**ORIGINAL ARTICLE**

# Postoperative discomfort and pain in the management of hemorrhoidal disease: laser hemorrhoidoplasty, a minimal invasive treatment of symptomatic hemorrhoids

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## Abstract
Hemorrhoidal disease (HD) treatment still remains controversial. In fact, despite many surgical progresses, postoperative pain, and discomfort remain the major weaknesses. Laser hemorrhoidoplasty (LHP) is a minimal invasive procedure for HD treatment determining the shrinkage of the hemorrhoidal piles by diode laser. The aim of the current study is to analyze the feasibility and efficacy of LHP in patients with II–III degrees hemorrhoids. Consecutive patients with II–III degree hemorrhoids were enrolled in the study and underwent an LHP treatment using a 1470-nm diode laser. Operative time, postoperative pain and complications, resolution of symptoms, and length of return to daily activity were prospectively evaluated. Recurrence of prolapsed hemorrhoid or symptoms at a minimum follow-up of 6 months was evaluated. Fifty patients (28 males and 22 females) were enrolled in the study. No significant intraoperative complications occurred. Postoperative pain score (at 12, 18, and 24 h postoperatively), evaluated through visual analogue scale, was extremely low (mean value 2). No postoperative spontaneous bleeding occurred. The 100% of our population came back to daily activity 2 days after surgery. At a mean follow-up period of 8.6 months, we reported a recurrence rate of 0%. LHP demonstrated a large efficacy in selected patients. The greatest strength points were low postoperative pain, the presence of slightly significant peri-anal wounds, no special anal hygienic measures and low surgical time. Thus, resulting in a negligible postoperative discomfort, LHP could be considered a painless and minimal invasive technique in the treatment of HD.

**Keywords** Hemorrhoidal disease · Laser hemorrhoidoplasty · Postoperative pain · Postoperative discomfort

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## Introduction

Hemorrhoidal disease (HD) is a widespread anorectal condition affecting millions of people around the world and representing a major medical and socioeconomic issue, severely influencing patients' quality of life [1, 2]. Hemorrhoids or hemorrhoidal columns are submucosal cushions containing venules, arterioles and smooth muscle fibers. They, along with the internal anal sphincter, are essential in the maintenance of continence by providing soft-tissue support and keeping the anal canal closed tightly [2]. HD surgical treatment is mostly required when the patient complains bleeding and prolapse (spontaneously or manually reducible). Surgical treatment choice still remains controversial. In fact, despite many modifications and progress in the HD surgical techniques, postoperative pain and discomfort, daily activity limitation, serous–mucous discharge, and recurrence remain the major weaknesses [1]. Nowadays, the resective approach,

open (Milligan–Morgan) or closed (Ferguson), leads to a low recurrence rate, but postoperative pain and discomfort are not negligible. On the other hand, the suspensive approaches have been burdened by a high recurrence rate, and despite a low postoperative pain and discomfort, though being frequently associated to new symptoms onset (defecatory urgency, unbearable pain, and tenesmus) [3, 4].

Currently, patients undergoing a surgical intervention for HD could experience variable intensity of pain depending on the adopted technique, postoperative bleeding, possible incontinence to flatus or liquid feces, delayed return to daily activity (> 5 days), and, in case of Milligan–Morgan technique, continuous serous discharge for the presence of surgical wounds, that could require qualified assistance (nursing and relative care) [5].

Moreover, other possible complications after hemorrhoidal surgery such as urinary retention in case of spinal anesthesia (20.1%), bleeding (secondary or reactionary) (2.4–6%), and subcutaneous abscess (0.5%) should not be neglected. The long-term complications include anal fissure (1–2.6%), anal stenosis (1%), incontinence (0.4%), fistula (0.5%) and recurrence of hemorrhoids [6–8].

Therefore, for the fear of postoperative pain and complications, mildly symptomatic patients often hesitate and delay undergoing to surgical treatment for this benign disease.

Laser hemorrhoidoplasty (LHP) is a new minimal invasive and painless procedure for day-surgery treatment of symptomatic hemorrhoids determining the shrinkage of the hemorrhoidal piles by mean of a diode laser [2, 9]. The commonly used laser energy in medicine are 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.

The aim of the current study is to analyze the feasibility and efficacy of LHP in patients with II–III degrees hemorrhoids, reporting our initial experience with this minimal invasive treatment, focusing on the patients' postoperative pain and discomfort (in terms of analgesic need and time of returning to daily activity).

## Materials and methods

### Study design

This study is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cohort studies [10]. Between May 2018 and October 2018, consecutive adult patients affected by II–III degrees symptomatic HD referred to our referral center of coloproctology (Master of pelvi-perineal rehabilitation and Master of coloproctology) at University of Study of Campania "Luigi Vanvitelli" of Naples were prospectively

assessed. Inclusion criteria were age ≥ 16 years, a symptomatic HD of II and III degree according to the Goligher's classification and failure of conservative medical treatment, an American Society of Anesthesiologists (ASA) physical status of grade I or II [9–12]. Exclusion criteria were acutely thrombosed hemorrhoids, patients affected by IBD involving rectum or anus, patients previously surgically treated for HD and the inability to complete study protocol. All subjects were preoperatively assessed during a specialized coloproctology evaluation in a teaching Hospital [13, 14]. A clinical examination, comprehensive of an anorectal digital evaluation followed by anoscopy, was performed in all patients and information on bowel function; pregnancies, episiotomy, previous surgery, and associated diseases were recorded. Before surgery, all patients underwent laboratory tests, chest X-ray, ECG examination, and cardiological counseling. Preoperatively, all patients underwent a pancolonscopy to exclude the presence of colic neoformations or inflammatory bowel disease. Patients underwent an LHP treatment using a 1470-nm diode laser (Biolitec® Jena, Germany). All surgical procedures were performed by the same surgeon (LB), experienced in coloproctological surgery, assisted by a skilled collaborative team. All patients were detailed informed about the study protocol, the surgical intervention, and the unknown long-term results of the technique and signed a written informed consent. The local ethical committee approved the study protocol (370/18).

## Operative technique

In lithotomy position, a bilateral pudendal nerve locoregional block was performed by administration of ropivacaine (10 ml for each side). A deep sedation, obtained by propofol (2.0 mg/kg i.v.) and associated with the use of a laryngeal mask was performed. Antibiotic prophylaxis with ceftriaxone (2 g i.v.) was administered. A skin microincision of 3 mm was made about 1–1.5 cm of distance from the anal verge at the base of each hemorrhoidal node. The probe (1.85 mm of diameter) was driven through the incision in the submucosal tissue until reaching the area underneath the distal rectal mucosa (Fig. 1). Then, 10–12 effective pulses (adjusted to resective node dimensions), 8 W per 3 s each, of approximately 24 Joule using a 1470-nm diode laser generator (LEONARDO® DUAL 45 Biolitec® Jena, Germany) were fired. Half of them were fired in the submucosal tissue, and the others in the intra-nodal compartment determining the shrinkage of the hemorrhoidal piles (Supplementary Video 1). The anal wounds were left open. At the end of the procedure, an anal tampon was positioned. After 12 h the anal tampon was removed, and patients were discharged the day after surgical operation, in case of no postoperative complications, presence of a tolerable pain ≤ 5 with VAS score, and tolerance to oral feeding.

**Fig. 1** Probe (1.85 mm of diameter) was driven through the anal verge minincision (1 cm) in the submucosal tissue until reaching the area underneath the distal rectal mucosa

**Table 1** Baseline characteristic of the patients

| Characteristics | Study group ($n = 50$) |
| --- | --- |
| Age (years) | $42 \pm 12.6$ |
| Gender | 28 Males (56%) |
|  | 22 Females (44%) |
| Preoperative symptoms |  |
| 1. Bleeding | 50 (100%) |
| 2. Pain | 33 (66%) |
| 3. Prolapsed hemorrhoids | 45 (90%) |
| Hemorrhoid grade |  |
| II | 5 (10%) |
| III | 45 (90%) |
| Number of columns |  |
| 2 | 8 (16%) |
| 3 | 42 (84%) |

## Outcome measures

Mean operative time was evaluated in minutes. Postoperative pain was considered as the main outcome and was evaluated with the visual analogue scale (VAS) at 6 and 12 h, and 1, 3, 7, 14, and 28 postoperative days. The need of analgesics after discharge was evaluated at days 1, 3, 7, 14, and 21. Eventual bleeding was evaluated at days 1, 3, 7, 14, andd 21; it was classified as follows: spontaneous, post-defecatory, or no evidence of bleeding. Sero-mucous discharge was also evaluated at days 1, 3, 7, 10, 14, and 21. Fecal and gas incontinence was assessed using the Cleveland clinic incontinence score for fecal incontinence at days 1, 3, 7, 10, 14, and 21 [15]. Time needed to come back to daily activity was also evaluated and expressed in days. One month after surgery, all patients were asked whether or not they would repeat the procedure in case of persistence or recurrence of the disease. The presence of recurrence and of any postoperative complications at a minimum follow-up time of 6 months was assessed.

## Statistical analysis

Data were analyzed using the statistical package for social sciences (SPSS, version 16.0, Chicago, IL, USA). Qualitative data are expressed as per cents, and quantitative data are expressed as the means.

## Results

Out of 60 consecutive patients affected by II–III degree HD, six refused the laser treatment, four presented a concomitant obstructive defecation syndrome. Fifty patients (28 females and 22 males) were finally enrolled in the current study. All patients had symptomatic grade II–III HD. Mean age was $42 \pm 12.6$ years (range 22–70 years). Age and sex ratio, preoperative symptoms, hemorrhoid grades, and number of treated hemorrhoidal columns are detailed in Table 1. No significant intraoperative complications occurred. Intraoperative mean time was 14 min. Mean hospitalization was 2 days (one night). Postoperative pain score evaluated through the visual analogue scale (VAS), was extremely low, with the eventual administration of only NSAIDs on request. In detail, in the early postoperative time (0–24 h) and the first 3 days after surgery a mean VAS value of 2 (range 0–3) was recorded, while in the subsequent days, the VAS value decreased to 0 (Fig. 2). The dose of postoperative administered analgesics and the number of patients who used analgesics after discharge was low (Fig. 2). No patients suffered of spontaneous bleeding after surgery, while 32 patients (60%) experienced a post-defecatory bleeding the day 1 after surgery, and 15 patients (30%) on postoperative day 3. From the 7th postoperative day, no bleeding event occurred in our cohort (Fig. 3). No patients experienced sero-mucous discharge for the absence of open surgical wounds and no patients reported fecal incontinence (mean Cleveland clinic incontinence score was 0) in the follow-up period. Twenty patients (40%) and the 100% of our population came back to daily activity 1 day and 2 days after surgery, respectively (Fig. 4). Considering our limited population and follow-up length, no patients experienced postoperative local infection. At a mean follow-up period of 8.6 months, we reported a rate of recurrence of 0%.

All patients (50/50 patients) affirmatively answered to the hypothetic possibility of repeating the procedure in case of persistence or recurrence of the disease.
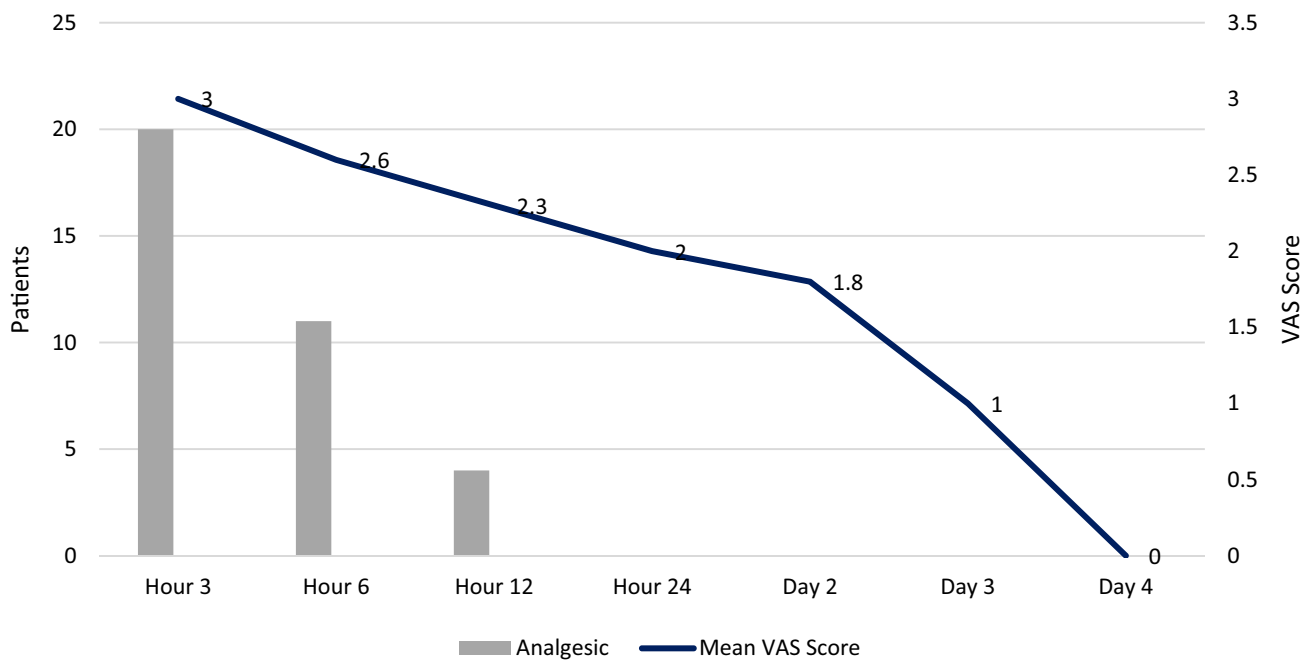
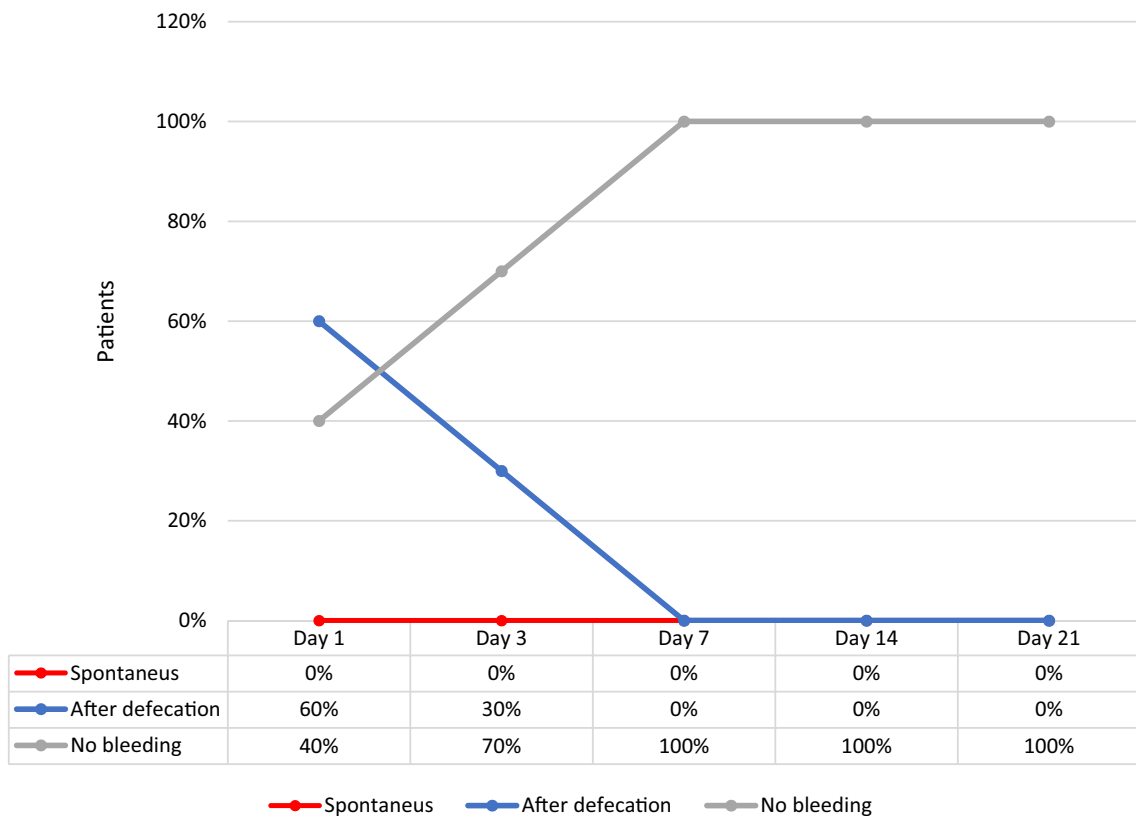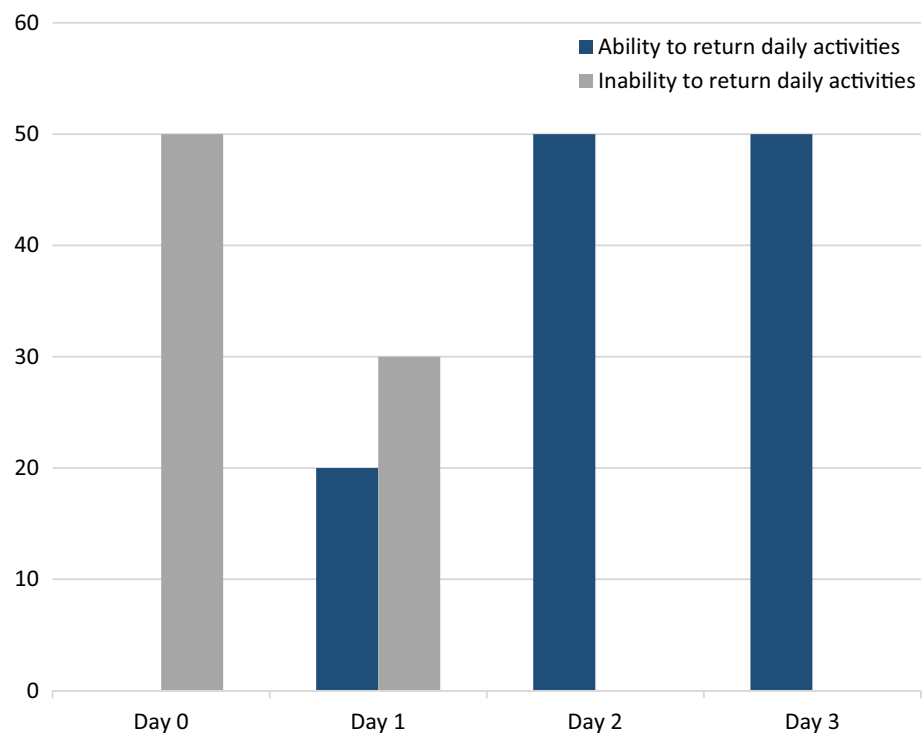**Fig. 2** Postoperative pain evaluation using VAS score and postoperative analgesic administrations



**Fig. 3** Postoperative spontaneous and post-defecation bleeding; no bleeding cases

**Fig. 4** Return to daily activity evaluation



## Discussion

Patients' postoperative discomfort and pain represent the most feared and complained complications after surgical hemorrhoidectomy. In response to the high request of painless treatments, in the recent years, we have assisted to the widespread of a broad spectrum of non-excisional and less invasive techniques including stapled hemorrhoidopexy, transanal hemorrhoidal dearterialization (THD), and hemorrhoidal artery ligation (HAL) [16–18].

Since 2006, LHP has been introduced as an innovative and alternative minimal-invasive technique in the treatment of HD. [19] The concept of laser coagulation in the treatment of veins varicosity was borrowed by the endovenous ablation in vascular surgery [16]. The diode laser (wavelength = 1470 nm) penetrates up to 2 mm, determining a submucosal denaturation and a controlled shrinkage of the hemorrhoidal tissue. It is selectively and better adsorbed by the hemoglobin, as compared to Nd:YAG laser, and consequently causes less damage to the surrounding tissue, preventing any sphincteral lesions [16]. In addition, fibrotic reconstruction generates new connective tissue, which ensures the full mucosa adherence to the underlying tissue. In the few reported papers, the laser ablation technique had short operative time, low postoperative pain and comparable effectiveness in the treatment of HD to the respective and more invasive techniques [9]. Another feature of paramount importance is the possibility to perform the procedure with a bilateral pudendal nerve locoregional block associated to a

deep sedation assisted by laryngeal mask ventilation. Thus, excluding the necessity of spinal or general anesthesia, the procedure can be safely performed even in unfit and aging patients with several comorbidities. Healing and return to work activities are facilitate, because, unlike conventional surgeries, there are no stitches for the presence of slightly significant wounds [16].

To date, although the exciting and promising results, the HD treatments by laser coagulation has been insufficiently analyzed and further studies are needed to adequately assess its efficacy and, above all, its long-term results. The largest reported series is the one of Jahanshahi et al. analyzing the feasibility of LHP, with a lower wave length generator (980 nm), in 368 patients affected by HD [20]. The Authors reported no case of recurrence at 1 year follow-up and a low complication rate of 3.51%. Similar results were reached by Maloku et al. on 20 patients treated by 980 nm diode laser coagulation [2]. Naderan et al. compared the efficacy of LHP treatment with 980 nm diode laser versus the conventional Milligan–Morgan resection in 60 patients [9]. The authors reported similar results in the effectiveness of the two techniques, underlining the better results of LHP group in terms of postoperative pain and postoperative complications [9]. Conversely, Giamundo et al. assessed that LHP technique is associated with higher pain and bleeding compared to the doppler assisted Hemorrhoid Laser Procedure (HeLP), but these conclusions were not supported by published data [21].

To the best of our knowledge this is the largest series analyzing the use of Diode Laser with 1470 nm wavelength

in the treatment of HD, in English Literature. Pain and postoperative discomfort are certainly the most important symptoms complained after surgical treatment of HD. In our series, pain and postoperative discomfort outcome, our primary end-point, were extremely encouraging. In detail, in the early postoperative time (0–24 h) and in the first 3 days a mean VAS value of 2 was recorded, while in the subsequent days the VAS value decreased to 0, making the most feared drawback of the HD treatment completely manageable with mild analgesics. In our first experience we reported an excellent resolution index of 100% (50/50). Considering a minimum follow-up time of 6 months, no patients experienced recurrence or persistence of HD. No case of spontaneous bleeding after surgery occurred, while 32 patients (60%) experienced a post-defecatory bleeding only the first day after surgery, and 15 patients (30%) on postoperative day 3, but in all cases the bleeding episodes disappeared from the 7th postoperative day. In detail, no patients required surgical hemostasis, suggesting the hemostatic and coagulative effectiveness of the laser technique. Given the presence of slightly significant incisions, no patients experienced seromucous discharge, preventing the necessity of numerous daily dressing by a qualified nurse or by a relative, as it often occurred after Milligan–Morgan procedure [22, 23]. Moreover, the LHP procedure allows a quick return to work and to daily activity. In detail, in our series, twenty patients (40%) and the 100% of our population came back to daily activity 1 day and 2 days after surgery, respectively. During our accurate postoperative clinical evaluations, we did not experience any significant and remarkable anal alteration such as submucous abscesses and anal fissures, but only the presence of a temporary hemorrhoidal piles hardening as consequence of the laser shrinkage. Concerning the anal function, we recorded in all patients an excellent strength and selectivity of the anal sphincter, probably due to the absence of intense postoperative pain. Therefore, we are confident in excluding any early postoperative anal relevant anatomical and functional impairment.

Even though LHP does not suffer of the abovementioned and well-known disadvantages of the resective and suspensive techniques, its actual drawback is the lack of long-term results reported in literature. Therefore, it is worth to inform the patient about the possibility of its inefficacy and of recurrence before the procedure, since literature is not conclusive on this matter. Nevertheless, the complete absence of postoperative discomfort and pain probably widely overcomes the latter limitation. Therefore, we reported our experience with a limited number of cases and with short follow-up period, to emphasize the brightening and encouraging impact on patients' satisfaction (in terms of postoperative pain and discomfort) more than to reach long-term conclusions. In our experience, the patients were asked about the possibility of repeating the procedure in case of disease persistence or

recurrence, and in the 100% of cases (50/50 patients), the answer was affirmative, attesting a complete patients' compliance. Moreover, LHP does not alter the normal anatomy of anal canal and hemorrhoids allowing the possibility of undergoing to a further more invasive surgical treatment in case of recurrence. Finally, it is an easy and reproducible technique, with a short learning curve that allow the surgeon to master the procedure after 3–5 cases [9].

Several authors have questioned about the excessive cost of the laser technique [21, 24]. Certainly, consistent with the literature, the cost of LHP is significantly higher than the one of conventional Milligan–Morgan hemorrhoidectomy by diathermy. In fact, purchasing, maintaining, and recharging laser devices are expensive even if in our case the diode laser generator was obtained as loan for use [9]. Nevertheless, it should be underlined that in case of use of radiofrequency or ultrasound coagulation, the cost for each single disposable advanced hemostasis device is similar to the cost of the single disposable laser probe (approximately 300€). Moreover, the laser procedure allows shorter hospitalization, shorter operative time and lower complications rate guarantying a cost saving that should be investigated in further cost analysis studies.

The current study has certainly several limitations to address. First, the small sample size, which precluded any analysis of the effect of covariates and the evidence of rare complications. Moreover, we do not yet have long-term follow-up data after the procedure, as the present study was prospective and focused mainly on assessing LHP effectiveness and feasibility.

## Conclusion

LHP is a minimal invasive, painless, safe and quick procedure that in our initial experience demonstrated large efficacy in patients affected by HD. Our preliminary data seems to suggest that the use of this technique provide a very low pain and discomfort period with minimal need of analgesics and wound care, electing it among the procedure suitable for HD. However, there is a need of a longer follow-up period to verify long-term outcomes of these treatment for HD and to compare this technique to the current conventional ones.

design and execution of the study and in the analysis and interpretation of the data. MSdV participated substantially in conception, design and execution of the study and in the analysis and interpretation of the data. ST participated substantially in conception, design and execution of the study and in the analysis and interpretation of the data. GdG participated substantially in conception, design and execution of the study and in the analysis and interpretation of the data. LD participated substantially in conception, design and execution of the study and in the analysis and interpretation of the data.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no competing interests.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee (University of Campania "Luigi Vanvitelli" Ethical Comitee-370/18) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** All patients gave written informed consent to publish.

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