Clinical Outcomes in Patients with Hemorrhoids Treated by Finger Guided Hemorrhoidal Artery Ligation with Laser Hemorrhoidoplasty: A Retrospective Cohort Study

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Authors’ contributions
This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Hemorrhoids are the most common anorectal disease. In Finger guided Hemorrhoidal Artery Ligation (FGHAL), the branches of Superior Hemorrhoidal Artery (SHA) are ligated after palpating the arteries with finger 2-3 cm above dentate line instead of using a doppler as in Doppler-guided Hemorrhoidal Artery Ligation (DGHAL). The procedure is followed by Laser Hemorrhoidoplasty (LHP), a minimally invasive technique.

Methods: We conducted the study to retrospectively analyze the clinical outcomes of FGHAL with LHP for surgical management in a patient cohort with hemorrhoids in routine clinical practice. We retrospectively collected and analyzed the data from hospital records of patients treated with FGHAL with LHP for their hemorrhoid disease (HD) from March 2017– March 2020 to understand the impact on pain, bleeding, and resolution of symptoms.

Results: The study included a total of 346 patients within 27 to 75 years of age. The presenting
features were bleeding (93%), pain (89%), and prolapsed hemorrhoids (69%). Most patients had grade II hemorrhoids (60.7%). Patients reported no spontaneous bleeding after surgery; 225 patients (65%) experienced post-defecatory bleeding the day one after surgery and 98 patients (28.3%) on postoperative day 3. Patients did not report any bleeding after the 7th postoperative day. 90.2% had completely resolved symptoms 6-months after surgery. The average VAS score at 6h, 12h, 24h, 48h and 72h after surgery were 3, 2.2, 1.3, 0.4 and 0.1 respectively.

**Conclusion:** FGHAL is a cost-effective alternative to DGHAL. FGHAL, followed by the LHP technique, provides a very low pain and discomfort with minimal need for analgesics and wound care, electing it among the procedures suitable for HD. The method is a cost-effective alternative to DGHAL.

**Keywords:** Hemorrhoids; laser hemorrhoidoplasty; finger guided hemorrhoidal artery ligation; pain score; complications.

1. INTRODUCTION

Hemorrhoids are the most common anorectal disease. They affect between 4.4% and 36.4% of the general population [1]. According to the vascular theory, arterial overflow in the superior hemorrhoidal arteries (SHA) would lead to dilatation of the hemorrhoidal venous plexus [2]. Hemorrhoidal disease presents with a variety of symptoms and a spectrum of severity. Conservative treatment can effectively manage the majority of patients. Surgical intervention, like hemorrhoidectomy, is required for patients with Grade III and Grade IV. Minimally invasive surgical options like Doppler-guided Hemorrhoidal Artery Ligation (DGHAL), aim to overcome the disadvantages of hemorrhoidectomy, including severe postoperative pain and complications as an anal stricture. DGHAL requires using a proctoscope with a Doppler transducer attached to detect the location and depth of arterial structures [1]. Though studies of DGHAL have shown encouraging short-term results in postoperative morbidity for symptomatic hemorrhoids, it has its limitations of being an expensive procedure [3]. Many studies have raised an issue about the necessity of using a Doppler as the localization of the hemorrhoidal arteries, which can easily be determined by palpation with a finger [4].

Finger guided Hemorrhoidal Artery Ligation (FGHAL) is a surgical approach where the branches of Superior Hemorrhoidal Artery (SHA) are palpated with the index finger at 2- 3cms above the dentate line (at the apex of pile masses) and are ligated [4]. It is followed by Laser Hemorrhoidoplasty (LHP), a laser-based minimally invasive technique for outpatient hemorrhoids treatment. Laser surgery is based on the principles of photoablation (breaking chemical bonds of cells), photocoagulation (induce protein denaturation that leads to shrinkage of arterial wall of the vessel), and photovaporization (cause shrinkage and fibrosis leading to fixation of the prolapsing element). Hemorrhoidal arterial flow feeding the hemorrhoidal plexus is stopped by this procedure (dearterialization). The controlled emission of laser energy, which is applied submucosally, causes the hemorrhoidal mass to shrink. Moreover, fibrotic reconstruction generates new connective tissue ensuring the mucosa adheres to the underlying tissue, preventing the occurrence or recurrence of a prolapsed [2,5].

Looking into the numerous surgical experiences of using the palpation-based approach and laser, we want to retrospectively analyze the clinical outcomes of hemorrhoids treated by FGHAL with LHP in the management of hemorrhoids at our center.

2. MATERIALS AND METHODS

The Ethics Committee approved this study, and as per the ethical guidelines of the Declaration of Helsinki, this study was conducted and reported based on STROCSS guidelines [6]. This retrospective study was registered in the Research Registry 6895.

We conducted this study to analyze the clinical outcomes of Finger guided hemorrhoidal artery ligation (FGHAL) with Laser Hemorrhoidoplasty (LHP) for the surgical management of hemorrhoids in routine clinical practice.

2.1 Methods

We retrospectively analyzed data from our hospital records of a patient cohort treated with FGHAL with LHP for their hemorrhoid disease (HD) in our hospital from March 2017– March
2020. We included in the study patients aged 18 years or more with grade 2 to 4 symptomatic internal hemorrhoids requiring surgery. Patients with hemorrhoids who were responding to conservative management, or with previous major surgery of the rectum, or having firm and fibrotic external irreducible hemorrhoids thrombosed hemorrhoids, or presence of other anorectal disorders like rectal or anal cancer, history of inflammatory bowel disease, rectal prolapse, rectal mucosa redundancy, and pregnant women were excluded from the study.

2.1.1 Surgical procedure

2.1.1.1 Preoperative preparation

Baseline investigations were carried out before every surgical intervention like complete blood count (CBC), random blood sugar, blood urea, serum creatinine, bleeding time, clotting time, prothrombin time, HIV, Hepatitis B, Hepatitis C, Blood Group, ECG, X-Ray chest, echocardiography (in all patients above 50 years of age), Sigmoidoscopy (in all the patients above 50 years of age). If the patient was detected with severe anemia (Hemoglobin <8 g/dl) due to blood loss from hemorrhoids, blood transfusion was done as required, and the patient was built up to 10g/dl of Hb. Preoperatively, 1gm of injection Cefuroxime was given half an hour before surgery.

2.1.1.2 Operative procedure

FGHAL with LHP was performed under spinal anesthesia by a trained surgeon. This operation was designed to eradicate hemorrhoids without the need for cutting. The entire procedure was performed above the dentate line of the anal canal, causing minimal discomfort. The surgeon used his finger to locate the blood vessels supplying the hemorrhoids(Fig. 1.a). The operation aimed to cut off the blood supply to the hemorrhoids, and a stitch was placed around each blood vessel using 27mm 5/8 2-0 vicryl on a round body needle. LHP followed it. The equipment used was 1470nm. A Conical Laser Fiber was introduced inside hemorrhoidal mass through the mucocutaneous junction in pulse mode. At the time of insertion, a dosage of 6 W for a 1-second pulse and 6 W for a 3-second pulse was given at the time of coagulation. It was advisable to withdraw fiber every 5mm. The total energy required was 150 – 200 Joules per pile mass. At the end of the procedure, an ice finger is placed for 20 minutes to reduce edema resulting from cellular injury due to thermal energy. The submucosal application of controlled emission of laser energy caused the hemorrhoidal mass to shrink. Moreover, fibrotic reconstruction generated new connective tissue ensuring that mucosa adheres to the underlying tissue. This helped in reducing prolapsed component of pile mass. (Fig. 1.a, b, c, d).

Fig. 1.a. Branching pattern of the Superior Hemorrhoidal Artery (SHA), also known as superior rectal artery (SRA), showing posterior lateral branch of SHA; IRA=Inferior Rectal Artery; MRA=Middle rectal artery; CCR=Corpus Cavernosum Recti; LA=; Levator Ani; ES=External Sphincter; IS= Internal Sphincter
2.1.1.3 Postoperative care

Postoperatively, the instructions during the hospital stay included antibiotics and IV fluid for 4 hours. After that, the patient was started on a liquid diet. Analgesics (Injection Diclofenac sodium) was given if required, and monitoring of vitals every 2 hourly in the recovery room. No postoperative imaging was ever required. CBC was repeated after 3 weeks if the patient was anemic at the time of surgery, and transfusion was given.
2.1.1.4 Advice at discharge

At the time of discharge, the patient was advised to avoid constipation, straining during bowel movements, sitting on the toilet seat for a long time, heavy lifting, standing for a long time without a break—moreover, a diet chart to be followed to avoid constipation.

2.1.2 Outcome measures

Mean operative time was evaluated in minutes. Postoperative pain was considered the primary outcome and was evaluated with the visual analogue scale (VAS) at 6 and 12 h, and 1, 2, and 3 postoperative days. Eventual bleeding was evaluated at days 1, 3, 7, 14, and 21; it was classified as spontaneous, post-defecatory, or no evidence of bleeding. The time needed to come back to daily activity was also evaluated and expressed in days. The number of patients with symptoms completely resolved, partially resolved, or persistent were assessed at a minimum follow-up time of 6 months. All analyses were conducted using SPSS (2012, version 21.0.0.0). Continuous data were presented as mean ± standard deviation, and categorical variables were presented as percentages.

3. RESULTS

We included 346 patients in this study from March 2017 to March 2020, with 247 males and 99 females. The age of the patients ranged from 27 to 75 years. The most common presenting features were bleeding (93%), pain (89%), and prolapsed hemorrhoids (69%). The majority of the patients have grade II hemorrhoids (60.7%) (Table 1). No patients suffered from spontaneous bleeding after surgery. While 225 patients (65%) experienced post-defecatory bleeding the day one after surgery, and 98 patients (28.3%) on postoperative day 3. From the 7th postoperative day, no bleeding event occurred in our cohort (Table 2). No patients experienced seromucous discharge for the absence of open surgical wounds, and no patients reported fecal incontinence (mean Cleveland clinic incontinence score was 0) in the follow-up period. 90.2% had completely resolved symptoms 6-months after surgery (Table 3). The average VAS score 6h,12h,24h,48h and 72h after surgery were 3,2.2,1.3,0.4 and 0.1 respectively (Fig. 2). As per the classification of surgical complications by Dindo et al. [7], there was no deviation in any patient from the normal postoperative course or any need for pharmacological treatment or surgical, endoscopic, and radiological interventions in this study.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Study group (n = 346)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>27-75</td>
</tr>
<tr>
<td>Gender</td>
<td>Male:247 Female: 99</td>
</tr>
<tr>
<td>Preoperative symptoms</td>
<td></td>
</tr>
<tr>
<td>Bleeding</td>
<td>322(93%)</td>
</tr>
<tr>
<td>Pain</td>
<td>308(89%)</td>
</tr>
<tr>
<td>Prolapsed hemorrhoids</td>
<td>239(69%)</td>
</tr>
<tr>
<td>Hemorrhoid grade</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>210(60.7%)</td>
</tr>
<tr>
<td>III</td>
<td>131(37.9%)</td>
</tr>
<tr>
<td>IV</td>
<td>5(1.4%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 1</td>
</tr>
<tr>
<td>Spontaneous</td>
<td>0</td>
</tr>
<tr>
<td>Post-defecatory</td>
<td>225(65%)</td>
</tr>
<tr>
<td>No evidence of bleeding</td>
<td>121(35%)</td>
</tr>
</tbody>
</table>
Table 3. Symptoms 6-months after surgery

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Number of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely resolved</td>
<td>312 (90.2%)</td>
</tr>
<tr>
<td>Partially resolved</td>
<td>32 (9.2%)</td>
</tr>
<tr>
<td>Persistent</td>
<td>2 (0.6%)</td>
</tr>
</tbody>
</table>

4. DISCUSSION

The need for treatment in patients with hemorrhoids is primarily based on the subjective perception of the severity of symptoms. The treatment assignment is decided on the traditional classification. It is not connected to the severity of symptoms. With the availability of numerous treatment modalities, there is confusion in selecting the correct treatment method. The optimal treatment technique remains unanswered despite most of the techniques in use being subjected to randomized evaluation. Laser hemorrhoidoplasty is gaining popularity. Laser hemorrhoidoplasty has the advantages of being hemostatic, bactericidal, fast healing, not affecting adjoining structures, less postoperative complications like postoperative hemorrhage and stenosis [2]. Newer techniques promise to be less painful, yet long-term results are uncertain, and questions remain regarding their recurrence rates [7]. Non-excisional procedures are a revolutionary approach to treating hemorrhoids. Most of these therapies cure symptoms while leaving hemorrhoidal piles and their physiological function in the anus intact, with no changes to the anatomy of the anal canal. In 1995, Moringa introduced the idea of curing hemorrhoids by reducing arterial overflow into the hemorrhoidal plexus. Morinaga described the Doppler-guided trans-anal hemorrhoidal artery ligation (HAL). Later, the addition of suture mucopexy for a more specific treatment of prolapse associated with high degree hemorrhoids (transanal hemorrhoidal dearterialization; THD) modified HAL [8].

We did this study to retrospectively analyze the clinical outcomes of hemorrhoids treated by Finger Guided Hemorrhoidal Artery Ligation (FGHAL) with LHP.

The anal cushions have an arteriovenous capillary network of corpus cavernosum recti (CCR) similar to the penile erectile tissue. It was believed that hyperplasia of CCR played a vital role in the pathogenesis of hemorrhoids. In the study on anatomical findings by Aigner et al. in [9], it was observed that terminal branches of
SHA solely contribute to the CCR [9]. Further, it was observed that SHA branching did not course exactly at 3, 7 & 11 o’clock positions. Moreover, in 82% of cases, the SHA had bifurcation and trifurcation in 12% of cases. SHA further divides into left and right branches [9-13]. The left artery did not branch further, and the right one gives 3 to 5 branches. But the posterior lateral branch of SHA was too high and too deep, almost at the level of the anorectal ring [11-14]. This finding was of utmost surgical significance and may explain the recurrence of hemorrhoids as whatever procedure may be followed, it is impossible to ligate the posterior lateral branches of the SHA because of their course.

Further, in a study on the vascular nature of hemorrhoids in 2006, Aigner et al., it was observed that the SHA’s terminal branches supplying the anal cushion in hemorrhoids had a larger diameter, greater blood flow, higher peak velocity, and acceleration velocity than healthy individuals [11]. Moreover, it was observed that there was a threefold increase in arterial caliber and flow in the terminal branches of the superior rectal artery. So, hyper vascularization of the anorectum due to the increased caliber and arterial flow of the terminal branches of SHA resulted in engorgement of cushions, consequently leading to the growth of hemorrhoids [15]. The study proposed that patients with grade 3 and 4 hemorrhoids had significantly larger vessels with a higher flow than those with grades 1 and 2. These abnormal findings remained after surgical excision of the hemorrhoids, confirming the association between hyper vascularization and recurrence. LHP plays a significant role in taking care of the leftover posterior lateral branches of SHA as what could not be ligated because of their course could be managed by photocoagulation which is one of the principles of LHP. Whenever laser energy is given in the pile mass, it causes protein denaturation, which leads to the shrinkage of vessel wall hence sealing the blood vessels leading to dearterialization [16].

LHP is an innovative and alternative minimal-invasive technique in treating hemorrhoid disease (HD) since 2006 [17]. It is based on the application of the laser beam inside the hemorrhoidal tissue. LHP reduces postoperative pain, intraoperative bleeding, and the need for postoperative analgesics compared to Milligan–Morgan procedure. It results in the complete resolution of symptoms in about 70% of cases. LHP, compared to excisional surgery, has a shorter operative time and less postoperative pain [8].

In a study by Kaushal et al comparing LHP and stapled hemorrhoidopexy (SH) with 85% of patients of Grade III hemorrhoids, the mean operative time was 143 min (LHP) and 284 min (SH)(p-value<0.05). The mean pain score at all intervals was significantly lesser in the LHP group (p-value=0.021). SH group had 24 patients with minimal bleed in stool at 1-week postoperative compared to the LHP group with only eight patients reporting the same. Mean hospital stay with LHP and SH were 1.4 and 0.8 days, respectively [18].

Three observational cohorts and three randomized trials reported operation time ranged from 5 to 40.4 min. Moreover, the three RCTs had a significantly shorter operation time with LH versus open HC (mean 33.1 min ± 7.3 vs. mean 52.6 min ± 15.6, p < 0.001; mean 30.6 min ± 4.9 vs. mean 50.5 min ± 12.1, p < 0.001; mean 15 min±5.6 vs. mean 29 min±10.3, p < 0.001, respectively). Four studies described the hospitalization duration, which ranged from 3 to 48 h and was similar to open HC [19].

In our study, the mean operative time was 25 minutes, and the mean hospital stay was one day.

An observational study by Brusciano et al. conducted on 50 patients with II- and III-degree HD reported a return to daily activity one day (40%) and two days (100%) after the procedures [20]. In our study, 100% of the patients return to work by the 4th day of the procedures.

Eskandaros et al. clarified that the most suitable technique for managing primary third-degree hemorrhoids was LHP followed by SHP compared with the conventional Milligan-Morgan hemorrhoidectomy (MMH) with shorter operative time, less postoperative pain, shorter hospital stays, and less postoperative bleeding. The complication rate showed a statistically non-significant difference with respect to the postoperative complications, such as urinary retention, anal stenosis, and recurrence rates [21]. Poskus et al. showed that LHP was a safe, minimally invasive option for hemorrhoids, more effective than mucopexy less effective than excisional hemorrhoidectomy [22]. A randomized trial by Naderan et al. demonstrated that intra-hemorrhoidal coagulation with 980-nm diode laser has some benefits over MM
hemorrhoidectomy in treating patients for symptomatic refractory hemorrhoids. This laser ablation technique has a shorter operative time, less severe postoperative pain, and comparable regression of hemorrhoid columns. There was no reported patient with bleeding requiring surgical hemostasis in either group [23].

Several patients with hemorrhoids only seek the reassurance of a non-serious pathology that does not require any specific treatment. While first- and second-degree hemorrhoids often respond to conservative and nonsurgical measures, larger prolapsing hemorrhoids require surgery. Conventional hemorrhoidectomy remains an integral part of hemorrhoid management and offers favorable long-term cure rates; however, it is associated with considerable pain and occasional severe complications. A patient with symptomatic hemorrhoids should be counseled regarding the advantages and disadvantages of each surgical approach, and surgeons managing hemorrhoids should be skilled in a variety of techniques to offer a tailored management strategy for each patient [7].

There have been discussions about the high cost of the laser technique in treating HD. Indeed, the cost of LHP is significantly higher than the one of conventional Milligan–Morgan hemorrhoidectomy by diathermy. However, if we consider radiofrequency or ultrasound coagulation, the cost for each single disposable advanced hemostasis device is similar to that of the single disposable laser probe. In addition, LHP allows shorter hospitalization, shorter operative time, and lower complications rate, making it cost-saving that should be investigated in further cost analysis studies [20].

An ongoing randomized, controlled, single-center clinical study compares DGHAL and FGHAL for grade II-III HD treatment. The primary endpoint is the recurrence of any symptoms of HD. The secondary endpoints are the severity of pain, treatment satisfaction (1 to 5 points), and the need for drug therapy in 30 days and 8 weeks after surgery. The results of this RCT may further endorse the absence of significant advantages in Doppler guidance technology for hemorrhoidal arteries detection in HAL procedures compared with finger-guided hemorrhoidal arteries detection concerning the efficiency in eliminating hemorrhoidal prolapse and/or hemorrhoidal bleeding [4]. Among the available published studies on laser-based procedures in the management of HD, our study reports a high success rate which is either comparable or better than the other available success rates [2,24,25,26,27,28].

There are some limitations to our study. The bias inherent to a retrospective, single-center study and selection bias could not be avoided. Moreover, there were no direct comparisons done with the DGHAL technique.

### Table 4. Success rates of different laser-based procedures in the management of HD

<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>No. of patients</th>
<th>Success rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Giamundo et al. [26]</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>2014</td>
<td>Crea et al. [27]</td>
<td>97</td>
<td>96</td>
</tr>
<tr>
<td>2017</td>
<td>Boarani et al. [28]</td>
<td>55</td>
<td>89</td>
</tr>
<tr>
<td>2018</td>
<td>Ram et al. [29]</td>
<td>62</td>
<td>95.2</td>
</tr>
<tr>
<td></td>
<td>Present Study</td>
<td>346</td>
<td>98.2%</td>
</tr>
</tbody>
</table>

5. CONCLUSION

FGHAL is a cost-effective alternative to DGHAL. LHP surgery can be the most effective and affordable treatment option for grade II and III hemorrhoids patients. However, further results need to be studied in terms of long-term outcomes and recurrence rate. Our data suggest that the use of FGHAL followed by the LHP technique provides a very low pain and discomfort period with minimal need of analgesics and wound care, electing it among the procedures suitable for HD. However, a longer follow-up period needs to verify long-term outcomes of this treatment for HD and compare this technique to the current conventional ones.

CONSENT

It is not applicable.

ETHICAL APPROVAL

The study obtained ethical clearance from Institutional Ethics Committee, Punjab Institute of Medical Sciences, Jalandhar, Punjab.
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"Provenance and peer review
Not commissioned, externally peer-reviewed"

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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