Outcomes of diode laser haemorrhoidoplasty in treatment of second, third and fourth grades of haemorrhoids. a retrospective study

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Introduction
Management of hemorrhoidal disease had been always a challenge for colorectal surgeons. Recently, the use of diode laser in proctology has emerged as an alternative to conventional surgical treatment. The laser beam causes shrinkage and degeneration that depend on the power and the duration of laser light application. It is also associated with minimal postoperative pain, bleeding, discharge and short hospital stay.
Patients and methods
This prospective study was carried out on 104 patients with second, third and fourth grades of hemorrhoids in the Gastrointestinal Surgery Unit, General Surgery Department, Tanta University Hospitals, during the study period (18 months, from February 2021 to August 2022). All patients underwent laser hemorrhoidoplasty lasotronix device, bare fibers, wavelength 1470 nm and 8 watts of power. Mucopexy was added in 28 patients with grade 4 hemorrhoids.
Results
Postoperative pain was evaluated using VAS score, in the first 6 h VAS ranged from 4-9 with mean of 5.81±1.23 SD, after 12 h ranged from 1 to 7 with mean of 4.19 ±1.70 SD. There was significant relation between the grade of hemorrhoid and postoperative edema (*P* value was less than 0.001) as all of the 24 patients who developed edema, they were grade 4 hemorrhoids. Also, there was relation between grade 4 hemorrhoid and the development of other postoperative complications but *P* value was not significant (0.066 in infection and 0.260 in recurrence). There was no incontinence or stenosis in all of the 104 patients and recurrence occurred only in 4 cases (3.8%) and underwent conventional hemorrhoidectomy after six months of follow up.
Conclusion
Diode laser is a safe minimally invasive procedure for the treatment of second, third and fourth grades of hemorrhoids with less postoperative pain and early return to normal activities but high cost remains the only limitation.

Keywords:
diode laser, haemorrhoids, laser hemorrhoidoplasty

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Introduction

Hemorrhoidal disease is one of the most common benign anorectal diseases that have a significant impact on patient's life [1].

The hemorrhoids may cause symptoms that are: bleeding, prolapse, itching, soiling of feces, and psychologic discomfort [2].

Surgical treatment has been always the definitive treatment for the previously mentioned lesions, even better than the medical choice [3].

Currently, patients undergoing anal surgical intervention as hemorrhoidectomy could experience variable intensity of postoperative pain, bleeding, delayed return to normal lifestyle and recurrence rate that differs according to the adopted technique and the operator [4].

The commonly used laser energy in medicine are diode laser, carbon dioxide, argon, and Nd:YAG. The laser beam causes tissue shrinkage and degeneration at different depths depending on the laser power and the duration of laser light application. Recently, laser treatment using diode laser is a new minimally invasive and painless procedure and considered as an alternative to the surgical choice and associated with less

postoperative pain, less bleeding and early return to normal life [5].

Aim of the work

The aim of this work was to evaluate the efficacy of diode laser in the treatment of patients with symptomatic haemorrhoids, focusing on the postoperative pain, complications and return to normal daily activity.

Patients and methods

This study was a retrospective study that included 104 patients who were presented with second, third and fourth grades of hemorrhoids. They were admitted to the general surgery department at Tanta University hospitals in the period between February 2021 and August 2022.

Inclusion criteria

(1) Age more than 18 years old.
(2) Second, third and fourth degrees of hemorrhoids.

Exclusion criteria

(1) Accompanied anorectal pathology as anal fissure or perianal fistula.
(2) Acutely inflamed thrombosed hemorrhoids.
(3) Patients affected by inflammatory bowel disease affecting the rectum or anus.

Preoperative assessment

All patients were subjected to full history taking, general examination, digital rectal examination to exclude the presence of anorectal mass or accompanied anorectal pathology, routine laboratory investigations and colonoscopy to exclude cancer colon and rectum in patients more than 50 years old.

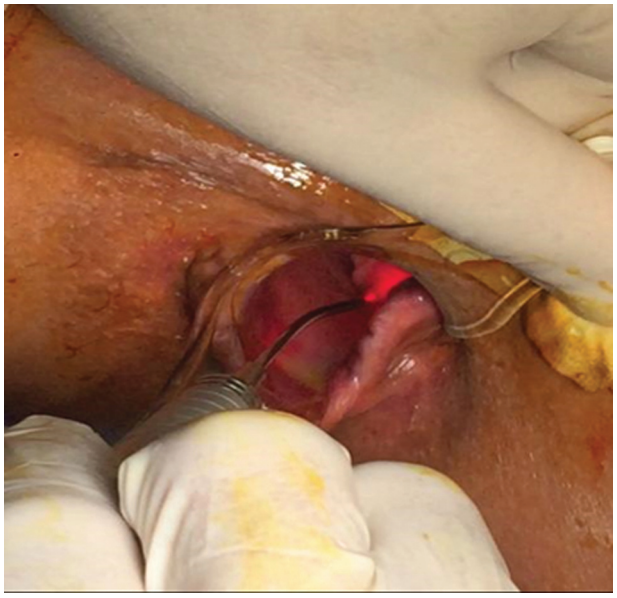
Operative technique

Laser hemorrhoidoplasty can be defined by three steps. Step A is the coagulation of the feeding vessel of the hemorrhoid, this was done by the introduction of the laser bare fiber through the anus and giving about 80 joules without touching the mucosa to avoid its injury (Fig. 1).

Step B was done by making a skin micro-incision of 3 mm using the laser probe about 0.5 cm from the anal verge at the base of each hemorrhoid in the subcutaneous plane. The probe was driven through the incision in the submucosal tissue till reaching the area underneath the distal rectal mucosa (Fig. 2).

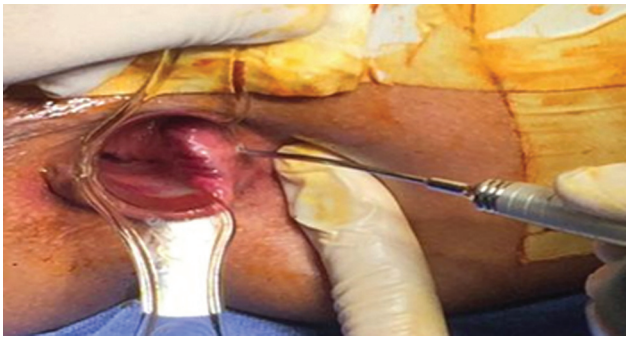
(1) Effective pulses (about 100 joules) using a laser generator were fired using bare fibers under 8 watts and a wavelength 1470 nm. Then step C was achieved by giving another 80–100 joules to the cushion to achieve shrinkage of the hemorrhoids.
(2) Total number of joules for each hemorrhoid was about 250–300 joules.
(3) Ice packs should be put inside the anus to produce cooling effect to avoid postoperative itching due to laser heat.
(4) In case of fourth-degree hemorrhoids and large external component, mucopexy was done to augment shrinkage of the hemorrhoid by the figure of 8 VICRYL sutures starting at the apex of the hemorrhoid with taking into consideration that only mucosa and submucosa are taken in the sutures.

Figure 1



Coagulation of the feeding vessel.

Figure 2



Introduction of the laser probe into the subcutaneous plane.

Follow up

(1) Assessment of postoperative pain using the visual analogue score (VAS), need of analgesics, postoperative bleeding (either spontaneous or postdefecatory), edema and sero-moucous discharge was evaluated in the first 24 h and weekly for one month and monthly for six months.
(2) Patients were discharged on the same day of the surgery or 24 h after surgery if the there is no complications and pain was less than 5 by VAS score.

Results

104 patients underwent laser hemorrhoidoplasty ranging from 22 to 76 years old. 68 of them were males (65.4%) and 36 were females (34.6%), the minimum age was 22 and the maximum age was 76. 40 patients (38.5%) suffered from grade 2 hemorrhoids, 36 (34.6%) suffered from grade 3 hemorrhoids and 28 (26.9%) suffered from grade 4 hemorrhoids. Operative time ranged from 6 to 23 min with a mean of 13.19±5.04 SD. Shrinkage of hemorrhoids occurred immediately postoperative at some extent and complete shrinkage occurred after one month (Figs. 3–5).

Figure 3

Grade 4 hemorrhoids preoperative.

Figure 4

Shrinkage of hemorrhoids immediately postoperative.

Postoperative pain was evaluated using VAS score, in the first 6 h VAS ranged from 4 to 9 with a mean of 5.81±1.23 SD, and after 12 h ranged from 1 to 7 with a mean of 4.19±1.70 SD. After 24 h VAS score ranged from 0 to 7 with a mean of 2.73±2.07 SD. Three days after surgery VAS score ranged from 0 to 3 with a mean of 0.12±0.59 SD. VAS score was 0 after one week, two weeks, one month, two months and six months of follow-up (Table 1). Postoperative bleeding was present in the form of spontaneous postdefecatory spotting with no eventual serious bleeding requiring intervention. It occurred in 12 patients after 24 h and was present in only 4 cases after 1 week, 2 weeks, and continued for 6 months which was considered as recurrence. There was no postoperative discharge in all cases after 24 h but discharge was present in 8 cases after one week in the form of infection and was treated conservatively by antibiotics such as ceftriaxone or levofloxacin. Postoperative edema (Fig. 6) was present in 24 patients (23.1%) and was treated conservatively by local and systemic anti-inflammatory medications.

Figure 5

Complete shrinkage of hemorrhoids after one mont.

Table 1 Descriptive analysis according to pain (VAS) score (*n*=104)

Pain (VAS) score	Min.–Max.	Mean±SD.	Median (IQR)
6 h	4.0–9.0	5.81±1.23	5.50 (5.0–7.0)
12 h	1.0–7.0	4.19±1.70	4.0 (3.0–5.0)
24 h	0.0–7.0	2.73±2.07	2.50 (1.0–5.0)
3 days	0.0–3.0	0.12±0.59	0.0 (0.0–0.0)
1 week	0.0–0.0	0.0±0.0	0.0 (0.0–0.0)
2 weeks	0.0–0.0	0.0±0.0	0.0 (0.0–0.0)
1 month	0.0–0.0	0.0±0.0	0.0 (0.0–0.0)
2 months	0.0–0.0	0.0±0.0	0.0 (0.0–0.0)
6 months	0.0–0.0	0.0±0.0	0.0 (0.0–0.0)

IQR, Inter quartile range; SD, Standard deviation.

Table 2 Relation between grade and complication (*n*=104)

	Grade				
	II (*n*=10) No. (%)	III (*n*=9) No. (%)	IV (*n*=7) No. (%)	χ^2	^{MC}P
Post. edema	0 (0.0)	0 (0.0)	24 (85.7)	17.396	<0.001*
Recurrence	0 (0.0)	0 (0.0)	4 (14.3)	2.356	0.260
Itching	0 (0.0)	8 (22.2)	4 (14.3)	2.368	0.339
Incontinence	0 (0.0)	0 (0.0)	0 (0.0)	-	-
Stenosis	0 (0.0)	0 (0.0)	0 (0.0)	-	-

χ^2, Chi square test; MC, Monte Carlo. *P*: *P* value for association between different categories. *: Statistically significant at $P \leq 0.05$.

Figure 6

Postoperative edema after laser hemorrhoidoplasty.

There was a significant relation between the grade of hemorrhoid and postoperative edema (*P* value was less than 0.001) as all of the 24 patients who developed edema were grade 4 hemorrhoids. Also, there was a relation between grade 4 hemorrhoid and the development of other postoperative complications but *P* value was not significant (0.066 in infection and 0.260 in recurrence) (Table 2). Itching occurred in 12 patients (11.5%) mainly due to the heat caused by the laser probe and was treated by local soothing agents as panthenol. There was no incontinence or stenosis in all of the 104 patients and recurrence occurred only in 4 cases (3.8%) and underwent conventional hemorrhoidectomy after six months of follow up (Table 3). Hospital stay ranged between one and two days with a mean of 1.12±0.33 SD. Return to normal activities ranged between 2 and 7 days (mean 3.73±1.34 SD).

Table 3 Complications recorded in the cases (*n* = 104)

Complication	No. (%)
Post. Edema	24 (23.1)
Infection	8 (7.7)
Recurrence	4 (3.8)
Itching	12 (11.5)
Incontinence	0 (0.0)
Stenosis	0 (0.0)

Discussion

Treatment of anorectal diseases had always been a challenge as there are many treatment modalities including surgical and nonsurgical options and this multiplicity added more confusion about the best modality for treatment which is still controversial [6]. Treatment of hemorrhoids by laser is based on the theory that congestion of the hemorrhoidal plexuses is caused by the overflow of blood in the superior hemorrhoidal artery feeding these plexuses, that is why targeting this artery by laser coagulation will cause shrinkage of venous plexuses and will be accepted treatment [3].

In our study we used diode laser for treatment of 104 patients that had second, third, and fourth grades of hemorrhoids, we used diode laser of wavelength 1470 nm 8 watts, the total application of joules ranged from 250 to 350 joules for each hemorrhoid, mucopexy was associated with laser hemorrhoidoplasty in 28 cases with grade 4 hemorrhoids. Follow up period was up to 6 months. There were multiple studies concerning the use of diode laser. In 2009, **Salfi R** used Doppler-Guided Laser Photocoagulation of Hemorrhoidal Arteries as a new technique for the treatment of hemorrhoids, **Jahanshahi *et al.*, Maloku *et al.* and Naderan *et al.*** used diode laser of 980 nm wavelength while **Weyand *et al.*, Brusciano *et al.* and Poskus *et al.*** used diode laser of 1470 nm wavelength which was similar to our study [2,3,5,7–9].

Postoperative pain is the most important complication that annoys most of the patients and makes them reluctant to have surgery. In a cohort study performed on 497 patients by **Weyand *et al.* in 2017** recorded the postoperative course and complications, the mean postoperative pain was 2.5/10 according to visual analogue score (VAS), patient satisfaction was 91%, complications occurred in 49 patients (9.9%): bleeding 1.8%, infection 1%, urine retention 1.8%, edema/thrombosis/prolapse 6.6%. 8.8% of patients had recurrence within 6 months. They claimed that energy given during laser

hemorrhoidoplasty should be reduced to a minimum and not exceed 500 joules to avoid complications as perianal edema and thrombosis especially of the external component of the hemorrhoid. They also performed associated mucopexy in indicated cases of grade 4 hemorrhoids to augment proper shrinkage which was similar to our study but they claimed that mucopexy was associated with increased complication [8]. In our series, postoperative pain was very low as the VAS score reached a mean of 2.37 in the first 24 h. Postdefecatory bleeding occurred in 8 patients but there was no serious bleeding that required hemostasis, Serous discharge was reported in 8 patients and stopped after three days. No incontinence was recorded in all of the 104 patients. Postoperative edema was reported in 24 patients and all of them were grade 4, there was a significant relation between postoperative edema and grade of hemorrhoids. Itching occurred in 12 patients and was treated by soothing agents,

Recurrence was recorded only in 4 of our cases (3.8%) in 6 months of follow-up and was treated later on by conventional surgery. In a study by **Poskus *et al.* in 2020**, they compared laser hemorrhoidoplasty (LHP) with sutured mucopexy and open hemorrhoidectomy in the treatment of second and third degrees of hemorrhoids, they concluded that LHP is associated with less postoperative pain, less operative time and earlier return to normal activities than the other two procedures and that patients rated LHP better than the other two modalities. They also mentioned that over one year of follow up, open hemorrhoidectomy was more effective than LHP regarding recurrence as LHP had (10%) recurrence rate while 22%) of the cases that had mucopexy alone experienced recurrence [9]. On the contrary to our study in which we added mucopexy to laser therapy for the treatment of 4th degree piles, **Poskus *et al*.** excluded 4th-degree piles from the study as their study was randomized controlled and they claimed that laser therapy was not applicable on 4th-degree piles, so they applied three modalities of treatment on three groups of patients. Also there was a study in 2020 in which they used mucopexy with hemorrhoidal laser procedure (HeLP) for the treatment of third-degree hemorrhoids, they had promising results regarding postoperative pain, bleeding and return to normal activities [10].

An experimental study was conducted on 54 samples from pigs to study the effect of power and time of exposure of 1470 nm diode laser on the perianal tissue, they found that 3.93 mm tissue injury was caused by laser exposure for 3 sec with no significant difference between laser power used [11]. This was one of the main limitations of our study because we did not study the effect of the dose of energy applied although we planned not to exceed 350 joules for each hemorrhoid.

Another limitation of our study that it was a retrospective study to increase the sample size, on the contrary, there was other important prospective study that had similar results to our study, in this study laser hemorrhoioplasty was performed on 50 patients with symptomatic hemorrhoids. The procedure was associated with minimal discomfort, and little postoperative pain which reached a mean VAS value of 2 (range 0–3), while in the subsequent days, the VAS value decreased to 0, short hospital stay, early return to normal activities and no recurrence. They also proposed that the use of wavelength of 1470 nm penetrated only 2 mm which lead to optimum shrinkage of hemorrhoidal tissue and was selectively better adsorbed by hemoglobin than Nd:YAG laser [7,10]. Naderan *et al*.'s prospective study in 2017 also proposed that laser hemorrhoidoplasty had a better outcomes than Milligan Morgan hemorrhoidectomy regarding operative time, postoperative pain and bleeding but had a higher cost [5].

Conclusion

Based on our study we conclude that:

Diode laser is a safe minimally invasive procedure for treatment of hemorrhoids, and is associated with minimal postoperative pain, short hospital stay and early return to normal activities but the procedure has higher cost than conventional surgery which can be the only limitation. We recommend the use of diode laser in a larger scale of patients and to watch the effect of the dose of appliance on the possible occurrence of complications.

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Conflicts of interest

There are no conflicts of interest.

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