Modified Doppler-guided laser procedure for the treatment of second- and third-degree hemorrhoids

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Background: Hemorrhoids are a common anorectal condition with a major medical and socioeconomic impact. Owing to the high incidence of symptomatic hemorrhoids in the adult population together with the risk of complications of traditional surgery, researchers are seeking less invasive methods of hemorrhoidal treatment.

The aim of this study was to present our experience with the mini-invasive Doppler guided hemorrhoidal laser procedure (HeLP) in symptomatic 2nd and 3rd degree hemorrhoids with absent or minimal mucosal prolapse.

Methods: The cohort included 62 patients with symptomatic hemorrhoids who underwent the HeLP at a tertiary medical center in 2014-2016. Data were collected on clinical and perioperative characteristics and outcome. Findings were compared between patients with second- and third-degree hemorrhoids.

Results: The cohort included 41 male and 21 female patients of mean age 41.5 years. Fifty-one had bleeding and 11 had hemorrhoidal syndrome. Mean operative time was 16.6 ± 3.7 minutes. A total of 8-12 arterial branches were treated. Patients were discharged home within a mean of 91.95 ± 20.48 minutes and allowed to resume normal activities. Compared to patients with second-degree hemorrhoids, patients with third-degree hemorrhoids had a significantly higher rate of recto-anal repair (18.2% vs 0, p < 0.05), intraoperative bleeding (11.3% vs 5%, p < 0.05), and thrombus formation in the hemorrhoids (11.3 % vs 0, p < 0.01). At the six-month follow-up, no complications were reported, and there was significant improvement in symptoms.

Using the visual analog scale, no pain was reported by 82.3% of patients at one week after surgery and 95.2% of patients at one month after surgery.

Conclusion: Patients with hemorrhoids treated with Doppler-guided laser had an excellent outcome in terms of resolution of symptoms and postoperative pain. Only Minor short-term complications were noted. Doppler-guided laser seems to be an effective and painless technique for the treatment of symptomatic second- to third grade hemorrhoids with minimal mucosal prolapse.

Key words: Doppler • Hemorrhoids • Laser procedure

Introduction

Hemorrhoids are a common anorectal condition with a major medical and socioeconomic impact. They affect a large proportion of the adult population worldwide, with reported rates in the United Kingdom ranging from 13% to 36% 1-9, depending on the enquiry method. The most common symptoms are rectal bleeding and pain, anal irritation, and anal mass prolapse 5. Men are affected more than women 6.

The pathophysiology of hemorrhoidal disease remains controversial. The anorectal vascular cushions along with the internal anal sphincter are essential in the maintenance of continence by providing soft tissue support and keeping the anal canal tightly closed 6. In pa-
tients with hemorrhoids, anatomical findings of an arteriovenous hemorrhoidal shunting system without capillary interposition suggest that hemorrhoids are caused by dilatation of the hemorrhoidal venous plexus due to overflow in the superior hemorrhoidal arteries. According to this theory, reducing the blood flow to the hemorrhoids should shrink the hemorrhoidal piles, leading to symptomatic improvement. The high incidence of symptomatic hemorrhoids in the adult population has prompted a search for an effective surgical treatment. Traditionally, the most widely used procedures are excision-ligation, first described by Milligan et al., and the closed variant technique, proposed by Ferguson and Heaton. Both, however, pose a high risk of complications and are associated with postoperative pain and discomfort. Therefore, attention is being directed to less invasive solutions to better control symptoms with less pain. In 2011, Giamundo et al. described the novel Doppler-guided hemorrhoidal laser procedure (HeLP) for the treatment of symptomatic second- to third-grade hemorrhoids in which a special laser device is used to shrink the terminal branches of the superior hemorrhoidal artery. Usually, no kind of anesthesia is required.

The aim of this study was to present our experience with this new painless technique for hemorrhoid treatment and describe our modification of the HeLP procedure. This procedure can be carried out without any anesthesia and it is recommended for symptomatic 2nd and 3rd degree hemorrhoids with absent or minimal mucosal prolapse.

Materials and methods

Setting and Patients
The cohort consisted of 62 patients with symptomatic hemorrhoids who underwent the HeLP procedure at the Department of General Surgery of a tertiary medical center between October 2014 and May 2016. This study was approved by the institutional ethics committee. Written informed consent for the operation was obtained from all patients.

Departmental Procedure
Preoperative evaluation for hemorrhoids included a thorough medical history and physical examination (digital and procto-sigmoidoscopy). Colonoscopy was performed to rule out other sources of bleeding. Indications for the HeLP were symptomatic second- or third-degree hemorrhoids, minimal mucosal prolapse on preoperative evaluation, and failure of conservative treatment. Second-degree hemorrhoids were defined as hemorrhoids with bleeding even after use of stool modifiers. The patients with second-degree hemorrhoids were also offered the option of ligation. Third-degree hemorrhoids were defined as hemorrhoids accompanied by rectal bleeding, discharge, pain, and itching. Contraindications for the HeLP were fourth-degree hemorrhoids, third-degree hemorrhoids with severe prolapse, previous surgical anastomosis lower than 5 cm from the dentate line, anal stenosis, anal fissures, anal fistulas, and thrombosis of the rectum.

Figure 1: Clinical work-up chart flow
hemorrhoidal cushions. Clinical work-up chart flow can be seen in Figure 1.

Surgical technique

An enema was administered 3 hours before the intervention. Laser dearterialization was performed using the HeLP kit developed by Biolitec AG–CeramOptec (Bonn, Germany). A dedicated 23-mm-diameter proctoscope with a small window at the distal part that holds the Doppler transducer was inserted into the rectum. The Doppler probe (20 MHz, 3 mm diameter) was used to identify the terminal branches of the superior hemorrhoidal arteries, approximately 3 cm proximal to the dentate line. When arterial flow was located, the probe was removed and replaced with a 1,000-micron laser optic fiber. The artery was closed using a laser beam (13 W, 5 pulsed shots of 1.2 s each with 0.6 s pause). The Doppler probe was then reintroduced to confirm arterial closure. In cases of persistent flow, another sequence of three laser shots was delivered at the same point.

The proctoscope was rotated clockwise to accurately localize all the terminal branches of the hemorrhoidal artery. A total of 8-12 arterial branches were treated, one at each o’clock hour. During retraction of the proctoscope, when it was 3 cm below the first line but still 1 cm above the dentate line, if residual pulsation was detected, the arteries were sequentially treated with the laser beam. This procedure was carried out at 5 or 6 points. Pre-and post-surgical intervention pictures can be seen in figures 2-3.

Data Collection

Data recorded for the study included patient characteristics, symptoms, indications for surgery, presence of intraoperative bleeding, operative time, number of vessels treated, postoperative complications, and pain scores on the visual analog scale (VAS) at different time points. Findings were compared between patients with second- and third-degree hemorrhoidal disease.

Statistical analysis

Statistical data for the present study were generated with the SPSS for Windows version 21. Significance was set at 5%. All statistical tests were two-sided. Nominal p values are presented. Two-sided, 95% confidence intervals were calculated when appropriate. Continuous variables are expressed as means and standard deviations. For comparison of continuous variables (operative time, number of vessels treated) between patients with second- and third-degree hemorrhoids, two-sample t-test test was used. To compare the rate of complications between the groups, chi-squared test or Fisher’s exact test was used.

Results

Clinical Characteristics

The cohort included 41 men and 21 women aged 24 to 67 years (mean 41.5 ± 8 SD years). Eighteen patients had clinical second-degree hemorrhoids and 44 patients had third-degree hemorrhoids, including 24 with prolapse. Fifty-one patients presented with bleeding and 11 with hemorrhoidal syndrome. The duration of symptoms before treatment was 6 to 24 months (mean 22.3 months).

Surgical Treatment

Fifty-eight laser procedures were performed under sedation, and 4, without any anesthesia. Mean operative time for second degree hemorrhoids was 16.6 ± 3.7 minutes (median 15, range 10-25 minutes) and for third degree hemorrhoids...
hemorrhoids was 20.8 ± 2.5 (median 13-31 minutes), Twelve arteries were laser-treated in 37 patients, 11 arteries in 5 patients, and 8-10 arteries in 20 patients. Bleeding was observed intraoperatively in 5 patients (8.1%). Two were successfully treated with a hemostatic suture, and 2 required rubber-band ligation; in the remaining patient, the bleeding stopped spontaneously. None of the patients needed a blood transfusion. A second-line procedure was required in 43 patients (45.8%). This consisted of retraction of the probe to 1-2 cm above the dentate line and repetition of the procedure at 5-6 points (fig. 4). Recto-anal repair was performed in 8 patients, all with moderate prolapse, in one hemorrhoid only.

Patients were discharged within a mean of 91.95 ± 20.48 minutes (median 120 minutes, range 60-180 minutes) after the operation and allowed to resume normal activities with no restrictions. Patients were followed for 2 to 6 months.

Postoperative complications

At the one-week follow-up, no edema or acute inflammatory episodes were reported. One patient with bleeding underwent reoperation, and the bleeding site was sutured. Urinary retention was observed in this patient and in another patient. Both were treated with insertion of a Foley catheter, which was removed after 24 hours. Seven patients complained of tenesmus which disappeared after one week. Hemorrhoidal thrombosis was observed in 5 of the 8 patients who required recto-anal repair (8.1% of the cohort). Spontaneous resolution was noted after several days. A 10-point VAS was used to measure postoperative pain, where 0 represents no pain and 10 represents the worst pain imaginable. The 1-hour VAS score was 2-7 in 13 patients (21%), 1 in 26 patients (41.9%), and 0 in 23 patients (37.1%). At the first defecation, the VAS score was 2-6 in 11 patients (17.8%), 1 in 1 patient (1.6%), and 0 in 50 patients (80.6%). At one week postoperatively, the VAS score was 2 in one patient, 1 in 10 patients (16.1%), and 0 in 51 patients (82.3%). After one month, pain at the VAS 2 level was recorded in 3 patients (4.8%); the remainder (95.2%) had no pain at all.

Forty-eight patients (77.4%) returned to their routine one day after surgery, 7 (11.3%) returned after 2 days, and 7 (11.3%) after 3-7 days. On rectoscopy, performed in all patients, the hemorrhoid grade was changed to 1 in 23 patients (37.1%) and to 2 in 39 patients (62.9%). No grade 3 hemorrhoids were found.

At the 6-month follow-up, no complications were reported. There was significant improvement in symptoms with a reduction in hemorrhoidal grade. No correlation was found between the clinical outcome and the number of bleeding arteries closed during the laser procedure.

Comparison between second- and third-degree hemorrhoids

The preoperative clinical data of the patients with second- and third-degree hemorrhoids is summarized in Table 1. Compared with second-degree hemorrhoids, third-degree hemorrhoids were associated with a significantly higher rate of recto-anal repair (8 patients vs 0, p < 0.05), intraoperative bleeding (5 patients vs 1 p < 0.05), and thrombus formation (5 patients vs 0, p < 0.01).

Discussion

Currently, several therapeutic modalities exist to treat haemorrhoids. The treatment of hemorrhoids is largely dependent on the severity and location of the hemorrhoids. Low grade hemorrhoids with moderate or minor prolapse which are able to be reduced (Grade II-III) are usually managed by rubber band ligation (RBL), hemorrhoidal artery ligation (HAL) or surgical resection. The RBL procedure can be performed in an outpatient setting.
may require repeated attempts but is considered very safe, and yields a 70-97% success rate [10]. Possible complications include severe pain (6%), hemorrhage (2%) anal fissure and fistula (0.4%) thrombosed external hemorrhoids (1.5%) [15]. Doppler guided HAL uses Doppler technology to identify and ligate 3-6 arterial vessels surrounding the anal canal and has been shown to result in lower recurrence rates than RBL, yet its association to increased post-operative pain must be taken into account when evaluating the different treatment modalities [10].

Our present study aimed to assess the safety and efficacy of a novel Doppler guided laser hemorrhoidal artery dearterialization and describe our experience as a tertiary general surgery department with the mini-invasive Doppler-guided laser procedure (HeLP) for the treatment of second and third-degree hemorrhoids. We modified the procedure by adding a second line of laser shots at 5 to 6 points when arterial pulsation persisted after the first-line treatment. This was intended to accelerate postoperative down-staging of the hemorrhoids. Hemorrhoidectomy is traditionally considered an extremely painful procedure for a fairly benign condition [17]. Short-term complications include urinary retention (20.1%), bleeding (secondary or reactionary) (2.4%-6%), and subcutaneous abscesses (0.5%). Long-term complications include anal fissure (1%-2.6%), anal stenosis (1%), incontinence (0.4%), fistula (0.5%), and recurrent hemorrhoidal symptoms (20%) [18].

The non-excisional treatment of hemorrhoids using Doppler laser to seal the terminal branches of the superior rectal artery is a novel approach [12] based on the rationale that the reduction in blood flow will shrink the hemorrhoids, followed by healing of the supportive tissue and alleviation of symptoms [13]. Dearterialization has the advantage of preservation of the anatomy and physiology of the anal canal relative to other surgical treatments for hemorrhoids, thereby minimizing the risk of impaired anal function [19]. Because the technique used here (HeLP) spares the sensitive region below the dentate line, patients had relatively less postoperative pain and a shorter hospital stay. The rate of intraoperative bleeding in our study was 8% which is slightly lower than the 10% reported by Crea et al. [20] using the HeLP. Furthermore, most of the patients in the earlier study [20] were discharged after 6 hours, and ours were discharged after less than 3 hours. On follow-up, outcome was excellent in terms of resolution of hemorrhoid-related symptoms and postoperative pain. Only minor early complications were noted.

Conclusions

Doppler-guided laser seems to be an effective and painless technique for the treatment of symptomatic second-to third-grade hemorrhoids with mild/moderate mucosal prolapse.

**Table 1:** Clinical data of patients with second- and third-degree hemorrhoids

| Clinical data | Second-degree hemorrhoids | Third-degree hemorrhoids | P value |
|---------------|---------------------------|--------------------------|---------|
| No. of patients, n (%) | 18 (29%) | 44 (71%) | NS |
| **Preoperative** | | | |
| Symptoms, n (%) | | | |
| Bleeding | 15 (83.3%) | 36 (81.8%) | NS |
| Hemorrhoidal syndrome | 3 (16.6%) | 8 (18.1%) | NS |
| Duration of symptoms (months), mean ± SD | 19.7 ± 12.6 | 23.4 ± 10.8 | NS |
| Hemorrhoids with prolapse, n (%) | 0 | 24 (54.5%) | < 0.0001 |
| **Intra- and Postoperative** | | | |
| Duration of surgery (minutes), mean ± SD | 16 ± 4.3 | 16.8 ± 3.5 | NS |
| Number of vessels treated, mean ± SD | 10.8 ± 1.4 | 11.1 ± 1.3 | NS |
| Recto-anal repair, n (%) | 0 | 8 (18.2%) | < 0.05 |
| Bleeding, n (%) | 1 (5.5%) | 5 (11.3%) | < 0.05 |
| Thrombosis of hemorrhoids, n (%) | 0 | 5 (11.3%) | < 0.01 |
| Transient fever, n (%) | 1 (5.5%) | 1 (2.2%) | NS |
Conflicts of interest
The authors declare that they have no conflict of interest.