

Comparison of Excisional Stapler Hemorrhoidopexy Method and Non-Excisional Arterial Detection Ligation Method; One Year Follow-Up

 Nevin Sakoglu¹,  Aziz Ocakoglu¹

¹ Medipol University, General Surgery Department, Istanbul, Türkiye

² Health Sciences University, Istanbul Kanuni Sultan Suleyman Training and Research Hospital, General Surgery Clinic, Istanbul, Türkiye

Abstract

Aim: Hemorrhoidal disease is a chronic disease of the lower rectum and anus occurs due to increased pressure during straining. Millions of people in the world suffer from this disease. Since the stage of the disease and the symptoms of the patients do not show parallelism, we evaluated the results of two different surgical methods; arterial detection ligation (ADL) and stapler hemorrhoidopexy (SH).

Methods: A retrospective study among patients who were operated for hemorrhoids between 2021-2022.

Results: Adult patients with Grades II, III and IV were included. SH and ADL groups containing 60 patients were formed. Pain complaints (VAS) and normal daily activities (KATZ) of patients after surgery were examined. In this study, statistical analyzes were performed with NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA) package program. 50 of the patients were female and 70 were male. There was no difference between the age and gender distributions of the SH and ADL groups ($p=0.231$, $p=0.711$). On the 1st day VAS values in the SH group were found to be statistically significantly higher than the ADL group ($p=0.003$). When the daily activities of both groups were examined, the dressing ($p=0.042$) and toileting ($p=0.012$) activities in the SH group were lower. On the other hand, there was a statistically significant difference within the groups (SH; $p=0.0001$, ADL; $p=0.0001$) related to the pain assessments.

Conclusions: When both methods were examined, the success rate of two techniques was similar and ADL least affects the anatomy of the anorectal region without serious complication risk.

Key words: Hemorrhoids, treatment, Stapler hemorrhoidopexy (SH), Arterial detection ligation (ADL)

1. Introduction

Hemorrhoidal disease is a chronic disease of the lower rectum and anus because of increased pressure during straining¹. After the age of 30, more than half of the population develops hemorrhoidal disease. Millions of people around the world suffer from this disease. The incidence of hemorrhoidal disease worldwide is 4.4%². There is no gender discrimination in the incidence of the disease. Despite technological advances in the treatment of hemorrhoidal disease, there is no single effective treatment. The reason for this is the location of the hemorrhoidal plexuses and especially the subjective sym-

ptoms reported by the patients for example bleeding, and varying degrees of prolapse but there is no a good correlation between patients' symptoms and surgical treatment planning although the pathophysiology of the disease is well known. Goligher classification is used in the surgical treatment selection phase of hemorrhoidal disease³. Excision is the conventional method in the surgical treatment of hemorrhoids. With the development of new treatment techniques, the hemorrhoidectomy method is used less frequently because of significant pain and bleeding complaints in the postoperative period. In this study, we investigated the ADL technique and the SH method and the clinical outcomes of the patients to whom we applied these techniques retrospectively.

2. Materials and methods

This study was conducted from July 2021 to July 2022. Adult patients undergoing elective surgery for symptomatic hemorrhoidal disease (Grades II, III and IV) were included in the study. Only patients who had never been operated on for any reason on the anorectal region before were included in the study. A total of 120 patients were treated with SH and ADL, 60 patients for each method.

* Corresponding Author: Nevin Sakoglu

e-mail: nev_sak@yahoo.com

Received: 25.06.2023, Accepted: 23.08.2023, Available Online Date: 31.08.2023

Cite this article as: Sakoglu N, Ocakoglu A. Comparison of Excisional Stapler Hemorrhoidopexy Method and Non-Excisional Arterial Detection Ligation Method; One Year Follow-Up. J Cukurova Anesth Surg. 2023; 6(2): 290-5.

doi: 10.36516/jocass.1319930

Copyright © 2023 This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CC-BY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

All patients were subjected to detailed preoperative evaluation including inspection during straining, digital rectal examination. Rectoscopy or colonoscopy was carried out selectively in those patients who had a positive family history of colon cancer. All cases were admitted on the morning of surgery. Before the surgical intervention, only fleet enema was applied to the patients. The procedures were explained to the patients and consent obtained. Similarly the Visual Analog Scale (VAS) for recording post-surgical pain and Katz Index Of Independence in Activities of Daily Living (Table 1) was explained to the patients.

Table 1
Katz Index of Independence in Activities of Daily Living

Activities Points (1 or 0)	Independence (1 Point) No supervision, direction or personal assistance	Dependence (0 Points) With supervision, direction, personal assistance or total care	Point
Bathing	Bathes self completely	Need help with bathing	
Dressing	Puts on clothes	Needs help with dressing	
Toileting	Goes to toilet without help.	Needs help transferring to the toilet	
Transferring	Moves in and out of bed.	Needs help in moving from bed to chair	
Continence	Exercises complete self-control over urination and defecation.	Is partially or totally incontinent of bowel or bladder	
Feeding	Gets food from plate into mouth without help.	Needs partial or total help with feeding or requires parenteral feeding.	
Score of 6 = High, Patient is independent.			Total
Score of 0 = Low, patient is very dependent.			Points

56 patients were operated under general anesthesia and 4 under spinal anesthesia in lithotomy position (Figure 1). The Proximate Hemorrhoidal Circular Stapler (HCS) manufactured by Ethicon Endo-surgery was used in 60 cases. First, we placed the circular anoscope inside the anal canal (Figure 2) then the purse string suture placed approximately 1-1.5 cm cephalad to the dentate line using a 2/0 polypropylene suture incorporating only the mucosa and submucosa to retract the anal cushions into their anatomical positions. Cushions do not recover sufficiently if the suture placed higher. After inserting the fully open stapler into the anal canal, it was closed in a controlled manner to avoid any complications and ring-shaped hemorrhoid tissue removed (Figure 3). Following operation dressings were applied and operative time and blood loss were assessed and recorded (Figure 4).

Of 60 patients who underwent ADL, 55 were operated on general anesthesia and 5 with spinal anesthesia in the lithotomy position. It is among the non-excisional treatment methods of hemorrhoid disease. It is based on the principle of determining the location of the hemorrhoidal arteries that supply blood to the hemorrhoidal pouches in the anal canal and distal rectum wall by Doppler USG and interrupting the arterial flow by suturing. After the induction of anesthesia, the anus and distal rectum are reevaluated and the LDL-2 is placed on the anal canal by applying gel to the tip of the proctoscope (Figure 5-6). After detecting the sound and images of the symptomatic hemorrhoidal arteries, the hemorrhoidal arteries with a depth of 6mm to a maximum of 12mm are ligated with a 5/8 needle with 2/0 absorbable sutures (Figure 7).

The peaks in the graph show the blood flow in the systolic phase and the flat points in the diastolic phase. We rechecked the arterial blood flow after ligation. After ligation, the amplitude of the pulse wave should decrease or disappear completely. Otherwise, resuture



Figure 1
Lithotomy position

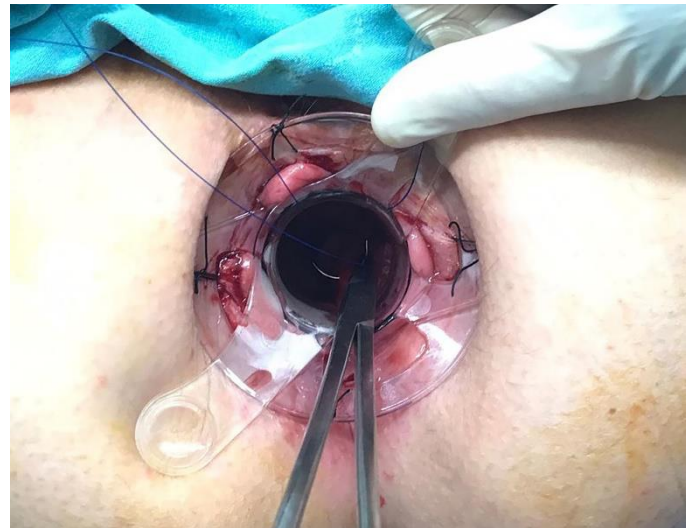


Figure 2
Circular anoscope

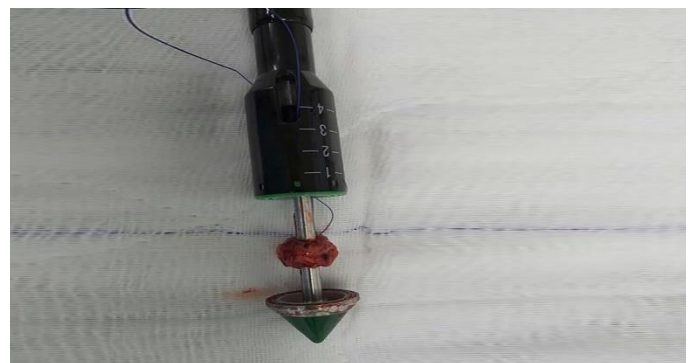


Figure 3
Ring-shaped tissue



Figure 4
Post-operative image

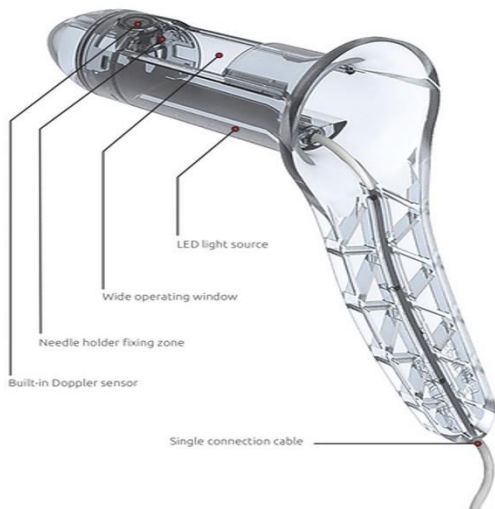


Figure 5
LDL-2 probe

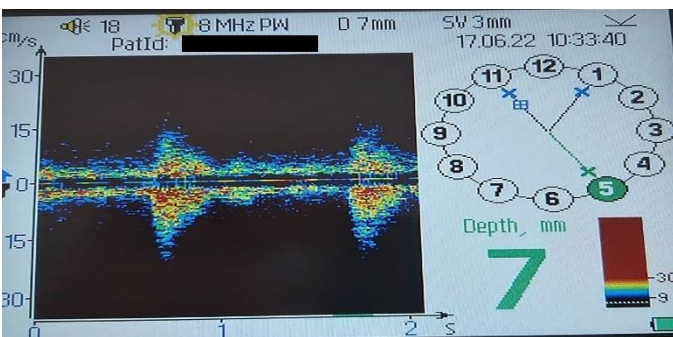


Figure 6
Detection of hemorrhoidal arteries

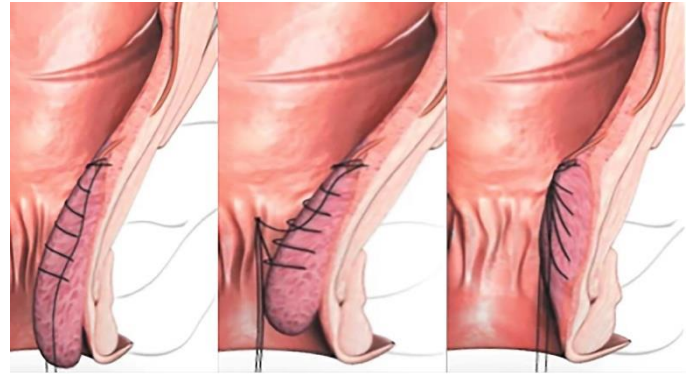


Figure 7
Ligation of hemorrhoidal arteries

is required. This process is repeated clockwise to include all arterial points. Almost 80% of the hemorrhoidal swellings recover immediately after the procedure and 100% within 1 week. If there is prolapsed hemorrhoid pouches, we applied the pexy process. As the dentate line gets closer, post-op pain can be severe. After controlling and recording bleeding we continued the post-op patient follow-up. To decrease post-surgery pain, pudendal nerve blok was done with marcaïne.

All patients was permitted to take oral fluids after 4 h of surgery. In the post-operative period, the patient's pain assessment and analgesia requirement were recorded with the VAS. The criteria evaluated for the first 24 hours were the need and frequency of analgesics. Pain was assessed at 24 h, 1st week and 1st month postoperatively. Activities of Daily Living (ADLs); bathing, dressing, toilet, transfer, continence and feeding activities of the patients, which represent the processes of returning to normal daily life in the post-operative period measured with the KATZ index. Patients are scored Yes/No for independence in each of the six functions. A score of 6 indicates full function, 4 indicates moderate impairment, and 2 or less indicates severe functional impairment. Patients were also followed for presence of bleeding per rectum, post-operative urinary retention, incontinence to flatus/stool, presence of post-operative anal stenosis, and residual hemorrhoidal swelling at 1 week, 1 month, and 1 year after the surgery. The follow-up was done during visits and also by telephonic interview of the patients.

This study and all relevant procedures were performed in accordance with the Helsinki Declaration after obtaining the ethical board approval from the Ethics Committee of İstanbul Kanuni Sultan Süleyman Training and Research Hospital (KAEK/2022.06.149).

2.1 Statistical Analysis:

In this study, statistical analyzes were performed with NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA) package program. In addition to descriptive statistical methods (mean, standard deviation) in the evaluation of the data, the distribution of the variables was examined with the Shapiro-Wilk normality test, the independent t-test for the comparison of the normally distributed variables between the paired groups, the Mann Whitney U test for the comparison of the non-normally distributed variables between the paired groups, and the comparison of the qualitative data. Chi-square test was used. The results were evaluated at the significance level of $p < 0.05$.

3. Results

A total of 120 patients, symptomatic with bleeding per rectum in-

cluded in this study. According to the Goligher Classification, of the patients who were operated with the ADL method, 13 had Grade II, 32 had Grade III, and 15 had Grade IV hemorrhoids. 24 of the patients were female and 36 were male. The mean age of the patients was $40,32\pm 8,75$. The patients who were operated with the SH method, 8 had Grade II, 39 had Grade III, and 13 had Grade IV hemorrhoids. 26 of the patients were female and 34 were male. The mean age of the patients was $42,17\pm 8,707$ (Table 2). No statistically significant difference was observed between the age and gender distributions of the SH and ADL groups ($p=0.231$, $p=0.711$). No statistically significant difference was observed between the HT and DM distributions of the SH and ADL groups respectively ($p=0.191$) ($p=0.729$) (Table 2).

Table 2

Clinical characteristics of our patients

		SH Group		ADL Group		p
Age		42.17±8.707		40.32±8.75		0.231*
Gender	Male	36	56.67%	36	60.00%	0.711+
	Female	24	43.33%	24	40.00%	
HT		11	18.33%	6	10.00%	0.191+
DM		5	8.33	4	6.67	0.729+

*Independent t test + Chi-square test. HT: Hypertension, DM: Diabetes mellitus

Table 3

Clinical characteristics of our patients

VAS	SH Group	ADL Group	p‡
1st Day AVG± SD	1.63±1.09	1.13±1.0	0.003
1st Day Median(IQR)	1 (1-2)	1 (1-1)	
1st Week AVG± SD	0.57±0.93	0.37±0.66	0.365
1st Week Median(IQR)	0 (0-1)	0 (0-1)	
1st Month AVG± SD	0±0	0±0	0.0001†
1st Month Median(IQR)	0 (0-0)	0 (0-0)	
p†	0.0001†	0.0001†	

‡Mann Whitney U test †Friedman test

The ADL method was applied under general anesthesia in 55 of the patients and spinal anesthesia in 5 of them because of comorbidity. The mean operative time was 12 ± 4 . 57 of them were discharged at the post-op 4-5th hour. Only 3 patient discharged the day after the operation because of pain. Postoperatively, pudendal nerve block with 10 ml of marcaine was done to patients who were operated under general anesthesia. There was no blood loss during peroperative and postoperative period. Mean follow-up period was 1 year. The post-operative VAS score at 24h, 1st week, and 1st month shown in Table 3. In the post-operative period 3 doses of intramuscular pain reliever were administered to 5 patients with stage IV hemorrhoids who underwent pexy procedure. Other patients did not need painkillers.

SH was performed under general anesthesia in 56 patients and spinal anesthesia in 4 patients. The mean operative time was 20 ± 6 . Postoperatively, pudendal nerve block was not applied to patients who were operated under spinal anesthesia. There was approximately 10-15 ml blood loss during peroperative period. While 55 patients were discharged on the day of the surgical procedure, the remaining patients were discharged the next day.

On the 1st day 1 VAS values in the SH group were found to be statistically significantly higher than the ADL group ($p=0.003$) (Table 3). No statistically significant difference was observed between the VAS values of the SH and ADL groups at 1st week ($p=0.365$) and at the 1st month ($p=1$) (Table 3).

Table 4

Statistical Evaluation of Visual Analog Scale

Dunn's Multipl Comparison Test	SH Group	ADL Group
1ST Day/ 1st Week	0.0001	0.0001
1st Day/ 1st Month	0.0001	0.0001
1st Week/ 1st Month	0.0001	0.0001

A statistically significant difference was observed between the VAS values at 1stday, 1st week, and 1st month in the SH group ($p=0.0001$) (Table 4). 1st day VAS values were found to be statistically significantly higher than 1stweek and 1st month VAS values ($p=0.0001$). 1st week VAS values were statistically significantly higher than 1st month VAS values ($p=0.0001$). A statistically significant difference was observed between the VAS values at 1st day, 1st week 1, and 1st month in the ADL group ($p=0.0001$) (Table 4). 1st day VAS values were found to be statistically significantly higher than 1stweek and 1st month VAS values ($p=0.0001$). 1st week VAS values were statistically significantly higher than 1st month VAS values ($p=0.0001$) (Table 4). When both groups were examined in terms of pain in the first month after surgery, it was found that the VAS score was significantly lower in the patients who had the ADL method according to the SH group (Figure 8).

Table 5

Statistical Evaluation-KATZ Index of Independence in Activities of Daily Living

KATZ	SH Group		ADL Group		p
Bathing	57	95.0%	60	100.0%	0.079+
Dressing	56	93.3%	60	100.0%	0.042+
Toilet	54	90.0%	60	100.0%	0.012+
Transferring	56	93.3%	57	95.0%	0.697+
Continence	60	100.0%	60	100.0%	
Feeding	60	100.0%	60	100.0%	

+Ki Kare testi

The Katz Index scores of these patients shown in Table 5. Katz Index score in ADL group was 6 in 57 patients discharged on the same day. 3 patients with co-morbidities required assistance during the transferring discharged on the next day. Katz Index score was 6 in 47 patients in SH group. In this group 55 patients discharged on the day of surgery and 5 patients the next day. 3 of 13 patients who underwent stapled hemorrhoidopexy needed help in the bathroom, 6 in the toilet due to fear of pain, and 4 older patients needed help for transfer and dressing. No statistically significant difference was observed between the distribution of Bathing in the SH and ADL groups ($p=0.079$). Dressing and Toilet activities were significantly lower in the SH group than the ADL group ($p=0.042$) ($p=0.012$). No statistically significant difference was observed between the distribution of Transferring in the SH and ADL groups ($p=0.697$). Both groups did not need support during feeding There was no any problem related to continence in both groups.

4. Discussion

Hemorrhoids are vascular structures consisting of smooth muscle and connective tissue covered with anal canal epithelium that divided into internal and external according to the dentate line⁴. Venous cushions are a normal part of the anorectum. Internal hemorrhoids consist of three main cushions above the dentate line: left side, right anterior and right posterior. They do not usually cause pain, as there are no somatic sensory nerves that supply internal hemorrhoids².

Normal hemorrhoidal pads account for 15-20% of the resting anal pressure. Thus, they support solid, liquid and gas separation. Normal hemorrhoidal tissue becomes symptomatic when enlarged. The most common symptoms are bright red rectal bleeding from the arterial structures, mucus discharge and swelling. We decided to take the Goligher classification into consideration when deciding on surgery in symptomatic patients (Table 6).

Table 6
Goligher Classification

Goligher Classification	
Grade I	Prominent hemorrhoids, no prolapse
Grade II	Prolapse after a Valsalva maneuver, prolapse reduces spontaneously
Grade III	Prolapse after a Valsalva maneuver, prolapse needs manual reduction
Grade IV	Chronic prolapse, manual reduction of prolapse ineffective

In cases where local hygiene, appropriate diet, stool softeners are not effective, surgical method was considered in the treatment⁴. Since excisional hemorrhoidectomy applied in the treatment of hemorrhoidal disease is a very painful procedure⁵, less painful methods have been developed. One of them is Stapler Hemorrhoidopexy, which was introduced by Sir Antonio Longo in 1997, has been widely applied for many years in the treatment of hemorrhoidal disease⁶. In this method, also known as rectal mucopexy, a circular mucosal tissue ring is removed from the anal canal above the dentate line. The blood flow to the hemorrhoid pads is reduced⁷. If the circular suture exceeds the mucosal layer, serious complications such as perforation, rectal stricture, recto-vaginal fistula, pelvic sepsis, gas-stool incontinence and hematoma may occur⁸⁻¹². Pathological examination revealed true mucosectomy in 55 of our patients, and mucosa and submucosa in 5 of our patients. No complications similar to these were observed in my patients. In the post-operative period, we detected tenesmus complaints in 4 of our patients. The patients stated that they went to the toilet as if they needed the toilet, but they could not do it. We found that this feeling decreased by 80% with the use of cortisone suppository that we started on the second post-operative day.

Unlike the excisional hemorrhoidectomy, the pain complaint is less common since the painless region is intervened through the anal canal and no intervention is made to the breach^{4,13-16}. A statistically significant difference was observed between the VAS values at 1st day, 1st week, and 1st month in the SH group ($p=0.0001$) (Table 4). 1st day VAS values were found to be statistically significantly higher than 1st week and 1st month ($p=0.0001$). We detected headache and urinary retention in 4 of our patients who were operated under spinal anesthesia. Urinary retention problem has been solved with hot application to groin areas. For headache, extra serum therapy was applied and caffeinated drinks recommended. In 47 patients, the KATZ index score was 6 in the post-operative period. 13 patients with additional co-morbidities achieved a score of 6 on the 3rd post-op day.

Cochrane analysis 2010 not accepted SH as a standard method in the treatment of internal hemorrhoids because of high rate of recurrence and prolapse symptoms in long-term follow-up¹⁷. No recurrence was observed in my patients at the first year after surgery.

ADL, a new less invasive surgical method, with less postoperative pain and complication risk, was developed by Morinaga¹⁸⁻²⁰. In this method, terminal branches of the superior rectal artery (SRA) are selectively ligated^{18,20}. To locate the hemorrhoidal arteries by Doppler ultrasound, a Comepa Angiodipine-Procto device and an LDL-2 proctoscope with a translucent window through which the ligation is performed and an internal Doppler probe distal to this window are used. With CW MOD, PW MOD, and M+PW MOD, location and depth of all arteries are displayed. While it is reducing the arterial inflow in the hemorrhoidal pack at the same time the direct fixative effect of the sutures and the inflammation cause fixation of the tissue^{4,21}.

The closer the pexy procedure is applied to the dentate line, the more pain complaints are seen in the patients. Pain complaints assessed by VAS were significantly higher in the SH group at 1 month postoperatively compared to the ADL group (Figure 8). The most common complaint we saw in patients with pexy was tenesmus. We detected tenesmus complaints in 10 of our patients (16.6 %) and is seen more prominently when vessels deeper than 12mm are ligated. Rotta et al reported a tenesmus rate of 85.7% in their study and they attributed this high rate to suturing and fixation of prolapsed hemorrhoids.

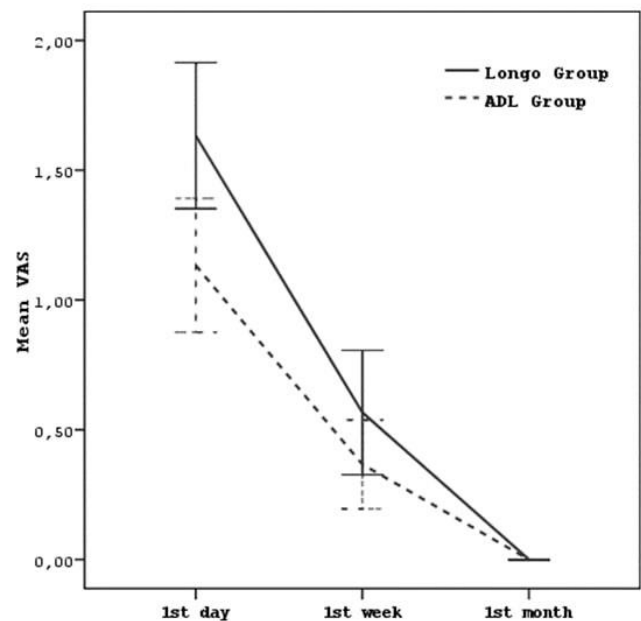


Figure 8
Post-operative pain-time graph

Bleeding after ADL procedure has been reported 2 to 29%²²⁻²⁵ but there was no blood loss in our patients during preoperative and postoperative period.

When we examined both methods, the VAS score was measured higher in the SH group than in the ADL group within one month from the surgery. No pain was observed in the patients after one month. Return to daily life activities was earlier in the ADL group than in the SH group. At the end of one year, we detected recurrence in two

patients with Stage IV who underwent the ADL method. Patient satisfaction was 96%. There was no recurrence in the SH group, but 3 patients stated that they had difficulty recovering after surgery. They stated that they would not have surgery with this method again. Patient satisfaction rate was 95%.

Due to the difference in the severity of subjective symptoms such as bleeding, swelling and pain reported by the patients, there is no single effective treatment method in the treatment of hemorrhoidal disease. There is no good correlation between patients' symptoms and surgical treatment planning. It is based on the surgeon's experience to choose the appropriate surgical method that will minimize the risk of recurrence according to the stage of the disease.

5. Conclusions

We have seen that we had similar success rate. Since hemorrhoidal disease is a disease that can recur depending on the toilet habits and diet of the patients in some societies, it is necessary to choose the method that will least affect the anatomy of the anorectal region, considering that surgical intervention may be required again.

Acknowledgements

None.

Statement of ethics

This study and all relevant procedures were performed in accordance with the Helsinki Declaration after obtaining the ethical board approval from the Ethics Committee of İstanbul Kanuni Sultan Süleyman Training and Research Hospital (KAEK/2022.06.149).

Conflict of interest statement

The authors declare that they have no financial conflict of interest with regard to the content of this report.

Funding source

The authors received no financial support for the research, authorship, and/or publication of this article.

Author contributions

All authors contributed to the study conception and design.

All authors read and approved the final manuscript.

References

- 1.Kaidar -Person O, Person B, Wesner SD. Hemorrhoidal disease: a comprehensive review. *J Am Coll Surg.* 2007; 204(1): 102-17. <https://doi.org/10.1016/j.jamcollsurg>
- 2.Perry KR, Geibel J. Hemorrhoids. May 31, 2022. <https://emedicine.medscape.com/article/775407-print;1-21>.
- 3.Gerjy R, Lindhoff-Larson A, Nystrom PO. Grade of prolapse and symptoms of hemorrhoids are poorly correlated: result of a classification algorithm in 270 patients. *Colorectal Dis.* 2008; 10(7): 694-700. <https://doi.org/10.1111/j.1463-1318.2008.01498.x>
- 4.Nelson H, Cima RR. Anus. In: Townsend, Beauchamp, Evers, Mattox, eds. *Sabiston Textbook of Surgery.* 18thed. Saunders Elsevier 2008: 1433-62.
- 5.Arbman G, Krook H, Haapaniemi S. Closed vs. open hemorrhoidectomy- is there any difference? *Dis Colon Rectum.* 2000; 43(1): 311-34. <https://doi.org/10.1007/BF02237240>
- 6.Longo A. Treatment of hemorrhoids disease by reduction of mucosa and hemorrhoidal prolapse with a circular -suturing device: a new procedure. *Proceedings of the Sixth World Congress of Endoscopic Surgery, Rome, Italy; 1998:777.*
- 7.Jaiswal CSS, Gupta MD, Davera SLS. Stapled hemorrhoidopexy-Initial experience from a general surgery center. *Medical Journal Armed Forces India.* 2013; 69(2): 119-23. <https://doi.org/10.1016/j.mjafi.2012.08.015>

- 8.Faucherson JL, Voirin D, Abba J. Rectal perforation with life-threatening peritonitis following stapled hemorrhoidopexy. *Br J Surg.* 2012; 99(6): 746-53. <https://doi.org/10.1002/bjs.7833>
- 9.Eberspacher C, Magliocca FM, Pontone S, et al. Stapled Hemorrhoidopexy. *Front. Surg. Sec. Visceral Surgery.* 2021; 12(8): 1-5. <https://doi.org/10.3389/fsurg.2021.655257>
- 10.Ripetti V, Caricato M, Arullani A. Rectal perforation, retroperitoneum, and pneumomediastinum after stapling procedure for prolapsed hemorrhoids: report of a case and subsequent considerations. *Dis Colon Rectum.* 2002; 45(2): 268-70. <https://doi.org/10.1007/s10350-004-6159-3>
- 11.Molloy RG, Kingsmore D. Life threatening pelvic sepsis after stapled hemorrhoidectomy. *Lancet* 2000; 4;355(9206): 810. [https://doi.org/10.1016/S0140-6736\(00\)02208-X](https://doi.org/10.1016/S0140-6736(00)02208-X)
- 12.Ciprani S, Pescatori M. Acute rectal obstruction after PPH stapled hemorrhoidectomy. *Colorectal Dis.* 2002; 4(5): 367-70. <https://doi.org/10.1046/j.1463-1318.2002.00409>
- 13.Slawik S, Kenefick N, Greenslade GI, Dixon AR. A prospective evaluation of stapled haemorrhoidopexy/rectal mucosectomy in the management of 3rd and 4th degree hemorrhoids. *Colorectal Dis.* 2007; 9(4): 352-6. <https://doi.org/10.1111/j.1463-1318.2006.01163.x>
- 14.Lan p, Wu X, Zhou X, et al. The safety and efficacy of stapled hemorrhoidopexy in the treatment of hemorrhoids: a systematic review and meta-analysis of ten randomized control trials. *Int J Colorectal Dis.* 2006; 21(2): 172-8. <https://doi.org/10.1007/s00384-005-0786-6>
- 15.Law WL, Tung HM, Chu KW, et al. Ambulatory stapled hemorrhoidectomy: a safe and feasible surgical technique. *Hong Kong Med J.* 2003; 9(2):103-7.
- 16.Nystrom PO, Quist N, Rahaave D. Randomized clinical trial of symptom control after stapled anopexy or diathermy excision for hemorrhoidal prolapse. *Br J Surg.* 2010; 97(2):167-76. <https://doi.org/10.1002/bjs.6804>
- 17.Lumb KJ, Colquhoun PH, Malthaner R, et al. Stapled versus Conventional Surgery for Hemorrhoids (Review). *The Cochrane Library.* 2006. <https://doi.org/10.1002/14651858.CD005393.pub2>
- 18.Giordano P, Overton J, Madeddu F, et al . Transanal hemorrhoidal dearterialization: a systematic review. *Dis Colon Rectum.* 2009; 52(9): 1665 <https://doi.org/10.1007/DCR.0b013e3181af50f4>
- 19.Sohn N, Aronoff JS, Cohen FS, et al. Transanal hemorrhoidal dearterialization is an alternative to operative hemorrhoidectomy. *Am J Surg.* 2001; 182(5): 515-9. [https://doi.org/10.1016/s0002-9610\(01\)00759-0](https://doi.org/10.1016/s0002-9610(01)00759-0)
- 20.Tjandra JJ, Chan MK. Systematic review on the procedure for prolapse and hemorrhoids (stapled hemorrhoidopexy). *Dis Colon Rectum.* 2007; 50(6): 878-92. <https://doi.org/10.1007/s10350-006-0852-3>
- 21.Elmer SE, Nygren JO, Lenander CE. A randomized trial of transanal hemorrhoidal dearterialization with anopexy compared with anopexy compared with open hemorrhoidectomy in the treatment of hemorrhoids. *Dis Colon Rectum.* 2013; 56(4): 484-90. <https://doi.org/10.1097/DCR.0b013e31827a8567>
- 22.Ratto C, Parello A, Veronese E, et al. Doppler-guided transanal hemorrhoidal dearterialization for hemorrhoids: results from a multicenter trial. *Colorectal Dis.* 2015; 17(1): 10-9. <https://doi.org/10.1111/codi.12779>
- 23.Jeong WJ, Cho SW, Noh KT, et al. One year follow-up results of Doppler-guided hemorrhoidal artery ligation and rectoanal repair in 97 consecutive patients. *J Korean Soc Coloproctol.* 2011; 27(6): 298-302. <https://doi.org/10.3393/jksc.2011.27.6.298>
- 24.Faucheron JL, Poncet G, Voirin D, et al. Doppler-guided hemorrhoidal artery ligation and rectoanal repair (HAL-RAR) for treatment of grade IV hemorrhoids: long term results in 100 consecutive patients. *Dis Colon Rectum.* 2011; 54(2):226-31. <https://doi.org/10.1007/DCR.0b013e318201d31c>
- 25.Zenger S, Gurbuz B, Can U, et al. A new technique of doppler dearterialization for hemorrhoidal disease: arterial detection ligation(ADL). *Surgery Today.* 2021; 51(4): 612-18. <https://doi.org/10.1007/s00595-020-02164-7>