

Study of laser haemorrhoidoplasty in terms of intraoperative and postoperative outcomes

¹Dr. Vishal Nandagawali, Associate Professor, Department of Surgery, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India.

²Dr. Nitin Jagtap, Junior Resident, Department of Surgery, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India.

³Dr. Mahendra Kamble, Assistant Professor, Department of Surgery, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India.

⁴Dr. Sumedh Mahajan, Junior Resident, IGGMC, Nagpur.

Corresponding Author: Dr. Nitin Jagtap, Junior Resident, Department of Surgery, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India.

Citation this Article: Dr. Vishal Nandagawali, Dr. Nitin Jagtap, Dr. Mahendra Kamble, Dr. Sumedh Mahajan, “Study of laser haemorrhoidoplasty in terms of intraoperative and postoperative outcomes”, IJMSIR- May - 2023, Vol – 8, Issue - 3, P. No. 128 – 137.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Haemorrhoids have affected humans since they attained the erect posture. For the treatment of haemorrhoids various modalities have been tried ranging from dietary modifications to open surgery Haemorrhoidectomy. Each procedure has its own complications and advantages, also newer modalities like rubber band ligation and stapler haemorrhoidectomy and laser haemorrhoidectomy are emerging which can be done as a day care surgery. Excisional techniques such as open or closed haemorrhoidectomy are recognized for their high short- and long-term efficacy, their drawback is severe postoperative pain and other complications. Minimally invasive techniques maintain the integrity of the somatically innervated anoderm and are associated with less post operative pain but higher long-term recurrence. In this study of laser haemorrhoidoplasty an attempt has

been made to study demo graphics intraoperative and post operative course of this disease.

Methods: The present cross sectional observational prospective study was conducted on 47 patients in Department of Surgery IGGMC, Nagpur.

Detailed clinical history, examination and investigation for managing patients and operative fitness were done. Surgical intervention was done accordingly.

Results: 47 patients in the age group of 18– 85 years were involved in the study with the average age of presentation being 45.2 years. 57.4% (27/ 47) of the study population were males while 42.6% (20/ 47) were females. 68% (32/ 47) patients presented with bleeding per rectum, 29.8% (14/ 47) patients with pain during defecation, 21.3% (10/ 47) patients noticed mass during defecation, 14.9% (7 /47) had pruritus while 10.40% (5/ 47) patients presented with symptoms of anemia and later diagnosed with haemorrhoids. Our study population

includes 27 patients with grade 2 haemorrhoids, 18 patients of grade 3 haemorrhoids and 2 patients of grade 4 haemorrhoids. The mean operative time for laser haemorrhoidoplasty was 20 minutes with standard deviation of 7.54 minutes. Intra operative blood loss in our study was assessed using bleeding visual analogue (44) and was 17.16 ± 4.5 minutes. Patients were discharged next day after the surgery except with postoperative moderate to severe pain (7/47) and those who developed haematoma (3/47). Mean postoperative stay was 1.5 ± 0.5 days and patients return to their work after mean postoperative time of 6.5 ± 1.9 days. Most common immediate postoperative complication was postoperative bleeding in 19% patients (9/47) followed by urinary retention in 3 patients and haematoma in 3 patients. After 2 weeks of follow up 2/3 among patients with haematoma developed perianal eczema and 1/3 had serous anal discharge. Late postoperative complications were observed after 30 days postoperatively and most common complication was postoperative plicoma in 3/47 patients (6.4%) and 1 patient had incomplete regression (with grade 4 haemorrhoid) which needed second setting of laser haemorrhoidoplasty after 6 months.

Conclusion: Laser haemorrhoidoplasty is safe, less time consuming, less postoperative pain, early out of bed mobilisation, cosmetic with less postoperative complications, shorter hospital stay, minimizes hospital visit, lesser morbidity and mortality

Keywords: Haemorrhoids, LASER, LASER haemorrhoidoplasty, minimally invasive hemorrhoid treatment

Introduction

Haemorrhoids are one of the most common ailments to afflict mankind, but it is impossible to give an accurate figure for their prevalence. Although many patients present with symptomatic disease, many do not and some

never have symptoms, whether such individuals can be considered to have a disease must remain a moot point.¹

Haemorrhoids have plagued humans since they attained the erect posture. The word 'haemorrhoid' is derived from the Greek word haemorrhoids, meaning flowing blood (haem = blood, rhoos=flowing). The word 'piles' comes from the Latin word pila meaning a pill or ball. To be accurate, we should call the disease as piles when the patient complains of swelling and 'haemorrhoids' when he or she complains of bleeding.¹

For the treatment of haemorrhoids various modalities have been tried ranging from dietary modifications to open surgery Haemorrhoidectomy. Each procedure has its own complications and advantages, also newer modalities like rubber band ligation and stapler haemorrhoidectomy and laser haemorrhoidectomy are emerging which can be done as a day care surgery.

The most common method of treatment of haemorrhoids is by haemorrhoidectomy. Measures have included conservative medical management, non-surgical treatments and various surgical techniques. The various non-surgical treatments include rubber band ligation (RBL), injection sclerotherapy, cryotherapy, infrared coagulation, laser therapy and diathermy coagulation; all of which may be performed as outpatient procedures without anaesthesia. These nonsurgical methods are considered to be the primary option for grades one to three (grade I-III) haemorrhoids² measures fail to control symptoms; patients may be referred to a surgeon for operative management. The indications for the surgical treatment include the presence of a significant external component, hypertrophied papillae, associated fissure, extensive thrombosis or recurrence of symptoms after repeated RBL. The technique employed may be open (Milligan-Morgan) or closed (Ferguson) and the instruments used are scalpel, scissor, electrocautery or laser.

Milligan-Morgan haemorrhoidectomy is the gold standard and frequently performed procedure. Post haemorrhoidectomy pain is the commonest problem associated with the surgical techniques reported as high as 65%. The other early complications are urinary as 65%. The other early complications are urinary retention (20.1%), bleeding (secondary or reactionary) (2.4%–6%) and subcutaneous abscess (0.5%). The long-term complications include anal fissure (1%–2.6%), anal stenosis (1%), incontinence (0.4%), fistula (0.5%) and recurrence of hemorrhoids (2). The aim of study is to study laser hemorrhoidectomy in terms of effectiveness for treatment of hemorrhoids.

Since the first description of a hemorrhoidal operation in 460 BC by Hippocrates a wide range of surgical procedures has evolved, with conflicting opinions on the most effective and least harmful technique.

Excisional techniques such as open or closed hemorrhoidectomy are recognized for their high short- and long-term efficacy, their drawback is severe postoperative pain and other complications. Minimally invasive techniques maintain the integrity of the somatically innervated Anoderm and are associated with less postoperative pain but higher long-term recurrence.

Optimal technique for the treatment of hemorrhoids would be associated with minimal pain and postoperative complications as well as a low long term recurrence rate.³

Advantages and superiority of Laser over other surgical and non-surgical procedure.⁴

- 1) Improved success rate of surgeries
- 2) Comparatively safer treatment with a low recurrence rate
- 3) Minimally invasive, cosmetically preferential procedure
- 4) No deep incision. No excision. No open wounds.

- 4) Faster recovery with less post-operative pain, bruising, and numbness
- 5) Procedure takes less than an hour
- 6) OPD procedure which can be performed under local anaesthesia
- 7) Minimal blood loss, pain, and trauma

Between 06/2005 and 12/2005, a total of 106 patients with first to second degree hemorrhoids were treated with the Cerales D15 ELVeS laser, a 980 nm diode laser for the first time by Ahmet Fatin Karahaliloğlu for the first time and published study in year 2007 following which this technique has been popularized worldwide.⁵

Very few studies for laser hemorrhoidectomy available in Indian setting, populations studied in previous studies from literature don't have long term follow-up, laser hemorrhoidectomy is preferred by common population in today's era because of its outcomes and so there is still need for the study of laser hemorrhoidectomy in terms of its outcome.

Materials & methods

The study population included all patients with symptomatic hemorrhoids, grade II, III and IV according to the Goligher's classification (45), admitted Department of General Surgery, Indira Gandhi Government Medical College and Hospital, Nagpur during the time period of 1st March 2021 to 31 August 2022. 47 patients who fulfil the criteria will be included in the study. Patients coming to general surgery opd with c/o bleeding per rectum, pain while defecation and mass per rectum will be assessed clinically and after confirmation of diagnosis will be included in study based on following inclusion and exclusion criteria.

Inclusion criteria

1. Patients with an American Society of Anesthesiologists' (ASA) physical status of grade I or II.
2. Age \geq 18 years

3. Symptomatic hemorrhoidal disease of II, III and IV

degrees with failure of conservative medical treatment

Exclusion criteria

1. Patients who did not agree with the protocol and patients under 18 years of age
2. Previous history of anorectal surgery.
3. Regular use of immunosuppressants or analgesics.
4. Neurologic deficit, chronic pain syndrome
5. Patients with recurrent haemorrhoids
6. Patients with grade 1 haemorrhoids
7. Patients with inflammatory bowel disease
8. Patients with haemorrhoids with pregnancy
9. Patients with haemorrhoids with portal hypertension and with liver cirrhosis
10. Patients who are unfit for either surgery or anaesthesia.



Figure 1: Preoperative grade 3 haemorrhoids.



Figure 2: Intraoperative picture of laser haemorrhoidoplasty.

Results

In our study we assessed the age distribution among the study subjects. We observed that the majority of the study subjects belonged to the age group of 21 to 40 years (38.3%), followed by 41 to 60 years (29.8%), >60 years (27.6%) with mean age of 45.2.

Sn.	Age distribution	No of patients	Percentage
1	<20	2	4.3
2	21-40	18	38.3
3	41-60	14	29.8
4	>60	13	27.6
5	Total	47	

Table 1: Age distribution

In our study we assessed the Gender wise distribution among the study subjects. We observed that the majority of the study subjects were males (57.5%), followed by 42.5% were females. The male: female ratio in the current study was 1.35:1

Sn.	Gender	No of cases	Percentage
1	Male	27	57.4%
2	Female	20	42.6%
3	Total	47	100%

Table 2: gender distribution

In the current study we assessed the presenting complaints of patients among the study subjects. We observed that the majority of the study subjects presented with bleeding per rectum followed by pain during defecation. Most of the patients with pain as presenting complaint had associated fissure in ano.

Sn.	Symptoms	No. of patients	Percentage
1	Bleeding per rectum	32	68%
2	Pain	14	29.8%
3	Mass	10	21.3%
4	Pruritus	7	14.9%
5	Symptoms of anaemia	5	10.4%

Table 3: presenting complaints

In the current study we assessed the grade of haemorrhoids among the study subjects. We noticed that majority of patients 57.4% were having grade 2 haemorrhoid followed by grade 3 haemorrhoids 38.3%.

Grade of haemorrhoid	No. Of subjects	Percentage
GRADE 2	27	57.4%
GRADE 3	18	38.3%
GRADE 4	2	4.3%
TOTAL	47	100%

Table 4: Haemorrhoidal grade at presentation

In the current study we assessed the haemoglobin among the study subjects. We observed that haemoglobin was between range of 10-13.5 in 30 patients. In 20 patients it was less than 10 g% out of which most of the patients were grade 3 and grade 4 haemorrhoids with chronic disease. Among 12 patients with <7.5, 5 patients presented with symptoms of anemia

Haemoglobin range(g%)	No of patients
<7.5	12
7.5-10	8
>10	27
Total	47

Table 5: preoperative haemoglobin

We observed that mean operating time was 20 ± 7.54 minutes ranging from minimum 13 minutes to maximum of 33 minutes. The operative time was 25-33 minutes for initial 6 procedures which reduced over time and we could complete the procedure within 13-15 minutes during our last 5 procedures.

Operative time	Values (minutes)
Mean	20
Sd	7.54
Median	23

Table 6: intraoperative time

Intra operative bleeding was calculated based on visual analogue. (44) The mean blood loss reported among the study subjects was 17.16 ± 4.56 ml. For 3 patients when the submucosal plane was lost we observed significant blood loss up to 50-75ml for which open Haemorrhoidal arterial ligation needed to be done along with laser hemorrhoidoplasty procedure.

Blood loss	Values (ml)
Mean	17.16
Sd	4.56
Median	16.00

Table 7: intraoperative bleeding

In the current study we assessed the post operative pain based on VAS score among the study subjects. Post operative VAS score reduced significantly from 11 patients with moderate to severe pain in the first 6 hrs to 3 patients after a period of 7 days. After 24 hours mean VAS score was 2.7 with standard deviation of 1.3. All 47 patients showed completely resolved pain with VAS score of 0-3 where only 2 patients complained of pain and for rest the vas score was 0. 7 Patients with VAS score ≥ 4 after 24 hours needed intravenous analgesia on 2nd and 3rd day which increased their postoperative hospital stay.

		6 HRS	24 hrs	7 days	1 month
Mild	0-3	36	40	44	47
Moderate	4-6	7	5	33	0
Severe	>6	4	2	0	0
	Total	47	47	47	477

Table 8: postoperative vas score

In the current study we assessed the postoperative hospital stay and mean duration required for return to work among the study subjects. We observed that the mean postoperative hospital stay was 1.5 ± 0.25 days, whereas the mean duration required for return to work

was 6.5 ± 1.9 days. Discharge was planned after post operative pain VAS score was reduced to < 5 and could be managed on oral analgesics. Median was 2 days with maximum postoperative stay of 3.5 days.

Postoperative hospital stay	Values
Mean	1.5 DAYS
Sd	0.5 DAY
Median	2 DAYS

Table 9: postoperative hospital stay.

Return to work	Values
Mean	6.5 days
SD	1.9day
Median	7.5 days

Table 10: postoperative return to work

In the current study we assessed the postoperative regression of grade of haemorrhoid after laser hemorrhoidoplasty procedure and was observed that there was regression in size of hemorrhoids with 37% patients with grade 2 hemorrhoids resolved completely immediate post operatively and remaining 67% resolved completely within 7 days post operatively.

For grade 3 hemorrhoids 22.2% patients completely resolved immediate post operatively with remaining 77.8 resolved within 7 days.

For grade 4 hemorrhoids 1 patient resolved completely after 7 days and 1 required second laser hemorrhoidoplasty setting after 1 month for complete resolution.

In the current study we assessed the early and late post operative complications of laser hemorrhoidoplasty. Where early complications were observed from day 1 to day 30 and late post operative complications were described as after 30 days postoperatively during the follow-up. We observed that postoperative bleeding was most common early complication followed by postoperative urinary retention and surgical site hematoma.

3 patients among patients with postoperative bleeding had post operative haematoma formation. 2 of which occurred within 12 hours postoperatively and 1 occurred within 24 hours.

Among these 3 patients with haematoma 2 had perianal eczema and 1 had anal discharge post operatively which was managed by conservative line of management, this patient had pruritus ani post operatively. Total early post operative complication occurred in 27.3%.

Sn.	Early post operative complications	No. Of patients	Percentage
1	Postoperative bleeding	9	19.1%
2	Urinary retention	3	6.4%
3	Haematoma	3	6.4%
4	Perianal eczema	2	4.3%
5	Anal discharge	1	2.1%
6	Pruritus ani	1	2.1%
7	Local infection and sepsis	0	0

Table 11: postoperative early complications

Amongst late postoperative complications after 30 days post operative skin tag was most common complication followed by incomplete regression in 1 grade 4 patient (2.1%).

which needed repeat laser hemorrhoidoplasty setting after 6 months. No patient had secondary bleeding, recurrence and anal stenosis.

Sn.	Late post operative complications (after 30 days)	No. Of patients	Percentage
1	Postoperative skin tag	3	6.4%
2	Incomplete regression	1	2.1%
3	Secondary bleeding	0	0
4	Recurrence	0	0
5	Anal stenosis	0	0

Table 12: postoperative early complications

Discussion

In our prospective study of 47 patients, the average age of patients was found to be 45.2 years and it was comparable to Naderan M. et al, 2016⁶ with 43.7 years average, Junnankar Et Al,2022⁷ with 43.7yrs average age, Harvitkar et al,2021⁸with 46 years average age Maloku H et al,2014²,with 47 years average age

In our prospective study male to female ratio is 27: 20 (1.3:1) and it was comparable to rest of the existing studies Harvitkar et al,2021⁸with 1.1:1,

Junnankar Et Al,2022⁷ with 1.1:1,Maloku H et al, 2014² with 1.3:1,Hussain et al,2020⁹ with 1.5:1 ,and all studies showed male preponderance except Shabahang H et al, 2019¹⁰, Alsisy et al, 2019 ¹¹ showed female preponderance

In our prospective study laser haemorrhoidoplasty most common complaint were bleeding per rectum 32/ 47 (68%) followed by pain during defecation 14/47 (29.8%). Results were comparable to that of study by Harvitkar et al, 2021⁸. Other symptoms like mass per rectum(21.3%), pruritus(14.9%) also were comparable with rest of the studies Eskanderos and Darwish et al 2020¹²and Karahaliloğlu et al 2007¹³,Pain during defecation in all these studies and also our study was due to associated fissure in Ano. 5 (10.4) percent of patients from our study presented with symptoms of anaemia like easy fatigability, palpitation, generalised weakness and light headedness. The cardinal rule is iron deficiency anaemia in adult male and post Menopausal women means gastro intestinal blood loss unless proven otherwise.¹⁴ The most common cause of gastrointestinal bleeding is haemorrhoids and so these patients on evaluation were diagnosed with haemorrhoids and after adequate blood transfusion underwent laser hemorrhoidoplasty.

In our prospective study most common Haemorrhoidal grade was grade 2 in 27 patients (57.4%) followed by grade 3 in 18 patients (38.3%) and grade 4 in 2 patients (4.3%) and it was comparable to the rest of the studies as mentioned in the table above. It was observed that most of the existing studies included grade 2 and grade 3 haemorrhoids in their studies. From our study population grade 2 Haemorrhoidal group was comparable with Harvitkar et al,2021⁸,Naderan M. et al,2016⁶,Alsisy et al,2019 ¹¹,Shabahang H et al,2019¹⁰.Grade 3 population was comparable with Junnankar Et Al,2022 and Khan et al,2021¹⁵,. Grade 4 population from our study was comparable with Junnankar Et Al,2022⁷.Indian studies by Khan et al,2021¹⁵Junnankar Et Al,2022⁷ and our studies included grade 4 haemorrhoids also to assess the outcome of laser hemorrhoidoplasty for grade 4 haemorrhoids. Our study was conducted in tertiary care centre and patients presented to us at late stages so there were more patients with grade 3 and grade 4 haemorrhoids compared to other studies.

In our prospective study of intraoperative time was mean 20 minutes with standard deviation of 7.54 minutes with ranged from 13 minutes to 32 minutes. In the initial period the time required was longer up to 30-32 minutes which we could reduce to 13 minutes with practice.

S n.	Study name	Intraoperative time Mean in minutes
1	Jahanshahi et al., 2012 ¹⁶	10
2	Giamundo et al., 2018 ¹⁷	15.5
3	Maloku H et al,2014 ²	15.94±3.5
4	Ram et al., 2018 ¹⁸	16.6 ± 3.7 (II degree) 20.8 ± 2.5 (III degree)

5	Our study	20±7.54
6	De Nardi et al., 2016, ¹⁹	21.29 ± 5.6
7	Naderan M. et al,2016 ⁶	33.1± 7.3

Table 13: intraoperative time

Intra operative blood loss was assessed in our present study and was mean 17.16± 4.5cc as calculated according to bleeding visual analogue. (44) with soakage of 1-2 gauze per procedure. Most of the intraoperative bleeding stopped after adequate compression 2 minutes (ice pack application). (51). For 3 patients (6.4%) patients the size of haemorrhoids reduced but had bleeding from laser insertion site which was controlled by suturing with vicryl 2-0. Intraoperative blood loss in our study was comparable with existing studies as mentioned and comparatively more as our study includes grade 4 haemorrhoids also

Sn.	Study name	Mean intraoperative blood loss
1	Naderan M. et al,2016 ⁶	12.8 ± 4.5
2	Alsisy et al,2019 ¹¹	15.50±4.80
3	Hussain et al,2020 ⁹	12(8-17cc)
4	Khan et al,2021 ¹⁵	14.0 ±5.5
5	Present study	17.16± 4.5

Table 13: intraoperative blood loss

In our prospective study we assessed post operative recovery in terms of postoperative hospital stay and post operative return to work. We discharged patients all the patients on the next day postoperatively except 7 patients (14.9%) post operative VAS score was ≥4 and 3 patients with post operative haematoma formation. These

10 patients needed post operative hospital stay >24 hours. All 3 patients with post operative haematoma needed post operative hospital stay with intravenous analgesics and antibiotics and were discharged on 3rd day post operatively. Out of 7 patients with postoperative pain with VAS score ≥4, 4 patients discharged on post operative day 2 and 3 discharged on postoperative day 3. Our results were comparable to existing studies except study by Ram et al., 2018, as most of the patients in this study were operated under intravenous sedation and discharged on same day and laser haemorrhoidoplasty was done as day care procedure.

Patients after discharge were able to carry daily routine activities with ease and return to routine daily activities on mean 6.5±1.9 days. This was comparable to existing studies. In our study return to work less duration in our study as most of our patients were labourer by occupation in our study.

In our prospective study of laser hemorrhoidoplasty postoperative complications noted were post operative bleeding, urinary retention, haematoma formation, perianal eczema, anal discharge, pruritus ani. Most common complications was postoperative bleeding(19%) followed by urinary retention (6.4%) and haematoma formation(6.4%) which was comparable to rest of the existing studies where incidence of postoperative bleeding was ranging from 2% in study by Faes et al,2019⁴ to 22% in study by Lim et al,2022²⁰. Postoperative bleeding was managed conservative line of management was resolved in 6 hours postoperatively in 6 patients. For 3 patients bleeding didn't respond and developed haematoma over the surgical site after 12 hours. These patients were treated with intravenous antibiotics and analgesics and all these patients showed 50-60% regression in size of haematoma after 3 days of hospital stay and were discharged. These patients were followed up with regular

Seitz bath postoperatively and given adequate analgesic management. After 2 weeks of follow up the hematoma was resolved completely in all three patients. 2 patients out of these had perianal eczema and 1 had serous anal discharge with 1 pad soakage daily which was reduced and stopped completely on conservative line of management after 1 month. No patient needed surgical intervention for the complications. Total percentage of complications was 27.3% which was comparable to existing studies. None of our patients developed local infection, thrombosed haemorrhoids and postoperative incontinence.

There are very few studies available mentioning late postoperative complications of laser hemorrhoidoplasty. Study by Faes et al, 2019⁴, mentions that 16/44 (36%) patients had recurrence of haemorrhoids during postoperative course of 2 months to 6 years.

Our study patients were followed up till 6 months did not encounter any recurrence. Postoperative skin tag was late postoperative complication in a study by Plaper et al, 2009, mentioned that 5/15 (33%) patients had plicoma as one of the major late postoperative complications whereas in our study incidence of plicoma was 3/47 (6.4%) in patients those needed haemostasis by ligation (3/47), no other study mentions about postoperative skin tag in case of laser haemorrhoidoplasty. No patient reported secondary bleeding, anal stenosis which is consistent with existing studies by Naderan M. et al, 2016⁶, Alsisy et al, 2019¹¹, Maloku H et al, 2014²

Conclusion

Following are the conclusions derived from our study 'Prospective Study of Laser haemorrhoidoplasty In Terms of Intraoperative and Postoperative Outcomes' Laser haemorrhoidoplasty is safe, less time consuming, less postoperative pain, early out of bed mobilisation, cosmetic with less postoperative complications, shorter

hospital stay, minimizes hospital visit, lesser morbidity and mortality. Patients in our study were followed up for 6 months and delayed postoperative complications were noted till 6 months postoperatively and it will need long term follow up for recurrence and more long-term complications as mentioned in some of the existing studies.

Our prospective study demonstrated that laser hemorrhoidoplasty is more effective technique for the treatment of symptomatic second and third-grade haemorrhoids, whereas for grade 4 haemorrhoids resolution of symptoms was late and cases of larger grade 4 haemorrhoids may need second setting of laser hemorrhoidoplasty.

References

1. In Sabiston Textbook of Surgery: the Biological Basis of Modern Surgical Practice (eds. Townsend, C. M., Beauchamp, R. D., Evers, B. M. & Mattox, K. L.) 1401 (Elsevier - Health Sciences Division, 2022).
2. Maloku, H., Gashi, Z., Lazovic, R., Islami, H. & Juniku Shkololli, A. Laser Hemorrhoidoplasty Procedure vs Open Surgical Hemorrhoidectomy: a Trial Comparing 2 Treatments for Hemorrhoids of Third and Fourth Degree. *Acta Inform. Medica* 22, 365 (2014).
3. Lohsiriwat, D. & Lohsiriwat, V. Outpatient hemorrhoidectomy under perianal anesthetics infiltration. *J. Med. Assoc. Thai. Chotmaihet Thangphaet* 88, 1821–1824 (2005).
4. Faes, S., Pratsinis, M., Hasler-Gehrer, S., Keerl, A. & Nocito, A. Short- and long-term outcomes of laser haemorrhoidoplasty for grade II – III Haemorrhoidal disease. *Colorectal Dis.* 21, 689–696 (2019).
5. Brown, S. R. Haemorrhoids: an update on management. *Ther. Adv. Chronic Dis.* 8, 141–147 (2017).
6. Naderan, M. et al. A Randomized Controlled Trial Comparing Laser Intra-Hemorrhoidal Coagulation and

- Milligan–Morgan Hemorrhoidectomy. *J. Invest. Surg.* 30, 325–331 (2017).
7. Junankar, N. & Junankar, N. Standardization reduces recurrence and overall complication rate in Laser haemorrhoidoplasty: Retrospective Cohort Study. *Iran. J. Colorectal Res.* 10, (2022).
8. Harvitkar, R. U., Gattupalli, G. B. & Bylapudi, S. K. The Laser Therapy for Hemorrhoidal Disease: A Prospective Study. *Cureus* (2021) doi:10.7759/cureus.19497.
9. Basim Ghaib Hussein¹, Jameel I. Azzawi¹, Rabah Ali Hussein. Diode Laser & Conventional Surgery Treatment, A Comparative Study in Anal Diseases. *Medico-Leg. Update* (2020) doi:10.37506/mlu.v20i1.365.
10. Nooghabi, M. J., Shabhang, H., Maddah, G., Mofidi, A. & Khaniki, S. H. A Randomized Clinical Trial of Laser Hemorrhoidoplasty vs Milligan and Morgan Hemorrhoidectomy. *World J. Laparosc. Surg.* DVD 12, 59–63 (2019).
11. Alsisy, A., Alkhateep, Y. & Salem, I. Comparative study between intra hemorrhoidal diode laser treatment and Milligan–Morgan hemorrhoidectomy. *Menoufia Med. J.* 32, 560 (2019).
12. Eskandaros, M. & Darwish, A. Comparative study between Milligan-Morgan hemorrhoidectomy, stapled hemorrhoidopexy, and laser hemorrhoidoplasty in patients with third degree hemorrhoids: a prospective study. *Egypt. J. Surg.* 39, 352 (2020).
13. Karahaliloğlu, A. F. First Results after Laser Obliteration of First- and Second-Degree Hemorrhoids. *coloproctology* 29, 327–336 (2007).
14. Massey, A. C. Microcytic anemia: Differential Diagnosis and Management of Iron Deficiency Anemia. *Med. Clin. North Am.* 76, 549–566 (1992).
15. Khan, H. M., Gowda, V. S. S., Ramesh, B. S. & Sandeep, D. A comparative evaluation of laser hemorrhoidoplasty versus open surgical hemorrhoidectomy treatment of grade III and IV hemorrhoids. A prospective observational study. *J. Clin. Investig. Surg.* 6, 30–36 (2021).
16. Jahanshahi, A., Mashhad Zadeh, E. & Sarmast, M.-H. Diode Laser for Treatment of Symptomatic Hemorrhoid: A Short-Term Clinical Result of a Mini Invasive Treatment, and One Year Follow Up. *Pol. J. Surg.* 84, (2012).
17. Giamundo, P. et al. Doppler-guided hemorrhoidal dearterialization with laser (Help): a prospective analysis of data from a multi-center trial. *Tech. Coloproctology* 22, 635–643 (2018).
18. Ram, E., Bachar, G. N., Goldes, Y., Joubran, S. & Rath-Wolfson, L. Modified Doppler-guided laser procedure for the treatment of second- and third-degree hemorrhoids. *Laser Ther.* 27, 137–142 (2018).
19. De Nardi, P. et al. Hemorrhoid laser procedure for second- and third-degree hemorrhoids: results from a multi-center prospective study. *Tech. Coloproctology* 20, 455–459 (2016).
20. Lim, S. Y., Rajandram, R. & Roslani, A. C. Comparison of post-operative bleeding incidence in laser hemorrhoidoplasty with and without hemorrhoidal artery ligation: a double-blinded randomized controlled trial. *BMC Surg.* 22, 146 (2022).