Laser hemorrhoidoplasty versus circumferential stapler hemorrhoidopexy: The early and mid-term results

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ABSTRACT

Background: Laser hemorrhoidoplasty (LHP) is a minimally-invasive, less, or nearly no pain treatment for symptomatic hemorrhoids with short operative time and hospitalization. The purpose of this study was to compare this procedure with Circumferential Stapler Hemorrhoidopexy (CSH). Methods: Patients with symptomatic hemorrhoids in grade II to grade IV were selected according to the
selection criteria and the sample size. The two techniques were evaluated concerning the operative time, postoperative pain, complications, and hospitalization. Results: There were 204 patients treated with LHP with 1470 nm wavelength diode laser, and 200 ones underwent Circumferential Hemorrhoidopexy. Grade III hemorrhoids were more common (77.5% in the LHP group and 94% in CSH group). The mean operative time between the two groups was similar. Postoperative pain was significantly less in the LHP group only on the day of operation. Mean hospital stay had not much different (1.33 days in LHP group and 1.66 days, p < 0.001). The overall incidence of complications in the LHP group was significantly lower than in the CSH group (8.8% and 15.5%, p = 0.040). The minimum follow-up was four months; the maximum follow-up was 38 months. Conclusions: LHP is safe, minimally invasive, and has an equivalent effect with CSH with fewer overall complications, especially anal stenosis.

Keywords: Circumferential Stapled Hemorrhoidopexy, Laser Hemorrhoidoplasty.

1. INTRODUCTION

Hemorrhoidal disease is a common disorder of the anorectal region. Due to psychological shyness, many patients come for medical examination and treatment when the disease is at an advanced grade or when there are symptoms that affect health or cause great discomfort. The pathophysiology of hemorrhoids is controversial with various theories, resulting in a descending in the anal cushion and congestion that cause symptoms of hemorrhoids. Finding an operation to treat hemorrhoids without or less pain is a goal pursued by colorectal surgeons. Patients are always hesitant to undergo painful operations because of a benign condition such as hemorrhoids. However, the symptoms associated with hemorrhoids are often uncomfortable and difficult to handle. Because there is little relationship between the severity of symptoms and the grade of the disease (Porrett et al., 2015), hemorrhoids grade II and III have minimal mucosal prolapse that can cause severe symptoms like hemorrhoids grade IV.

The Longo (CSH, Circumferential Stapled Hemorrhoidopexy) operation has been described since 1993 by Italian surgeon Antonio Longo. By cutting a doughnut of the mucosa of the lower rectum, Longo operation helps pull the hemorrhoids back into physiological position and reduces the amount of blood to the hemorrhoids (Uras et al., 2008). This operation based on the pathophysiological mechanism: an anal cushion prolapse and congestion. Since its inception, this method has been widely applied in many parts of the world with positive results: short operation time, less postoperative pain, good surgical results compared with previous methods. Liesel J, 2015, synthesized a large number of studies reporting the results of Longo operation on a total of 14232 patients showing a common complication rate of 3.3% - 81% with five deaths, the early complication rate is 2.3% - 58.9% and the late complication rate is 2.5% -80%.

In 2012, Lin introduced the PSH (Partial Stapled Hemorrhoidopexy) PSH operation using a tissue-selecting technique to preserve the bridge of the mucosa (Naderan et al., 2017). A comparative study with Longo operation concludes: PSH has the advantage of reducing postoperative pain and early complications, preserving better anal continence, lower risk of anal stenosis, which is explained by PSH’s preserving normal mucosal and submucosal endodermal tissue, the number of staples on the incision is less so the impact on nerve receptors is also reduced (Longo, 1998). The trend of current surgery is “minimally invasive”. Laser hemorrhoidoplasty is one of the methods developed in that trend. The laser has been applied to medicine for a long time and has applications in many different specialties. Particularly for hemorrhoidal disease, lasers used in various treatments, such as: cutting hemorrhoids with CO2 laser, Nd: YAG laser, ablation with 980nm diode laser and laser hemorrhoidoplasty with laser diode in many different wavelengths.

Laser hemorrhoidoplasty (LHP) is a method using a diode laser to act directly on the tissues and blood vessels in hemorrhoids. The laser degrades hemorrhoidal tissue in the submucosa, which immediately shrinks the tissues and arterial branches about 5mm deep. These effects are limited to hemorrhoids, not to other parts of the anal canal. In 2008, Plapler developed an experimental model using a diode laser to treat hemorrhoids in monkeys. After creating the hemorrhoids by ligation of the lower hemorrhoid vein, he inserted a laser wire into the hemorrhoids and activated the laser. The hemorrhoids shrunk immediately after the procedure, and the results of a follow-up test 10 days later recorded a reduction in the dilated veins and proper healing in the intervention area. Laser energy does not act directly within the dilated veins but rather into the surrounding tissue in the submucosal region, which is effective at shrinking hemorrhoids.

LHP has been applied in many parts of the world, there have been studies when using this method in patients with hemorrhoids grade II and III with positive results such as less painful, less invasive, operation time and short hospital stay, suitable for patients with long-term symptoms and patients are satisfied with the surgical outcomes (Lin et al., 2019; Weyand et al., 2019). So far, Vietnam has not had any research on LHP. Therefore, we researched to evaluate the results of the method and compared it with Longo operation (CSH), a technique with many advantages in terms of the short operation time, low postoperative pain level, and quick
recovery time. Whether the application of this new treatment method in Vietnamese has shows positive results or not. From there, we can widely deploy, replace, or complement existing hemorrhoidal treatment methods in Vietnam. This study aimed to compare the results of LHP and Longo operation in the treatment of symptomatic hemorrhoids.

2. MATERIALS AND METHODS

Study population
We compared two randomly selected patient groups. The number of patients needed to have sufficient confidence in statistical processing calculated using the Feinstein formula (A.F, 2010). In one of our studies, comparing the surgical results of the two groups of patients with hemorrhoids under Longo operation and MM, each group was 200 cases. The overall complication rate is 20.5%, taking the round number as 20%. We expect that, when applying the LHP technique in Vietnamese, the complication rate drops to 10%. The formula for calculating the sample size according to Feinstein is:

\[
\left(\frac{2.80}{|P_1 - P_2|}\right)^2 [P_1 (100 - P_1) + P_2 (100 - P_2)]
\]

In which, P1 is the complication rate of the control lot (20%), P2 is the desired complication rate of the study lot (10%). 2.80 is the constant when choosing \(\alpha = 0.05\) (5% risk of rejecting the null hypothesis) and \(\beta = 0.20\) (20% risk of accepting false null hypothesis).

So, each lot needs 196 patients. We selected 200 patients each lot (Figure 1).

Inclusion criteria were: 1) ≥ 16 years old; 2) Good condition (ASA I or II); 3) Hemorrhoids II or higher (Goligher classification); 4) The patient agrees to participate in the study.

Exclusion criteria: 1) Inflammatory bowel disease (IBD). 2) History of hemorrhoid operation, operation with intestinal - anal anastomosis <3cm from the anal verge. 3) Outlet obstruction syndrome (ODS) does not respond to medical treatment. 4) Fecal incontinence. 5) Anal canal stenosis. 6) Comorbidities: local (anal fissure, anal fistula) or systemic (cirrhosis, renal failure). 7) Anticoagulant (relatively). 8) Irritable bowel syndrome with severe diarrhea or constipation.

Variables
Variables related to the characteristics of the study sample: qualitative variables: gender (values: male and female); nominal variables: disease grade (according to Goligher classification, values: I, II, III, IV); quantitative variables: age (in year of the time of operation), the follow-up time (unit: month, from the time of operation).

Anesthetic method: nominal variables, values: spinal anesthesia, laryngeal mask, intubation anesthesia.

Operation time: quantitative variable, unit: minutes, excluding time for performing anesthesia procedures.

Postoperative pain level: nominal variable, values: painless, mild, moderate, severe. Postoperative pain levels were recorded mainly on the day of operation and the first postoperative day for comparison, if necessary, the following postoperative days will be recorded.

Recording complications during and after operation: bleeding, urinary retention, wound infection, anal stenosis, and recurrence: the variables recorded separately, are qualitative variables, values: yes, no.

The number of hospitalization days is calculated from the operation day, so as not to be affected by patients who have to be hospitalized early to treat medical conditions necessary to prepare for surgery such as hypertension, coronary artery disease, diabetes mellitus, severe anemia without emergency intervention needs.

Stapler technique
Stapler technique is used according to Longo. The tool used is the Covidien EEA stapler. Purse-string suture made of polypropylene 3-0, at least 2cm from the dentate line. The circular stapler is fully opened, inserted into the purse-string suture, and tied tightly. In female patients, the posterior vaginal wall should be checked to avoid getting stuck in the stitches. Then, tighten the stapler and hold for about 30 seconds to stop the bleeding. Sutures are checked, additional hemostatic sutures if bleeding (by Vicryl 3-0). The research team did not perform this technique.

Laser hemorrhoidoplasty
In laser surgery, we use a semiconductor laser generator with a wavelength of 1470nm, laser power of 15W (Biolitec, Germany). Place CAD (23mm) for observation, stitching on the dentate line 2 - 4 cm if hemorrhoids prolapse more than 2 cm from the dentate...
line, wear protective eyeglasses (including surgical assistants). The skin incision is 1 - 1.5cm from the anal verge, about 1mm long. Insert the laser probe (2mm) into the hemorrhoidal segment, under the rectal mucosa. Laser emission mode is pulse mode; each pulse lasts 3 seconds, stops 1 second between pulses. Distributes energy is ½ under the mucosa and ½ in the hemorrhoidal segment. Specific effects: hemorrhoidal segments shrink and discolor; hemorrhoids shrink about 5mm after each session. Apply ice to the treated hemorrhoids for about 30-45 seconds to avoid edema after completing every segment. Check for bleeding and Place 2% xylocaine gel foam into the anal canal. The research team implements this technique.

Postoperative care
The use of postoperative analgesia is flexibly adjusted according to the patient’s pain level assessed on the VAS scale (no pain: VAS = 0, minor pain: VAS = 1-3, moderate pain: VAS = 4 -6, severe pain: VAS = 7-10). Other drugs may be added depending on the underlying disease and the patient’s condition. Patients may be discharged from the hospital with no pain or minor pain and uncomplicated. Patients were re-examined two weeks after the operation to evaluate the complications and surgical results. Patients are instructed to re-examine at any time when problems occur.

Statistical analysis
Quantitative variables are expressed as mean ± standard deviation; qualitative variables are described as scales. Comparing two average values by t-test, testing the ratios with the Chi-square test, p <0.05 is considered to have statistical significance.

3. RESULTS
During the three years from September 2016 to September 2019, we collected 204 cases of LHP and 200 CSH. The age and follow-up factors were not significantly different. However, sex distribution and Goligher classification were significantly different between the two groups, which were confounding factors. The average operation time for the LHP group is 31.82 minutes (10-90 minutes), the CSH group is 30.03 minutes (10-80 minutes). The difference is not statistically significant (Table 1). The level of postoperative pain is assessed primarily on the day of surgery and the day after surgery (Table 2).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Characteristics of the study sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LHP (N=204)</td>
</tr>
<tr>
<td>Age</td>
<td>46.5 (18-89)</td>
</tr>
<tr>
<td>Male/Female</td>
<td>94/110</td>
</tr>
<tr>
<td>Goligher grade</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>24 (11.8%)</td>
</tr>
<tr>
<td>III</td>
<td>158 (77.5%)</td>
</tr>
<tr>
<td>IV</td>
<td>22 (10.8%)</td>
</tr>
<tr>
<td>Follow-up time (months)</td>
<td>21 (4-38)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Degree of postoperative pain on the day of surgery (D0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0</td>
<td>LHP</td>
</tr>
<tr>
<td>No pain</td>
<td>49 (24%)</td>
</tr>
<tr>
<td>Less</td>
<td>143 (70.1%)</td>
</tr>
<tr>
<td>Medium</td>
<td>2 (1%)</td>
</tr>
<tr>
<td>Severe</td>
<td>10 (4.9%)</td>
</tr>
</tbody>
</table>
The postoperative pain score was analyzed with additional factors: hemorrhoidal classification, whether or not to perform additional techniques (such as skin tag removal, polyps cutting) after performing CSH or LHP techniques, the patient with/without anal pain earlier. In general, the pain score on the day of operation in the CSH group is higher than in the LHP group, with the influence of classification: the number of patients with grade III is the most in both groups, the difference is statistically significant ($p < 0.001$). The pain score on the first postoperative day was not significantly different between the two groups (Table 3). Each group had one patient with severe pain who had to be hospitalized. Urinary retention was investigated with gender and anesthetic methods. Statistically significant differences were noted in the male group with spinal anesthesia. In this group, the rate of urinary retention after CSH is higher than the LHP group (Table 4). Other complications are shown in Table 5.

**Table 3** Severity of postoperative pain and first postoperative day (D1)

<table>
<thead>
<tr>
<th>Severity</th>
<th>LHP</th>
<th>CSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>No pain</td>
<td>5 (2.5%)</td>
<td>2 (1%)</td>
</tr>
<tr>
<td>Less</td>
<td>198 (97.1%)</td>
<td>198 (99%)</td>
</tr>
<tr>
<td>medium</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Severe</td>
<td>1 (0.5%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

**Table 4** Urinary retentions in spinal anesthesia cases

<table>
<thead>
<tr>
<th>Spinal anesthesia group (N=384)</th>
<th>Sex</th>
<th>LHP (N=191)</th>
<th>CSH (N=193)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary retention</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (N=206)</td>
<td></td>
<td>2 (2.3%)</td>
<td>13 (10.9%)</td>
<td>0.019</td>
</tr>
<tr>
<td>Female (N=178)</td>
<td></td>
<td>5 (4.8%)</td>
<td>3 (4.1%)</td>
<td>0.811</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>7 (3.7%)</td>
<td>16 (8.3%)</td>
<td>0.083</td>
</tr>
</tbody>
</table>

**Table 5** Postoperative complications

<table>
<thead>
<tr>
<th></th>
<th>LHP</th>
<th>CSH</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding</td>
<td>8 (3.9%) No operation needed</td>
<td>5 (2.5%) No operation needed</td>
<td>0.3</td>
</tr>
<tr>
<td>Infection</td>
<td>1 (0.49%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Thrombosis</td>
<td>1 (0.49%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Anal stenosis</td>
<td>0 (0%)</td>
<td>9 (4.5%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Fecal incontinence</td>
<td>0 (0%)</td>
<td>5 (2.5%)</td>
<td></td>
</tr>
<tr>
<td>Fecal urgency</td>
<td>0 (0%)</td>
<td>4 (2%)</td>
<td></td>
</tr>
<tr>
<td>Skin tag</td>
<td>2 (1%)</td>
<td>0 (0%)</td>
<td>0.499</td>
</tr>
<tr>
<td>Total</td>
<td>8.8%</td>
<td>15%</td>
<td>0.040</td>
</tr>
</tbody>
</table>

There were 2 cases in the LHP group that continued anticoagulants for cardiovascular disease on the 7th postoperative day and blended after two days of using the drug. Anal stenosis recorded in the CSH group: 1 case of moderate anal stenosis treated medically, 2 cases of anal stenosis require an additional operation, and the remaining cases have anal dilatation at the clinic and home. A case of perineal inflammation after LHP was medically treated. A case of external hemorrhoid thrombosis after the LHP was treated by removing surgically afterward. Two cases of the skin tag were treated by cutting under local anesthesia.

The overall complication rate in the CSH group was 15.5% (31 cases), higher than the LHP group (8.8%, 18 cases); this difference was statistically significant ($p = 0.040$). General complications include urinary retention. The average length of hospital stay in 2 surgical groups was different: 1.33 days in the LHP and 1.61 days in the SH group, with statistical significance ($p < 0.001$). Most patients are discharged on the first or second postoperative day. Relapse: No recurrence of hemorrhoids has been reported in both LHP and SH groups.

**4. DISCUSSION**

Longo (CSH) operation is a long-standing surgical treatment of hemorrhoids with many advantages such as less postoperative pain, short operation time, less postoperative complications (Uras et al., 2008). LHP is also a method that has been studied in many
hospitals around the world with similar advantages (Lin et al., 2019; Weyand et al., 2019). The average operation time in the two groups in the study did not have a statistically significant difference, about 30 minutes. Duong Van Hai, in 2012, noted that CSH operation time is an average of 25.49 minutes, shorter than Milligan-Morgan surgery time of 32.56 minutes (Maloku et al., 2014). Many studies in the world have shown that the time for performing LHP techniques varies from 10-33 minutes (Lin et al., 2019; Weyand et al., 2019), possibly due to the performance speed of operations, whether or not to perform additional mastopexy suture techniques, the number of hemorrhoidal segments and hemorrhoidal classification.

Postoperative is the most critical complication that makes patients uncomfortable and does not want to have surgery (Weyand et al., 2019). LHP causes little pain after surgery, almost painless. In our study, the postoperative pain score in the LHP group during the operation day was lower than that of the CSH group, probably due to the preservation of the anal canal mucosa and small incisions. Patients often describe a burning and/or heavy sensation in the anal region after the operation. Postoperative bleeding was recorded in both groups, with early and late bleeding, with no cases requiring surgical intervention. Patients were treated conservatively with hemostatic drugs, gauze or balloon compression in the anal canal to stop bleeding. No blood transfusion is needed. Postoperative bleeding, whether early or late, is a common complication in CSH operation with rates from 0 to 68% of early complications and from 0.18 to 33% of late complications. For LHP, too, the complication of bleeding is the most common complication in the studies with the rate of change of 0.6-10% (Lin et al., 2019; Weyand et al., 2019). 2 cases of late bleeding after surgery were when using anti-platelet aggregation drugs for cardiovascular disease. These two cases must use hemostatic gauze and balloon anal canal compression concurrently with stop using anticoagulants. Maloku also recorded one case of bleeding from a patient taking aspirin (Weyand et al., 2019). So, consider the necessity of surgery and the risk of stopping anticoagulants for patients.

Anal stenosis is an important complication after hemorrhoid surgery due to the influence on the patient’s life, often with anal dilatation or anal plastic operation if anal dilatation fails (Longo, 1998). In our study, anal stenosis was only seen in the CSH group (9 cases, 4.5%), no case in the LHP group; this difference is statistically significant. Risk factors for anal stenosis after CSH operation include the severity of hemorrhoidal classification, increased sphincter tone, and sphincter injuries (Longo, 1998). PSH, mucocutaneous bridges retained, and the number of staples to use was reduced compared to CSH, which should have a significantly lower complication rate (Piapler et al., 2009). In the LHP method, the skin and mucosa of the anal canal are maximally preserved, without the use of a stapler, so no foreign bodies remain after the technique is performed; the laser energy has a limited impact on the hemorrhoid segments, limiting the effect on other surrounding tissues in the anal canal, especially the sphincter.

In addition to the above complications, our study also remarked other complications with low incidence such as local infections (response to medical treatment), thrombosed hemorrhoids (surgical removal in 2 cases), skin tags (2 cases treated by cutting under local anesthetic for aesthetic and discomfort) in the LHP and feces, grit (in medical treatment) in the group Longo surgery. The urinary retention in the CSH group is higher than in the LHP group, but it is not statistically significant. There are no severe life-threatening complications. The overall complication rate for the CSH group was 15.5%, approximately the same as our previous study of 15%. The overall complication rate of the LHP group was lower, 8.8%, the difference was statistically significant.

5. CONCLUSION

The operation time was not different between 2 groups of LHP and SH (31.82 minutes versus 30.03 minutes). The time of hospitalization in the LHP group was shorter than the SH group (1.33 days versus 1.61 days). The postoperative pain score in the LHP group is lower than that of the SH group on the day of operation with grade III hemorrhoids. The pain level of the two groups in the first postoperative day was similar. The LHP group had a lower overall complication rate than the SH group (8.8% versus 15.5%). The bleeding complication in the LHP group (3.9%) was higher than in the SH group (2.5%), but it was not statistically significant. The complication of anal stenosis in the SH group was higher than in the LHP group (4.5% versus 0%). In general, both surgical methods have short surgical time and hospital stay, and the level of postoperative pain is low. The complication rate in the LHP group is lower than in the SH group, especially the anal stenosis, a very annoying complication.

**Abbreviation**

LHP: Laser Hemorrhoidopasty  
CSH: Circumferential Stapled Hemorrhoidoplasty  
PSH: Partial Stapled Hemorrhoidopexy  
MM: Milligan-Morgan Operation
**Funding:** This research received no external funding.

**Conflicts of Interest:** The authors declare no conflict of interest.

**Informed consent**
Informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

**Ethical approval for study protocol**
The study was approved by the Medical Ethics Committee of Binh Dan Hospital (ethical approval code: 21/BDH).

**REFERENCE**


