8%) had bleeding on the same day, 1 (4%) had bleeding on follow up and 1 (4%) had recurrence.
Conclusion: In terms of early postoperative pain and complications, LH offers better results as compared to SH. It was associated with a shorter hospital stay and early return to work. No significant complications were noted in LH compared to SH. LH is an extremely viable alternative to the popular SH for grade II-III hemorrhoids.

Keywords: Hemorrhoids; stapler hemorrhoidopexy; laser hemorrhoidoplasty; anal canal; anorectal diseases.

1. INTRODUCTION

Hemorrhoidal disease is ranked first amongst diseases of the rectum and large intestine, and the estimated worldwide prevalence ranges from 2.9% to 27.9%, of which more than 4% are symptomatic [1]. Approximately, one third of these patients seek physicians for advice. Age distribution demonstrates a Gaussian distribution with a peak incidence between 45 and 65 years with subsequent decline after 65 years [2]. Around half of the population has some degree of affection by the age of 50 years. In USA, the estimated prevalence is 58% in over 40 years of age [3]. Exact prevalence in the developing countries is not known. Men are more frequently affected than women [4]. Surgical management of hemorrhoids has progressed tremendously from complex ligation procedures in the past to simpler techniques today that allow the patient to return to normal activities in a short period. The understanding of the anatomy and underlying pathophysiology of the disease has helped in continuous evolution of the surgical techniques and the quest continues to find the best physiological technique with minimal disturbances and complications.

Surgery is the most effective treatment for hemorrhoids and is particularly recommended in prolapsing piles during defecation that may be reduced manually (Grade III) and irreducible hemorrhoids (Grade IV) [2]. Other indications to surgery are failure of non-operative management, patient preference and concomitant conditions (such as fissure or fistula) that require surgery [5]. The rationale of these procedures is based on the theory that hemorrhoids are caused by vascular hyperplasia of the arteriovenous network within the anorectal submucosa. Traditional surgery for hemorrhoids aims to remove the hemorrhoids, with closure (Fergusson's technique; 1952) or without closure (Milligan–Morgan procedure; 1937) of the ensuing defect. This traditional approach is effective, but causes significant postoperative pain because of wide external wounds in the innervated perianal skin.

Post-hemorrhoidectomy pain is the commonest problem associated with the surgical techniques. The other early complications are urinary retention, bleeding (secondary or reactionary) and subcutaneous abscess. The long-term complications include anal fissure, anal stenosis, incontinence, fistula and recurrence of hemorrhoids. Pain after surgery for hemorrhoids is a major worry [6].

Spasm of the internal sphincter is thought to play an important role in postoperative pain. However, there is no evidence that simultaneous internal sphincterotomy is helpful [7]. In fact, this may lead to long-term sequelae of mild incontinence in 22% of patients. Topical application of 0.2% glycerine trinitrate gel, 'chemical sphincterotomy' has no benefit on improvement of pain, however, it may affect more rapid wound healing [8].

Postoperative hemorrhage is a relatively common complication. Bleeding in the immediate postoperative period is almost always due to inadequate intraoperative hemostasis. In the existing literature, this complication occurs in 4 to 25% of cases [9]. Delayed hemorrhage between 7 and 14 days occurs in 2.4% of cases [10]. Small amount of bleeding, especially with bowel movements, is expected. A massive hemorrhage in the immediate postoperative period mandates return to the operating room where suture

ligation of the bleeding vessel solves the problem. Late bleeding, 7 to 10 days after surgery, occurs when the necrotic mucosa overlying the vascular pedicle sloughs. Some patients can be managed observantly, while some will require examination under anesthesia and ligation of bleeding vessel.

Stapler hemorrhoidopexy, proposed by Longo, has gained vast acceptance because of less postoperative pain and faster return to normal activities. Hemorrhoidal prolapse is resolved by repositioning the hemorrhoidal masses into the anal canal and by reducing the venous engorgement with transection of the feeding arteries and redundant mucosa. This technique results in a stapled mucosa anatomized in the rectum, at least 3 cm above the dentate line, where sensitive receptors are few [11]. The major advantage being reduced postoperative bleeding and earlier return to work with shorter hospital stay. Other results in favor of stapler were related to pain, bleeding, anal discharge, wound healing, tenderness at per rectal examination, incontinence scores, earlier return of bowel function, analgesic requirement and resumption of normal activities [12]. However, the overall late complications of stapler hemorrhoidopexy have been said to be similar to those seen with conventional hemorrhoidectomy [13]. Bleeding following stapler hemorrhoidopexy is often secondary to an arteriolar bleed along the staple line, and may also be secondary to inflammation due to staples [14]. Other complications related particularly to stapler procedure include rectovaginal fistula, rectal perforation, rectal obstruction. It is noted that stapler hemorrhoidopexy was associated with a higher rate of recurrent disease than conventional methods. Localized residual prolapse may be related to incomplete 'donut' of mucosa. The depth and height of the purse-string suture appears critical to ensure an adequate 'donut' and that the staple line lies at an appropriate height. Incorporation of some muscle into the 'donut' leads to symptoms of pain during defecation and fecal urgency [15]. Stapler hemorrhoidopexy was recommended because of the short operative time, lesser postoperative pain and faster recovery. However, in the recent literature, a significant incidence of recurrence after stapler hemorrhoidopexy was reported [16].

In 2009, the Hemorrhoidal LASER Procedure (HeLP) technique was described as a minimally invasive technique, which requires photocoagulation of arterial branches using a LASER diode fiber [17]. Laser ablation has opened new possibilities for the minimally invasive treatment of hemorrhoids. A variety of lasers have been used for this such as Carbon dioxide, Argon, and Nd:YAG lasers. The laser beam causes tissue shrinkage and degeneration at different depths depending on the laser power (irradiance) and the duration of laser light application [18]. Recent evidence has supported this modality of treatment for symptomatic hemorrhoids. It can be used alone or in combination with other modalities. However, long term results and its comparison with other methods are lacking in literature [19].

Multiplicity of treatment modalities for hemorrhoids has led to confusion in decision about the treatment method. The question of optimal treatment technique remains unanswered despite most of the techniques in use being subjected to randomized evaluation. The present study aims to describe and compare cases in which Stapler Hemorrhoidopexy and Laser Hemorrhoidoplasty has been done. Postoperative evaluation and follow up shall be carried out, analyzing clinical and functional aspects of patients, evaluating the improvement of symptoms, characteristics of the studied population, description of the technique used and overall symptomatic relief and complication profile.

2. MATERIALS AND METHODS

It is a prospective comparative study in which patients getting operated for Hemorrhoids either using Stapler Hemorrhoidopexy or Laser Hemorrhoidoplasty techniques in the Department of General Surgery at Artemis Hospitals, Gurgaon, during the period from April 2018 to September 2019 were studied.

Inclusion criteria:

- Symptomatic Grade II and III hemorrhoids
- Age 18 years to 75 years

Exclusion criteria:

- Grade I and IV hemorrhoids
- Acutely thrombosed hemorrhoids
- Concurrent acute anorectal diseases
- Previously operated cases

2.1 Methodology

The study was conducted in the Department of General, MI & Bariatric Surgery at Artemis

Hospitals, Gurgaon (India). Patients coming to the OPD that fulfilled the inclusion criteria were explained about both the procedures and were allowed to make a choice for surgery and their inclusion in the study. After admission, the enrolled patients underwent routine investigations followed by a pre-anesthetic check. Based on their choice of surgery, the patients were allotted to SH group (Stapler Hemorrhoidopexy) or LH group (Laser Hemorrhoidoplasty).

Data collection was done as per the proforma. Details regarding their demographics, clinical symptoms, examination findings and pre-operative investigations were noted down. Preoperative pain scoring was done using Visual Analog Scale (VAS). They were operated by one of the techniques as described ahead. The intraoperative data was collected including the operative duration, blood loss, and any inadvertent events during the operation. Postoperative pain score (VAS) was noted at 12 hours and 24 hours of the operation. The patients were discharged the next day, before which the operative site was inspected for any bleeding. Patients were given a laxative and SOS pain medicines at discharge and advised to follow up at 1 week, during which pain score (VAS), any complaints/symptoms and examination findings were noted down. The patients were followed up at 3 months. For the patients who were unable to follow up in the hospital, a telephonic follow up was done and any complaints were asked, the pain score (VAS) was noted and in case of any complaints, they were followed up in the surgical OPD and data was collected. Surgical informed consent was taken as per standard protocol. Study consent was taken for their willful participation into the study. Data was collected from the Artemis eHIS and patient visits during follow up.

Comparative statistical analysis was carried out between the groups by using IBM SPSS software. The quantitative data was summarized as mean and standard deviation, the qualitative data was summarized as frequency and percentage. The group demographics and the presentation complaints were compared in both groups to avoid any selection bias. Both the groups were comparable and there was no significant difference in their demographics or complaints. Comparison of the quantitative parameters between the two groups was done using independent t-test with 95% confidence interval (CI) and P values less than 0.05 were considered significant. Comparison of qualitative parameters between the two groups was done using chi-square test with 95% confidence interval (CI) and P values less than 0.05 were considered significant. Pearson's correlation table was used to identify the variables which significantly affect the outcome in the hemorrhoid surgeries.

2.2 Stapler Hemorrhoidopexy

Stapler Hemorrhoidopexy was performed by using a specifically-designed 3 rows circular stapling device, MIRUS™ Hemorrhoids Stapler by Meril Endo-Surgery Pvt. Ltd. The operation was performed in the standard extended lithotomy position. Preoperative purgation was not done. Under spinal anesthesia, after painting and draping the operative field, the anus is progressively dilated to accommodate the side viewing anoscope (external diameter 34-36 mm). After dilatation, the circular anoscope and obturator are inserted into the rectum.

Fig. 1. Introducing the obturator (above) and fixation of the anoscope to the perianal skin (below) during stapler hemorrhoidopexy

The obturator is removed and the anoscope is fixed to the perianal skin using number 1 silk so as the inner border is beyond the dentate line. A side viewing anoscope is inserted through the circular anoscope to facilitate the placement of circumferential purse-string suture (using 2-0 prolene) into the mucosa and submucosa, around 5 cm proximal to the dentate line. In females, care is taken to avoid suture placement into the posterior vaginal wall. Once completed, the purse-string suture is partially tightened to draw the redundant mucosa into the lumen.

The anvil of the fully opened stapler is then inserted across the anus and through the purse-string suture. The purse-string suture is then fully tightened and tied around the shaft of the stapler. Then three maneuvers are performed at the same time: gentle traction on the suture, tightening of the stapler head and advancing the stapler into the rectum. When fully tightened, the 4-cm mark on the stapler should be at the anal verge. The vagina is examined in females to confirm that the posterior vaginal wall is not incorporated into the suture. The stapler is then fired and held closed for 1 minute to achieve hemostasis.

Fig. 2. Introduction of side viewing anoscope (above) followed by purse-string suture placement

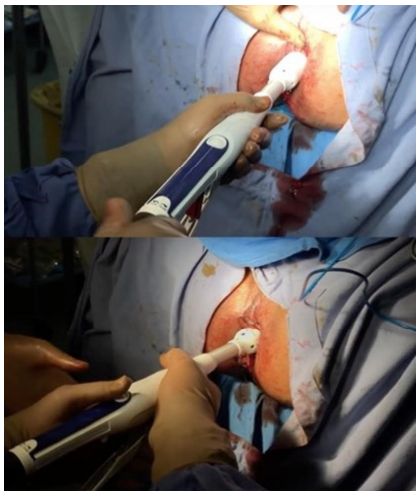

Fig. 3. Introduction of stapling device (above) followed by tightening and firing the stapler
Note that the stapler is introduced inside with at least 4-cm mark within the anal canal

The head of the stapler is opened and drawn out gently. The specimen is retrieved from the stapler and inspected to verify that a complete circumferential "donut" of tissue has been excised. A side viewing anoscope is then introduced to inspect the anastomosed staple line to check for any staple dislodgements, any bleeding or any gaps in the anastomosis, which may be reinforced by simple 3-0 absorbable sutures.

A rolled-up gauze lubricated with lignocaine gel, is gently placed into the anal canal and kept for 4-6 hours to assist hemostasis. Anoscope sutures are then cut and anoscope removed. The patient is then shifted to recovery and inspected for any bleeding. In the absence of any events, the patient is then shifted to the ward and discharged the next day.

2.3 Laser Hemorrhoidoplasty

Laser Hemorrhoidoplasty was performed using a Diode Laser with bare Optical Fibre emitting 1470-nm LASER, delivering pulses at a fixed interval.

Under spinal anesthesia, after painting and draping the operative field, a side viewing anoscope is introduced for the inspection of hemorrhoids and their pedicles. A stab is then made at mucocutaneous junction; the base of the hemorrhoid pedicle is identified. The laser optical fibre is then introduced in the opening, parallel to the pedicle beyond the dentate line and up to the base of the prolapsing tissue.

Once the pedicle was identified, up to 6 pulses at a power of 13 W, each lasting for 3 seconds at a gap of 1.2 seconds were delivered. For wider base, the direction of the fibre was changed after pulling back the fibre and repositioning it in a fan-shaped manner to coagulate all parts of the enlarged pedicle.

To decrease post operative edema, pressure using a gauze piece was applied on the coagulated tissue for 30 seconds. The procedure was repeated at all the hemorrhoids in the other two positions. However, it was not done all around the anal canal. The laser beam induces a degeneration of mucosal and submucosal tissues, causing shrinkage of the underlying tissues there and then and arterial branches to a depth of 5 mm. At the end of the procedure, bleeding from the pedicle was checked, which if required, was ligated using simple absorbable

sutures. In patients with significant mucosal prolapse, mucopexy was also done using 2-0 vicryl at 2, 4, 8 and 10 o'clock. The anal canal was packed using a lubricated rolled up gauze and kept for 4-6 hours. The patient is then shifted to recovery and in the absence of any events, discharged the next day.

Fig. 4. Complete "donut" of tissue removed with stapler (above). The suture-line is inspected at the end of the procedure

Fig. 5. The Laser device control panel

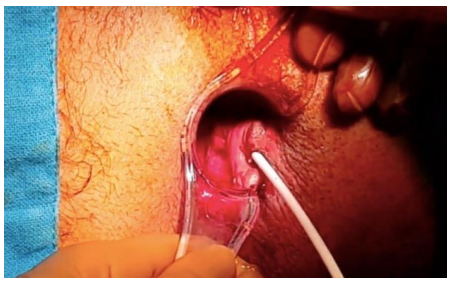

Fig. 6. Introduction of the laser fibre into the hemorrhoid pedicle after giving a stab incision

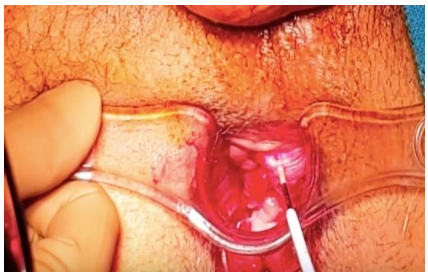

Fig. 7. Firing of Laser beam at multiple locations within the hemorrhoidal tissue

In both the above groups, any external hemorrhoids or redundant prolapsing tissue was excised using closed technique. Postoperative analgesia was given as injection diclofenac 75mg on SOS basis to calculate VAS and converted to tablet diclofenac 50mg from the next morning. In cases of pain despite the above doses, addition of injection tramadol 50mg was done. Any persistent pain or bleeding, warranted inspection of the wound and if required return to the theatre.

3. RESULTS

There were 50 patients enrolled in this study. They were allocated to two groups, 25 each in LH (Laser Hemorrhoidoplasty) group and SH (Stapler Hemorrhoidopexy) group. The mean age of patients was 51.08 years with minimum age 28 years and maximum age 61 years. There were 40 males (80%) and 10 females (20%). Most common presenting symptom was tissue prolapse per rectum in 40 (80%) patients. The other symptoms were bleeding per rectum in 33 (66%), constipation in 23 (46%), pain during defecation in 17 (34%) patients. On examination, majority of them, 41 patients (82%) had grade III internal hemorrhoids while 9 patients (18%) had grade II internal hemorrhoids. 10 patients (20%) had some degree of external hemorrhoids and 7 (14%) had skin tag. Examination during surgery revealed active bleeding in 10 patients (20%) and mucosal prolapse in 22 (44%).

Spinal anesthesia was preferred and 48 patients underwent procedures under spinal anesthesia while 2 patients were operated under general anesthesia due to medical conditions.

3.1 Comparing Surgical Groups: Demographics

The two groups: LH (laser hemorrhoidoplasty) and SH (stapler hemorrhoidopexy) were

compared using independent t-test for quantitative parameters and chi-square test for qualitative parameters. They were compared to see if there was significant difference between their demographics.

There was no significant age difference between the groups. However, LH group had 95% males and 4% females, while the SH group had 64% males and 36% females, the difference was statistically significant. Both the surgical groups were fairly comparable in their presenting symptoms and the examination findings. Only one parameter was significantly different, the bleeding per rectum as a symptom. However, on examination, the active bleeding was present in both the groups and had no significant difference.

The mean operative duration in LH was 24.6 min and in SH was 28.6 min, which was not statistically different. The blood loss was 8.32 ml in LH and 11.64 ml in SH, which was significantly more in the SH group (*P* =.011). The mean hospital stay was 21.44 hours in LH and 32.64 hours in SH, which was significantly better in LH group (*P* =.007). 4 patients in the LH group were discharged the same evening (stay of 8 hours) while the others were discharged the next day.

In the SH group, six patients had more than 1 day of hospital stay. The maximum stay was for 4 days in a 35 years old gentleman who had severe post operative pain (VAS score 10) and required consultation of Pain Management Team. He was managed conservatively with centrally acting analgesic, gabapentin. One patient had three days stay due to severe postoperative pain (VAS score 9) requiring intravenous analgesics. Four other patients had two days of stay due to postoperative pain (VAS>7) requiring intravenous analgesics and one of them had urine retention postoperatively requiring catheter for longer time (5 weeks). All these patients belonged to the stapler group.

Postoperative pain was a significant clinical outcome. The mean pain score VAS at 12 hours and 24 hours postoperatively was 2.64 and 1.88 in LH group and 4.76 and 3.6 in SH group. The LH group had significantly better outcome in terms of less pain score VAS in the first 24 hours. The mean pain score VAS at 1 week and 3 months was 0.36 and 0.04 in LH and 0.88 and 0.12 in SH. Even though at 1 week, the LH group had less pain score, no significant difference was noted in the 1 week or 3 months pain scores in both the groups.

Complications within first week were seen in 6 patients (12%). One patient in the LH group, came on the fourth postoperative day with bleeding and was readmitted. He was managed with laxatives and observation. In the SH group, two patients had severe pain which required consultation from Pain Management Team and were managed with gabapentin, as described above. Three patients (6%) had postoperative

Table 1. Demographics

Mean ± SD (standard deviation)		
Age (years)	51.08 ± 15.105	
	n	**n %**
Male	40	80
Female	10	20
Symptoms		
Pain	17	34
Bleeding	33	66
Constipation	23	46
Prolapse	40	80
Co-morbidities	16	32
Examination		
Skin tag	7	14
Ext piles	10	20
Grade of Piles		
II	9	18
III	41	82
Active bleeding	10	20
Mucosal prolapse	22	44

Table 2. Comparing surgical groups: Demographics

	LH group		SH group		Independent t-test	
	Mean	**SD**	**Mean**	**SD**	***P* value**	**Significance**
Age (years)	47.44	15.22	54.72	14.36	.08	Not significant
	LH group		**SH group**		**Chi-square test**	
Sex	**n**	**%**	**n**	**%**	***P* value**	**Significance**
males	24	96%	16	64%	.005	Significant
females	1	4%	9	36%		

Symptoms	LH group		SH group		Chi-square test	
	n	**%**	**n**	**%**	***P* value**	**Significance**
Pain	8	32%	9	36%	.765	Not significant
Bleeding	12	48%	21	84%	.007	Significant
Constipation	13	52%	10	40%	.395	Not significant
Prolapse	18	72%	22	88%	.157	Not significant
Co-morbidities	9	36%	7	28%	.544	Not significant
Examination						
Skin tag	3	12%	4	16%	.684	Not significant
Ext piles	6	24%	4	16%	.48	Not significant
Active bleeding	3	12%	7	28%	.157	Not significant
Mucosal prolapse	12	48%	10	4%	.569	Not significant

Table 3. Comparing Surgical Groups: Outcomes

Surgical	LH group		SH group		Independent t-test	
	Mean	**SD**	**Mean**	**SD**	***P* value**	**Significance**
Operative time (min)	24.6	6.60	28.6	10.85	.122	Not significant
Blood loss (ml)	8.32	4.08	11.64	4.76	.011	Significant
Hospital stay (hours)	21.44	5.98	32.64	18.17	.007	Significant

bleeding, two of them had bleeding on the same evening, required re-exploration. No active bleeding was seen and clots were evacuated. Complications were noted on follow up in 3 patients (6%). One patient from the stapler group, came after 11 months with bleeding per rectum and recurrent grade I piles on colonoscopy. One patient from the stapler group came at 6 months with bleeding per rectum and was managed conservatively. One patient who had urine retention, as described above, from the stapler group came on follow up at 1 month with pain during defecation. The catheter was removed and he was managed conservatively with laxatives and sitz bath.

Within the first week, only one patient in the LH group (4%) had complication. He presented with bleeding on the 4th postoperative day, as described above. Whereas, in the SH group, 7 patients (28%) had some postoperative event. On follow up, there were 3 complications and all in the SH group (12%). Statistically, the LH group fared significantly better than the SH group in terms of complications within 1 week and even on longer follow up.

As seen in the above table, sex affected the VAS score at 24 hours, however the correlation coefficient is weak, only 35%. Bleeding during the surgery also affected the VAS score at 24 hours and the chances of complications within 1 week, but with weaker coefficients, 29.5% and 31.3% respectively. The grade of piles affected the blood loss to an extent of 32%. Significant correlation was seen between operative time and blood loss (51.3%); also seen between operative time and hospital stay, 12 hour VAS and 24 hour VAS but the coefficients were weaker.

Five patients underwent mucopexy in the LH group and 20 patients did not. The 12 hour VAS was slightly more in the mucopexy patients; however no significant difference was noted between them. It is likely that the sample size in mucopexy group is very small and both the groups are not exactly comparable which invalidates the statistics.

4. DISCUSSION

Currently, several therapeutic modalities are available for the treatment of hemorrhoids. It

largely depends on the severity and location of the hemorrhoids. Low grade (grade II) hemorrhoids are usually managed by non-invasive methods like Rubber-Band Ligation (RBL). The RBL procedure can be performed in an outpatient setting (may require several sittings), is considered safe, preferred by patients and yields a success rate of 70-97% [20]. Doppler technology to identify and ligate 3-6 hemorrhoidal vessels has shown to result in lower recurrence rates than RBL, yet its association to increased postoperative pain and being an invasive procedure it is not practiced widely.

For grade III prolapsing hemorrhoids, excision has been considered the standard of treatment. With the advent of stapler hemorrhoidal procedure, the ease of availability of stapler devices, the variety of options available and increasing expertise in the technique, the current era has seen the stapler procedure being performed at an increasing rate in the last decade. However, even the stapler procedure is not free from complications. Postoperative pain has always been a fear-factor in patients with hemorrhoids. Pain is the major concern, which makes patients reluctant to undergo surgical procedure.

Sutherland et al.[12] conducted a meta-analysis on stapler hemorrhoidopexy and included several randomized control trials. Postoperative pain scores collected at various stages after recovery show pain scores of 0.6 VAS at 1 week after surgery in stapler hemorrhoidopexy. When compared to conventional hemorrhoidectomy, pain scores are 2-5 at one week. In a study performed at Colon and Rectal Clinic Orlando,[21] early complications in stapler hemorrhoidopexy were bleeding (2.5%), urine retention (7.5%), significant pain (12.5%). Delayed complications (after 2 weeks) were bleeding (2.5%), excessive pain (2.5%) and abscess in 2.5%. The results are comparable to those found in our study.

However, the long term results of stapler are not better than the conventional excisional hemorrhoidectomy. Bellio et al. [22] studied 77 patients operated for stapler hemorrhoidopexy for grade III hemorrhoids at a median follow-up of 119 months. They found 39% rate of recurrent hemorrhoidal prolapse, 8 of whom had reoperation. 44% had defecation urgency. 8% of patients had gas leakage without any solid or liquid incontinence. Procedural satisfaction rate was 68%. These results show that stapler hemorrhoidopexy is definitely a

Table 4. Comparing surgical outcomes: Postoperative pain scores

Pain	LH group		SH group		Independent t-test	
	Mean	SD	Mean	SD	*P* value	Significance
12 hours - VAS	2.64	0.95	4.76	2.24	<.001	Significant
24 hours –VAS	1.88	0.92	3.6	1.82	<.001	Significant
1 week –VAS	0.36	0.49	0.88	1.2	.054	Not significant
3 months - VAS	0.04	0.2	0.12	0.6	.53	Not significant

Table 5. Comparing surgical outcomes: Complications

Complications < 1 week	n	%
Severe Pain - Intervention	2	4%
Bleeding	3	6%
Urine Retention	1	2%
Constipation	1	2%
Re-exploration	2	4%
Readmission	1	2%
Complications > 1 week	**n**	**%**
Severe Pain – Intervention	1	2%
Recurrence	1	2%
Bleeding	1	2%

Complications	LH group		SH group		Chi-square test	
	n	%	N	%	*P* value	Significance
< 1 week	1	4%	5	20%	.021	Significant
> 1 week	0	0%	3	12%	.037	Significant

Table 6. Identifying the factors affecting the outcome

		Blood loss	Hosp stay	12hr VAS	24hr VAS	1wk VAS	3mo VAS	<1wk	>1wk
Age	correlation	0.116	-0.032	0.132	0.102	0.052	0.051	0.045	-0.046
	P value	.421	.823	.359	.483	.719	.727	.756	.751
Sex	correlation	0.120	0.145	0.226	0.350	-0.011	-0.091	0.191	0.037
	P value	.405	.317	.115	.013	.941	.530	.184	.799
Co-morbidities	correlation	-0.135	-0.097	0.039	0.056	0.095	0.168	0.051	0.114
	P value	.349	.502	.789	.700	.510	.245	.723	.431
Pain	correlation	-0.097	0.200	0.044	0.036	0.066	-0.130	-0.083	-0.212
	P value	.504	.163	.759	.803	.649	.366	.567	.140
Bleeding	correlation	0.169	0.246	0.231	0.295	0.160	0.130	0.313	0.212
	P value	.239	.086	.107	.038	.268	.366	.027	.140
Active bleeding	correlation	0.067	0.089	0.100	0.018	0.043	0.023	0.055	0.037
	P value	.645	.539	.488	.901	.768	.876	.707	.799
Prolapse	correlation	-0.110	0.161	0.050	0.012	0.171	0.091	0.082	0.147
	P value	.448	.263	.729	.934	.235	.530	.572	.307
Grade of piles	correlation	0.323	0.215	0.191	0.209	0.088	0.085	0.204	0.138
	P value	.022	.134	.185	.145	.544	.556	.154	.339
Operative time	correlation	0.513	0.357	0.394	0.402	0.143	0.144	0.255	0.111
	P value	<.001	.011	.005	.004	.322	.318	.074	.442

novel procedure, which has improved the immediate postoperative outcomes when compared to conventional hemorrhoidectomy. The long term results of stapler are still far from satisfactory and the search of the ideal treatment procedure continues.

Hemorrhoidal Laser Procedure (HeLP) was described by Giamundo et al. [20] as a novel doppler-guided procedure using a special laser device to shrink terminal branches of the superior hemorrhoidal artery. The procedure has been described for the treatment of second and third degree hemorrhoids. It is intended to accelerate postoperative downstaging of the hemorrhoids. Spontaneous resolution is noted after several days. Ram et al. [23] studied 58 procedures with operation duration mean 20.8 minutes. Postoperative pain was noted to be VAS 0 in 80.6% patients at the first defecation, VAS 0 in 82.3% patients at 1 week and VAS 0 in 95.2% at 1 month. Other complications noted were bleeding (2.4–6%), abscess (0-5%) and urine retention in 20.1%. Long term complications include fissure (1-2.6%), anal stenosis (1%), incontinence (0.4%), fistula (0.5%). Present study showed similar results. Mean postoperative VAS score was 1.88 at 1 day, 0.36 at 1 week and 0.04 at 3 months. There was only 1 event of bleeding within first week (4%).

Laser dearterialization has the advantage of preservation of the anatomy and physiology of the anal canal, when compared to other forms of treatment. Thus, it minimizes the risk of postoperative impaired anal function. As the technique spares the sensitive region below the dentate line, the pain in the postoperative period is very less when compared to other methods. Incidence of postoperative bleeding is also lesser compared to other methods. It may not require anesthesia for the procedure; however, regional anesthesia is preferred to allay the patient anxiety. Patient can be discharged the same day evening. At three months follow up, no complications have been reported.

Other forms of hemorrhoidal coagulation have been attempted by several authors such as LigaSure system, Harmonic Scalpel, electrothermal coagulation. Peker et al. [24] studied 69 patients randomized to LigaSure, Harmonic Scalpel and conventional hemorrhoidectomy. They observed that the postoperative pain and analgesic requirement was much higher in LigaSure and Harmonic Scalpel group. Wound healing was also rapid in conventional group. The lateral heat dissipation of these sources is considerably higher compared to conventional methods and the thermal damage could be the cause of increased pain. Hence, these techniques did not gain popularity.

In comparison, laser coagulation does not generate excessive heat and the beam is focused on the target tissue avoiding the lateral damage. Laser hemorrhoidoplasty is nearly pain-free, minimally invasive procedure with acceptable patient satisfaction. In the present study, the first one of its kind, laser hemorrhoidoplasty is fairly comparable to stapler hemorrhoidopexy and is associated with less operative time, less bleeding and significantly lesser number of complications. Since last two decades, stapler hemorrhoidopexy has become a low-pain alternative for prolapsed hemorrhoids. However, the supra-anal mucosal resection involved in the procedure causes a severe circular trauma. This unique step of stapler procedure, the mucosal resection and anastomosis, becomes the root-entry for a variety of specific complications related to stapler procedure. On the contrary, the diode laser serves to denaturize the hypertrophic

Table 7. Comparison of complications of stapler hemorrhoidopexy

SH Group	Early complications		Late complications	
	Orlando study	Present study	Orlando study	Present study
Bleeding	2.50%	8%	2.50%	4%
Urine retention	7.50%	4%	5%	4%
Severe pain	12.50%	4%	7.50%	4%

Table 8. Comparison of results of laser hemorrhoidoplasty

LH group	VAS at 24hr	VAS at 1wk	Bleeding	Urine retention
Ram et al.	0 in 80.6%	0 in 82.3%	2.4-6%	20.10%
Present study	<2 in 64%	0 in 72%, <2 in 98%	4%	0%

hemorrhoidal tissue submucosally and thus downgrades the disease. The entry to the hemorrhoidal pedicle is achieved via 2 mm small nick at mucocutaneous junction wherein the pointed laser probe is inserted submucosally until it has reached the area underneath the distal anal mucosa. After application of laser pulses, the tissue's response can be seen as slight reduction, but the better contraction response is seen later on follow-up. For patients with symptomatic or significant mucosal prolapse, a short distance mucopexy can be added, above the dentate line. However, the comparative results and complications related to mucopexy need to be studied.

In our comparative analysis, we found that both stapler hemorrhoidopexy and laser hemorrhoidoplasty are safe and effective procedures for hemorrhoids. However, significant difference was noted in the operative blood loss and outcome parameters like hospital stay, immediate postoperative VAS and complications. The operative bleeding was lesser in laser than in stapler procedures. More importantly, there was only one patient with postoperative bleeding in laser group compared to significant number of patients in stapler who needed re-entry to the operating room to re-explore for postoperative bleeding. The complication rate is higher in stapler group, however further future studies with larger sample size need to be conducted to verify the results.

Cost-effectiveness is an important factor for the surgeons and the patients when deciding which technique to opt for. In India, Laser apparatus is not affordable and accessible to all because of its price and availability. The awareness regarding the laser procedure is not widespread due to the novelty of the procedure. However, with the present study and the further research in the subject, it may gain popularity as a procedure of choice by many surgeons as well as patients. In our current study, we were able to match the equipment cost between stapler device and laser probe. It may not be possible to procure laser set-up at equivalent cost as stapling devices. However, in regard to significantly reduced hospital stay, reduced incidence of post-operative re-exploration and complications, the overall cost-effectiveness of laser surgery may be better than the stapler procedure.

In conclusion, laser hemorrhoidoplasty offers a safer alternative to stapler hemorrhoidopexy in terms of significantly better pain-control, perioperative bleeding episodes, hospital stay and complications profile. There are no similar studies available in the literature, comparing these two procedures. Further studies with larger sample size are required to elucidate and confirm these results in long term period.

4.1 Strengths and Limitations of the Study

The strength of our study is that it is a prospective comparative study on a reasonably sized cohort of patients with adequate short-term follow-up. All the surgeries were performed by the same operating team led by the same surgeon. Protocols for perioperative pain and patient management are well-defined in the study and in our hospital, thereby eliminating the chances of any interventional-bias between the groups. The data collection and the analysis were blinded to prevent any confounding factors or subjective bias towards any procedure. There is no study in the literature which compares stapler and laser procedures for hemorrhoids. This study can act as a foundation for further research in the search for the most ideal and effective treatment for hemorrhoids.

There are some limitations of this study. Firstly, patients of different grades are not matched to their corresponding grades in both the groups. The bleeding and prolapse profiles in these groups need to be matched and the analysis adjusted. Unfortunately due to smaller sample size, this analysis could not be performed. Second, the follow up time varies from 3 months to 11 months. Hence, the long-term outcomes of LH and SH cannot be accurately compared. Third, patients were discharged after 24 hours when the quantity of analgesics taken by the patients may have influenced the results of pain scores at 1 week or later. Fourth, within the laser group, the application of energy at single location or circumferential may likely affect the outcome and need to be studied. Lastly, patient blinding was not feasible due to paucity of study duration and achieving the required sample size.

5. CONCLUSION

Laser Hemorrhoidoplasty surgery is better than Stapler Hemorrhoidopexy surgery in terms of favorable immediate postoperative pain outcome, hospital stay and short-term complications. This technique has potential as the most effective and affordable treatment option for patients with grade II and III hemorrhoids. However, further

results need to be studied in terms of long-term outcome and recurrence rate compared to Stapler Hemorrhoidopexy.

CONSENT

All authors declare that a 'written informed consent' was obtained from the patient (or other approved parties) for publication of the study and accompanying images without disclosure of the patient's identity.

ETHICAL APPROVAL

All authors hereby declare that the study was approved by Institutional Ethical Committee of Artemis Hospitals and has therefore been performed in accordance with the institutional ethical standards.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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