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CO_2 Diode Laser Hemorrhoidectomy: Clinical Experience with 150 Patients

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Abstract

Background Hemorrhoids are the most common benign anorectal conditions. About half of population are affected by hemorrhoids during their life time. Conventional surgical hemorrhoidectomy, which was the standard treatment for many decades are associated with remarkable and intolerable pain that may last up to 3 to 6 weeks, which makes more patients reluctant to surgery. Laser hemorrhoidectomy is relatively new promising modality with less postoperative pain and less complications with fast wound healing and early return to work.

Objective To assess the validity, feasibility and the outcomes of using the CO_2 diode laser for treatment of symptomatic hemorrhoids.

Methods A prospective study conducted for the period from September 2013 to April 2015, included 150 patients (135 male and 15 female), with symptomatic first, second and third degree piles with age ranged from 24 to 83 years (mean 48.7 year) submitted to CO_2 diode laser hemorrhoidectomy with either the coagulation mode or cutting mode of 30 Watt diode laser surgical machine. The procedures were done under local anesthesia as a day case surgery by single surgeon.

Results The results showed that the operative time ranges from 15 to 30 minutes (mean 23.5 minutes). Postoperative pain scores by visual analog scale (VAS) in the first, second and third postoperative days were 2.9, 2.1, 1.8 respectively. The pain decreased rapidly after the first week and reached to zero after 14 days postoperatively. The complications rate recorded in this work was 7.3%. All these complications were mild and can be dealt with conservatively; redo surgery was not required in any case. All patients were discharged 2 to 4 hours postoperatively and were followed for 3 to 6 months.

Conclusion Hemorrhoidectomy by CO_2 diode laser is effective, and very quick outpatient procedure with very mild postoperative pain and low or negligible rate of complications. It associated with rapid healing and fast recovery that most patient can return to normal daily activity within 2 to 5 days. These results are considered a big advantage upon conventional hemorrhoidectomy.

Keywords Hemorrhoids, laser hemorrhoidectomy, CO_2 diode laser

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List of abbreviations: None.

Introduction

Hemorrhoids or piles are the commonest anorectal diseases. They affected about 50% to 70% of population by the ages of fifty to sixty-five years [1]. The disease tends to runs in family and affect male slightly more than female. Although hemorrhoidal cushions are normal vascular structures found in anal canal above the dentate line that aid in fine continence and found along the final distribution of terminal branches of superior rectal artery at 3, 7, and 11 o'clock in a lithotomy position, they are infrequently referred to them until they are enlarged and

dilated, then the term "hemorrhoid" is described as a pathologic process [1,2].

Clinical presentations of hemorrhoids range from being completely asymptomatic, bleeding (1st degree), mucosal prolapse that return spontaneously or manually after defecation (2nd and 3rd degree piles respectively) and permanent prolapsed with itching and pruritis (4th degree). Treatment is usually required for all symptomatic hemorrhoid to remove the hemorrhoid and relieve the symptoms.

The pathogenesis of hemorrhoid is not completely understood. Several theories were put to explain the development of hemorrhoid. The arterial flow or hypervascularization theory adapted by Aigner et al [1] is one of these theories. They suggest that the three terminal branches of superior rectal artery have large diameters, greater blood flow, in addition to a higher peak velocity and acceleration velocity in patients with hemorrhoidal disease when compared to those of healthy individuals. According to this theory, the arterial overflow in the superior hemorrhoidal arteries will lead to dilatation and enlargement of hemorrhoidal vascular plexus [3].

The conventional excisional hemorrhoidectomy whether open (Milligan-Morgan) or closed (Ferguson) is usually associated with remarkable postoperative pain which may last up to 2 to 3 months in addition to other complications like bleeding, urine retention, infection, anal stenosis and could be recurrence [3,4].

Laser hemorrhoidectomy by CO_2 diode laser is new ambulatory outpatient procedure for treatment of selected patient with 1st, 2nd and 3rd degree piles in which the hemorrhoidal arterial flow feeding the enlarged vascular plexus is stopped by laser vaporization, coagulation and by excision [4]. The utilization of laser for removal of hemorrhoid in selected patients are expected to have many advantages over the classical surgical hemorrhoidectomy such as less postoperative pain with smooth and comfortable postoperative course, no hospitalization is required with faster return to work.

The aim of this study was to present and evaluate our initial clinical experience with 150 consecutive patients presented with symptomatic hemorrhoid of first, second and third degree submitted to ambulatory hemorrhoidectomy using the CO_2 diode laser.

Methods

This is a prospective study conducted for the period from September 2013 to April 2015 in which, 150 consecutive patients with symptomatic first, second and third-degree piles were selected to have hemorrhoidectomy using CO_2 diode laser. They were 135 male and 15 female patients with age ranges between 24 and 83 years (mean 48.7 years). Patients with American Society of Anesthesiologist (ASA) grade III and IV, previous anal surgery fourth degree piles, prolapsed, strangulated and thrombosed piles, recurrent piles, and piles with concomitant anorectal diseases were excluded from laser hemorrhoidectomy and offered for conventional surgical excision by open Milligan-Morgan procedure.

A detailed history was obtained and through physical examination were offered to all patients in this study. Routine preoperative investigations were done, which include complete blood count, blood sugar, blood urea, hepatitis viral profile and electrocardiography for all patients above 40 years. Proctoscopy was done for all patients to exclude secondary hemorrhoid or to exclude other pathology of bleeding per rectum.

All operations were done as outpatient ambulatory procedures. Bowel preparations by rectal enema was not required. Patients before procedures were pre-medicated by receiving 75 mg diclofenac and/or tramadol intramuscular injection. The procedure started with the patients lying in lithotomy position. The perianal area is infiltrated by injection of about 20 ml mixture containing equal amount of 2% lidocaine with adrenaline and 0.5% bupivacaine with 5 ml Na-bicarbonate to reduce the acidic effect of anesthetic mixture.

The laser machine used in these procedures was 30-Watt diode laser surgical machine, model IB 411 made by Innobri Technology company (Figure 1). Patients were informed about all details of the procedure and informed verbal consent was obtained from each patient prior to operation. All operations were conducted by the same single surgeon.

Figure 1. 30 W DIODE laser surgical machine

Procedure

- The procedure starts with anal dilatation with aid of lidocaine jell 5% to relax the anal internal sphincter and to bring the internal hemorrhoid in to the view.
- The CO_2 diode laser machine setting is adjusted on 10-Watt, time on 45 ms, time off 30 ms.
- Having the laser cable of 400 micron on the hand piece, a cerebrospinal fluid needle (CSF) is inserted on the hand piece that the laser optic fiber pass through and only 1-2 mm appeared from the needle tip.
- C-shaped anoscope lubricated with 2% lidocaine jell introduced inside the anal canal.
- Starting with a large pile which is usually at 3 o'clock position, an Allis forceps is applied at muco-cutaneous junction of the piles and pull the piles outward and downward to bring it outside the anal canal, using the laser in a cutting setting mode, the pile is excised with a pinpoint accuracy. Stitches are not needed as the laser seals the blood vessels as it cut so. The risk of incontinence due to internal sphincter injury is absent because the laser beam is so small and there is very clear view of hemorrhoid.
- After removal of large pile, smaller piles are dealt with now. With anoscope still inside, the pile is grasped at its tip with an Allis forceps, the CSF needle with the laser fiber optic tip (1-2 mm bare fiber out) as the laser setting on coagulation mode, the needle got inside the pile from the outer part down up to the pile root submucosally to avoid the perforation of the pile from inside to prevent bleeding.
- The CO_2 diode laser stars to coagulate the vascular pedicle (root) of the pile by 5 to 10 shots generated at a power of 10 Watt causing shrinkage of the pile mass. The coagulation depth reaches to the depth of about 5 to 10 mm. the rest of the pile is further coagulated by passing the laser fiber tip into all parts of the pile. It is not needed to make more than one entry spot to the hemorrhoid, it needs only one entry at the top of the pile and from it we can do laser effect on the entire of the pile. It takes about 3 minutes for each pile to be fully coagulated.

- The same process was repeated with the rest of the piles.
- Mixed pile (has internal and external components) are dealt with by separation of both components by a bridge of anal skin. The internal pile then will be coagulated and vaporized with a coagulation laser beam and the external part excised with a cutting mode laser.
- At the end of the procedure, sterile gauze dressing soaked with lidocaine jell is applied externally over the anal verge. The time taken by this procedure ranged between 15 minutes to 25 minutes with mean time of 21.6 minutes (Figure 2).

Figure 2. Laser hemorrhoidectomy procedure

After surgery

After the procedure, the majority of the patients has a good feeling of wellbeing. There was no pain as long as the long acting anesthesia (0.5% bupivacaine) still active and working (Figure 3).

Figure 3. Preoperative and immediate postoperative laser hemorrhoidectomy

All patients were send home 2 to 4 hours postoperatively. Drugs prescribed for patients to be taken at home include pain killer in form of ibubrufen and Tylenol or Panadol

(acetaminophene) tablets, stool softener like bisacodyl (dulcolax) tablet, and antibiotics like metronidazole and cefepime tablet. Injectable medications were rarely required.

Patients were informed prior to discharge that any discomfort or pain felt at home can be greatly alleviated by sitting in a warm water (sitz path) 2 to 3 times daily. Patients were ordered to be seen on fifth postoperative day or earlier when they have any questions or complain.

Postoperative pain, complications, healing rate, recurrence rate and patient satisfaction with results of operation were recorded and assessed. Postoperative pain was evaluated by using the visual analog scale in which 0 represent no pain and 10 score represents the worst and intolerable pain. The fellow up period in this study was 3 to 6months.

Results

Laser hemorrhoidectomy by CO_2 diode laser machine was carried out on 150 consecutive patients (135 male and 15 female) with mean age 48.7 years range from 24 to 83 years. The age distribution of patients included in this study is shown in table (1).

Table 1. Age distribution of patients presented in the study

Age	Sex		Total
	Male	Female	
20-39	32	3	35
40-59	77	6	83
≥60	26	6	32

They presented with symptomatic first, second and third-degree piles with no or mild permanent mucosal prolapsed (Table 2). None of the patient was incontinent preoperatively (Wexner score 0-2).

Operative time ranges from 15 to 30 minutes, mean 23.5 minutes. Hospital stay was 2 to 4 hours. All patients were discharged after pack checking to ensure no bleeding and almost with no pain or very mild pain that can be dealt with oral or parentral analgesics. Postoperative pain, complications, wound healing, patients' satisfaction with the procedure and recurrence rate were all documented and evaluated. The main patients' symptoms were bleeding and prolapse of the piles masses as shown in table (2).

Table 2. Distribution of symptoms among patients

Symptoms	No	%
Bleeding without prolapsed (1st degree)	16	10.7
Bleeding with prolapsed during defection only (2nd degree)	62	41.3
Bleeding with permanent prolapsed (3rd degree)	72	48

Postoperative pain as assessed using the visual analog scale (VAS) is demonstrated by table (3). The pain score in the first, second, and third postoperative day were 2.9, 2.1 and 1.8 respectively. The pain score will decrease gradually over the first week to reach 0.9 in the seven-postoperative day. Most patients (no. 136, 90.7%) record pain score of 0 (no pain) after 14 days postoperatively.

The overall complications rate among patients in this study was 7.3% (11 patients) (Table 4). Bleeding was the most common immediate and early post-operative complication, developed in 5 patients (3.3%). It was mild

bleeding and stopped conservatively and no re-intervention was required. All cases were dealt with successfully by dressing with absorbable hemostatic gelatin sponge.

Three patients in this study developed wound infection. These infections were managed by intravenous antibiotics in form of metronidazole and ceftriaxone for 5 days and all patients were improved and healed.

Urine retention occurred in 2 (1.3%) elderly male patients. Only one patient required catheterization due to concomitant benign prostatic hypertrophy and the other 2 patients were treated conservatively by sedation, fluid restriction and warm path.

Anal stenosis observed only in one patient, it was managed by anal dilatation under local anesthesia together with application of 0.2% GTN cream for 7 days.

All patients treated by laser hemorrhoidectomy in this study were able to return to their normal activities within 5 to 7 days and complete healing was achieved and accomplished in all patients after 14 to 21 days postoperatively.

Anal incontinence was not detected in any patient probably due to pin point accuracy and precision of laser beam used in these procedures. Furthermore, recurrence was not recorded in any patient throughout the 6 months fellow up period.

Table 3. Pain score by VAS among patients by Laser Hemorrhoidectomy

VAS	Day 0	Day 1	Day 3	Day 7	Day 14	Day 21
0-2	35/150	65/150	115/150	140/150	150/150	150/150
2-5	112/150	83/150	33/150	9/150	0/150	0/150
>5	3/150	2/150	2/150	1/150	0/150	0/150

Table 4. Postoperative complications among patients by laser hemorrhoidectomy

Complications	No	%
Bleeding	5	3.3
Urine retention	2	1.3
Wound infection	3	2
Delay wound healing	1	0.6
Anal stenosis	1	0.6
Incontinence	0	0
Recurrence	0	0
Overall complications	11	7.3

Patients satisfaction about the procedures was also studied (Table 5). Majority of patients included in this study (no. 137, 91.3%) were very satisfied with the procedure and its outcomes. They preferred laser hemorrhoidectomy over conventional surgical hemorrhoidectomy because of less postoperative pain, speeder recovery and fewer complications.

Table 5. Patients satisfaction with laser hemorrhoidectomy

Patients	Operation results				Total
	Satisfied		Unsatisfied		
	Very satisfied	Satisfied	Fair	Unsatisfied	
Male	59	67	7	2	135
Female	65	2	2	2	15
Total	65	72	9	4	150

Discussion

The majority of patients with piles were reluctant to surgery due to postoperative pain, which may lead to delay of surgical treatment. Traditional excision and suture ligation hemorrhoidectomy whether by open method (Milligan-Morgan) or by closed method (Ferguson) is still most commonly practiced symptomatic and complicated hemorrhoids [2]. Postoperative pain is the most common and disabling complication after these procedures due to highly sensitive anoderm. The pain could last for 3 to 6 weeks. Other less frequent complications of these operations include bleeding, anal stricture and recurrence. Therefore, uneventful and relatively painless procedure are the main aims of both the surgeon and the patient [4].

Postoperative pain after excisional hemorrhoidectomy may results from cutting the somatic nerves in highly sensitive anoderm, sphincter spasm, mucosal damage, insertion of hemostatic gauze or could be due to sutures ligation of piles pedicle [2,5].

Laser hemorrhoidectomy is a new treatment modality employing laser energy to coagulate, vaporize, disintegrate and excise hemorrhoid [2,5]. It is relatively painless procedure when compared with excisional or stapled hemorrhoidectomy. Early reported results were promising and good [4-6]. The main principle and justification of hemorrhoidal procedure is based upon the fact tans-anal hemorrhoidal de-arterializations that by reducing the inflow of the arterial blood causes a gradual and progressive reduction of hemorrhoidal mass volume, which in turn results in progressive improvement of hemorrhoidal related symptoms. Besides, the pinpoint laser beam can be used to excise the prolapsed and external piles with high accuracy and precision [5,6].

Laser hemorrhoidectomy is a clinical procedure when hemorrhoids are disintegrated and removed using specialized equipment that emits laser. It is similar to other procedures that are performed to manage hemorrhoids [7]. The ultimate goal of laser hemorrhoidectomy is to get rid of the piles completely, relieve the patients' symptoms, postoperative pain and less complications with prompt healing and recovery. It is an outpatient or office-based procedure, which is very quick to perform and needs no hospitalization [6,8].

Laser was first introduced and used in anorectal surgery in the 1960s by Senagore et al. [9] who used Nd:YAG laser in their series of 86 patients. They concluded that there are no advantages with the use of Nd:YAG laser for hemorrhoidectomy upon traditional excisional hemorrhoidectomy. Later on, the results have been greatly improved with the advent of CO_2 diode laser together with the development of scanned and pulsed laser. Plapler et al. [10] recorded in their study of 350 patients who submitted to hemorrhoidectomy with CO_2 diode laser that laser hemorrhoidal operations resulted in less postoperative pain and better outcomes when compared with conventional hemorrhoidectomy.

The results of this study showed that the treatment of hemorrhoid with CO_2 diode laser results in much low score of postoperative pain. The pain score didn't exceed 3 degrees score on visual analog scale in the first 3 postoperative day and decreased gradually to

reach to the base line 2 weeks after intervention. Patients in this study needed mild analgesics in form of NSAIDs and warm sitz path to manage their postoperative pain and narcotic analgesics were not required or used for any patient. Zahir et al. [11] reported in their study of 50 patients with second and third-degree piles who submitted to hemorrhoidectomy by CO_2 diode laser that the procedure has better postoperative course and remarkably less pain. Wang et al. [12] in their study, which compared the outcomes of conventional excisional hemorrhoidectomy with CO_2 diode laser hemorrhoidectomy showed that 11% in laser hemorrhoidectomy group needed analgesia versus 56% in conventional hemorrhoidectomy.

A reduction in postoperative pain and discomfort after laser hemorrhoidectomy is mainly due to sealing the superficial nerve endings, minor tissue damage, and faster wound healing.

The complications rate in this study was 7.3%. All these complications were minor. No patient had suffered a major postoperative complication that requiring re-intervention or hospitalization. Bleeding was most common complication. It was light bleeding, never cause alarm and no more than three days after intervention. It stopped conservatively and blood transfusion never required. Other less frequent complications such as wound infection (2%), urine retention (1.3%) and anal stenosis (0.6%) were managed conservatively and there was no need for further surgery. Giamundo et al. [13] recorded in their study that laser hemorrhoidectomy procedure as less painful and more effective than rubber band ligation. They found that laser hemorrhoidectomy associated with fast recovery and low complications rate.

All laser hemorrhoidectomy procedures were done as a day case surgery. All patients were discharged 2 to 4 hours after procedure. Hospital admission was not needed, for any patient.

A study of 750 patients presented with second and third-degree hemorrhoids conducted by Hodgson et al. [14] who submitted to laser hemorrhoidectomy, 98% successful rate was recorded and patients' satisfaction was 99%. The current study reported a satisfaction rate of 94.7%. Another study conducted at university of Sao Paolo in Brazil [15] found that CO_2 diode laser hemorrhoidectomy is superior to conventional hemorrhoidectomy by being hemostatic, less postoperative pain and complications, fast healing, less damage to the tissues and neighboring structures, and bactericidal as well. They also showed that 94% of patients required no or simple postoperative analgesics, 14% of patients need narcotics. The incidence of postoperative complications like bleeding and stenosis were about 1%.

A study by Maloku et al. [16] observed in their study of 40 patients that there were statistically significant differences between laser hemorrhoidplasty and open surgical hemorrhoidectomy inoperative time and early postoperative pain and they concluded that laser hemorrhoidectomy was more effective than open surgical hemorrhoidectomy. Similar retrospective comparative study of 1024 patients with third and fourth degree hemorrhoids by Saad et al. [17] who randomly subjected to either surgical excisional hemorrhoidectomy or CO_2 diode laser hemorrhoidectomy, they found that CO_2 diode laser hemorrhoidectomy was safe and easy procedure with lower rate of complications, shorter hospital stay and cost effective. These findings were also recorded by Awazli [18] who used 10600 nm CO_2 diode laser for 25 patients complaining from symptomatic hemorrhoids for many years.

It worthwhile to mention that the laser is inherently therapeutic, sealing off nerves therefore, patients treated by laser hemorrhoidectomy have a minimum postoperative discomfort. Furthermore, laser results in closure of small blood vessels with small invisible light and thus it facilitates the surgeon to operate in blood less white field.

Laser hemorrhoidectomy procedure is commonly performed under local anesthesia with sedation as a day case surgery and thus the chance of any major complications from this procedure are rare.

This study concluded that CO_2 diode Laser hemorrhoidectomy is an effective procedure characterize by decreased tissue damage, minimal blood loss and less postoperative pain and postoperative complications. It is associated with short operative time and performed as a day case surgery and hospitalization never required. It results in fast recovery and earl return to normal daily activity. It is safe, feasible procedure that commonly performed under local anesthesia. It require a well-trained and expert surgeon and expensive machine (CO_2 diode laser system machine).

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Conflict of interest
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