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RESEARCH ARTICLE

Doppler-Guided Hemorrhoidal Artery Ligation: Effects on Quality-of-Life and Symptomatic Outcomes-A Retrospective Study

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ABSTRACT

Aim: Minimally invasive surgical techniques for hemorrhoidal disease aim to reduce symptom burden while preserving anorectal function and improving patient-centered outcomes. However, real-world data on both clinical severity and quality-of-life (QoL) outcomes following these procedures remain limited.

Method: This single-center retrospective observational study included patients who underwent Doppler-guided hemorrhoidal artery ligation (DG-HAL) for symptomatic hemorrhoidal disease. Demographic data, operative time, and postoperative complications were recorded. Symptoms such as bleeding, soiling, prolapse, and pain were assessed both preoperatively and postoperatively using validated assessment tools; QoL was measured using the Short Form Survey-36 (SF-36) and the World Health Organization QoL-BREF (WHOQOL-BREF) questionnaire. The Hemorrhoidal Disease Symptom Score (HDSS), Wexner Score, and visual analogue scale (VAS) scores were also used to assess the symptomatic improvement. The primary outcome measures were patient satisfaction, QoL, hemorrhoidal symptom scores, and postoperative pain levels. The secondary outcomes were complete healing and recurrence rates.

Results: Treatment with DG-HAL was associated with a clinically meaningful reduction in HDSS scores following the procedure. Exploratory analyses demonstrated improvements across multiple domains of WHOQOL-BREF and SF-36; VAS scores also showed improvement on postoperative day 7. Only one patient experienced a complication, namely, persistent anal pain lasting for 1 month; however, by the 2nd postoperative month, the pain had completely resolved. Two patients experienced recurrence postoperatively and subsequently underwent hemorrhoidectomy.

Conclusion: In this real-world cohort, DG-HAL was associated with improvement in symptom severity and exploratory QoL measures. These findings require further prospective studies focusing on patient-centered outcomes following minimally invasive surgical treatment.

Keywords: Doppler-guided hemorrhoidal artery ligation, quality of life

Introduction

Hemorrhoids are natural anatomical cushions located just above the dentate line in the anal canal, composed of clusters of venous vessels and connective tissue. Some hemorrhoidal structures lack the muscular wall typical of arteries or veins and may therefore be appropriately referred to as sinusoids.[1] These vascular cushions engorge in situations that increase intra-abdominal pressure, thereby contributing to complete closure of the anal canal. In this way, they help prevent fecal leakage and maintain continence. Hemorrhoidal disease is a condition resulting from pathological changes in the natural vascular cushions of the anal canal, triggered by various factors, such as a low-fiber diet and constipation, prolonged straining during defecation, diarrhea, hereditary predisposition, pregnancy, occupational and recreational activities, psychological disorders,

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and spinal paralysis.[2] These pathological changes give rise to symptoms such as pain, swelling, and rectal bleeding, which can be distressing for patients and significantly impair their quality-of-life (QoL).

Although conservative management is the initial approach in treating hemorrhoidal disease, surgical procedures may become necessary in more advanced stages or when non-operative methods are ineffective. Specifically in cases where external hemorrhoids are also removed during surgery, the resulting postoperative pain can significantly impact the patient's comfort and QoL. This has prompted the search for surgical techniques that minimize postoperative discomfort and enhance patient recovery. Among the various minimally invasive options, Doppler-guided hemorrhoidal artery ligation (DG-HAL), originally described by Morinaga et al.[3] in 1995, constitutes a notable technique. Since its introduction, an expanding body of literature has evaluated its clinical efficacy and outcomes across diverse patient populations.[4-6] Although it generally yields favorable patient satisfaction outcomes, the technique has also been associated with a relatively high recurrence rate.[7,8]

The Short Form-36 (SF-36) is a widely used generic health-related QoL questionnaire assessing eight domains of physical and mental health.[9] The World Health Organization QoL (WOHQoL)-BREF is a brief version of the WOH's QoL instrument[10], evaluating four broad domains: physical health, psychological well-being, social relationships, and environment. Both instruments have been utilized in studies assessing QoL outcomes in patients with hemorrhoidal disease.[11,12] In addition to the SF-36 and WHOQOL-BREF scales, the Hemorrhoidal Disease Symptom Score (HDSS) and visual analogue scale (VAS) were used to specifically evaluate symptom severity and pain intensity. This comprehensive approach allows for a more detailed assessment of both the biopsychosocial aspects of QoL and the physical symptoms experienced by patients, thereby providing a holistic perspective on recovery and treatment effectiveness.

Materials and Methods

Study Design and Patients

This study was designed as a retrospective analysis of prospectively collected data and follows an observational cohort methodology. A total of 116 consecutive patients who underwent surgical treatment for hemorrhoidal disease between March 2020 and August 2024 were screened for eligibility. Among these, 70 patients treated exclusively with DG-HAL met the inclusion criteria and were included in the final analysis.

Patients were excluded if they underwent concomitant excisional procedures for external hemorrhoids, had a history of inflammatory bowel disease, prior pelvic radiotherapy, or coexisting pelvic floor disorders such as rectocele or rectal prolapse. Patients with incomplete or missing QoL questionnaire data at baseline or follow-up assessments were also excluded to ensure data integrity and comparability (Figure 1).

Baseline demographic and clinical characteristics, including age, sex, body mass index (BMI), comorbidities, presenting symptoms, and associated anal pathologies, were recorded prospectively. Operative variables, including operative time, number of ligated arteries, and any concomitant surgical interventions, were documented intraoperatively.

QoL and symptom severity were assessed using validated instruments. On the morning of surgery, all patients completed the SF-36, the WHOQOL-BREF, and the HDSS. Postoperative pain intensity was evaluated using the VAS and recorded in the medical records. All patients were evaluated in person on postoperative day 7 and at 1 month to assess early complications and initial symptom control. Subsequent assessments, including QoL (SF-36 and WHOQOL-BREF) and symptom scores (HDSS, VAS, Wexner), were conducted at 3, 6, and 12 months using a combined communication approach (telephone interviews and email-based questionnaires) performed concurrently to maximize response rates and minimize loss to follow-up.

The primary outcome measures included patient-reported satisfaction, QoL scores, HDSS, and postoperative pain levels. Secondary outcome measures were complete healing and recurrence rates during the follow-up period. Recurrence was defined as the reappearance of hemorrhoidal symptoms (bleeding, prolapse, pain, or pruritus) after an initial symptom-free period, with or without the need for additional medical or surgical intervention. Given the lack of a universally accepted definition in current guidelines, recurrence was defined based on commonly used criteria in the literature.

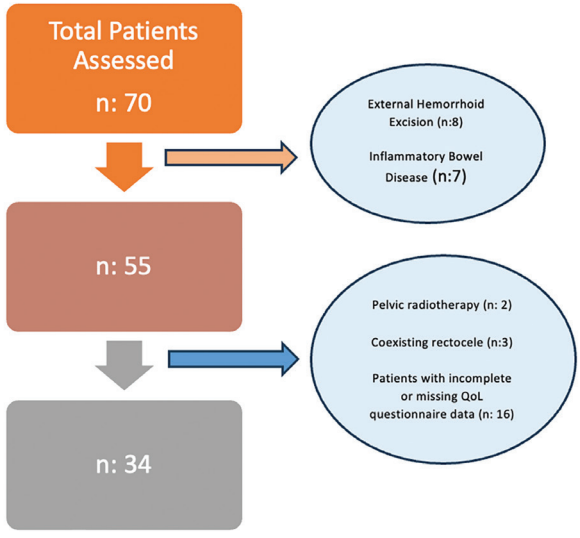

Figure 1. Flow diagram of patient inclusion
QoL: Quality-of-life

Surgical Procedure

Prior to surgery, all patients received comprehensive counseling regarding available treatment options, including DG-HAL, Longo hemorrhoidectomy, rubber band ligation, and conventional excisional hemorrhoidectomy. The final choice of surgical procedure was based on clinical indication and patient preference. All DG-HAL procedures were performed under general anesthesia with the patient in the lithotomy position. Doppler guidance was used to identify terminal branches of the superior rectal artery, which were subsequently ligated using synthetic absorbable polyglactin sutures. Following ligation, Doppler signal verification was performed; persistent arterial pulsation prompted repeat ligation until complete signal abolition was achieved. This protocol was applied circumferentially, with a mean of 10 ligation sites per patient. Mucopexy was performed selectively when mucosal prolapse was identified intraoperatively.

Ethical Considerations

All procedures performed in this study complied with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments, or comparable ethical standards. The study was approved by the local Ethics Committee of Memorial Şişli Hospital with decision no: 001, date: 28.03.2025. Informed consent was obtained from all patients.

Statistical Analysis

Data were analyzed using SPSS version 28.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean ± standard deviation for normally distributed data or median (range) for non-normally distributed data, whereas categorical variables are summarized as frequencies and percentages. Associations between categorical variables were examined using the chi-square test or Fisher's exact test when appropriate. Comparisons of continuous variables across categorical groups were performed using the Wilcoxon-Mann-Whitney or Kruskal-Wallis tests. Relationships between continuous variables were evaluated using scatter plots and Spearman's rank correlation coefficients. A p-value <0.05 was considered statistically significant.

Results

A total of 34 patients were included in the analysis, of whom 27 (79.4%) were men. The mean age of the cohort was 45.5±12.6 years, and the median duration of follow-up was 25.5 months. Five patients (14.7%) were diagnosed with grade IV hemorrhoidal disease, and the remaining 29 patients (85.3%) had grade III disease. Swelling and pain were the most frequently reported presenting symptoms, with a median symptom duration of 48 months. Concomitant anal pathologies were identified in eight patients, including anal fistula in three and anal fissure in five. Fourteen patients underwent additional concurrent procedures. Anal botulinum toxin injection was performed in six patients, and mucopexy was added in six. One patient underwent fistulotomy, and one received laser treatment for pilonidal sinus disease. Clinicodemographic characteristics are summarized in Table 1.

Table 1. Clinicodemographic characteristics of the patients

Patients	n (%)
Age (Mean, SD)	**45.5±12.6**
Gender	
Female	7 (20.59)
Male	27 (79.41)
BMI (kg/m^2, median)	24.9
Smoking	
Non-smoker	16 (47.06)
Smoker	18 (52.94)
Comorbidities	
No comorbidities	21 (61.76)
1+ comorbidities	13 (38.24)
Goligher grade	
Grade III	29 (85.3)
Grade IV	5 (14.7)
Concurrent anal disease	
No concurrent anal disease	26 (76.47)
Concurrent anal disease	8 (23.53)
Surgery history	
No previous surgery	22 (64.71)
Previous surgery	12 (35.29)
Preop bleeding	
No	10 (29.41)
Yes	24 (70.59)
Preop pain	
No	13 (38.24)
Yes	21 (61.76)
Preop swelling	
No	12 (35.29)
Yes	22 (64.71)
Symptom duration (median, months)	48
Operative time (mean, min)	65.9 (25)
Additional concurrent surgery	
No	20 (58.82)
Anal botox	6 (17.65)
Mucopexy	6 (17.65)
Others	2 (5.88)
LoHS (mean, day)	1.7 (0.7)
Follow-up (median, months)	25.5

BMI: Body mass index, LoHS: Length of hospital stay, SD: Standard deviation

Postoperative complications were observed in one patient (2.94%), who reported persistent anal pain lasting approximately 1 month following surgery, which resolved with conservative management and did not recur during follow-up. Another patient presented with altered bowel habits and abdominal pain at postoperative month 6; subsequent colonoscopic evaluation revealed a rectosigmoid adenocarcinoma, for which surgical resection was performed.

Two patients experienced recurrence at postoperative months 1 and 2, respectively, and both subsequently underwent conventional hemorrhoidectomy. Both cases of recurrence occurred in patients with grade IV hemorrhoidal disease. No statistically significant associations were observed between recurrence and gender [odds ratio (OR): 0.231, CI: 0.013-4.238, p=0.374)], smoking status (OR: 0.882, CI: 0.051-15.36, p=0.93), BMI (r=0.13, p=0.45), symptom duration (r=0.33, p=0.056), preoperative HDSS (r=0.24, p=0.17), Wexner score (r=0.07, p=0.69), or VAS pain score (r=0.29, p=0.08). Among the evaluated variables, symptom duration showed the strongest association with recurrence (r=0.33).

Patient-reported QoL scores showed postoperative increases; SF-36 scores increased from 75 to 90, with a median change of 15 (r=0.919, p<0.0001); WHOQOL scores improved from 81 to 88 (median change of 7; r=0.797, p<0.0001); HDSS decreased from 7 to 0 (median reduction of -7; r=0.611, p<0.0001); VAS score declined from 4 to 0.5 (median change of -3; r=0.400, p<0.0001); Wexner scores improved from 2 to 0 (median change of -2; p<0.0001). Changes in QoL and symptom scale scores are shown in Table 2.

In addition, the relationship between changes in these scores and variables such as gender, smoking status, comorbidities, and preoperative symptoms was evaluated. A statistically significant association was identified between preoperative bleeding and postoperative changes in VAS pain scores (95% CI: -0.689 to -0.121, r=-0.45, p=0.01). Another objective of this study was to assess the effect of the DG-HAL procedure on hemorrhoidal symptom improvement. A significant reduction in all symptoms was observed following surgery. Preoperatively, bleeding was present in 24 patients (70.59%), which decreased to 2 patients (5.88%) postoperatively (95% CI: 0.967-1.231; p<0.001). Pain was reported in 21 patients (61.76%) preoperatively and in 4 patients (11.7%) postoperatively (OR: 2.29; 95% CI: 0.213-24.67; p<0.001). Prolapse was present in 22 patients (64.71%) preoperatively and decreased to 1 patient (2.94%) postoperatively (CI: 0.956-1.148; p<0.001). The degree of symptom improvement is summarized in Table 3.

Table 2. Changes in Patient-Reported Outcome Measures (PROMs)

PROMs	Preoperative	Postoperative	p*	r**
SF-36 (Median)	75	90	**<0.001**	**0.919**
WHOQOL-BREF (Median)	81	88	**<0.001**	**0.797**
HDSS (Median)	7	0	**<0.001**	**0.611**
Wexner (Median)	2	0	**<0.001**	
VAS (Median)	4	0.5	**<0.001**	**0.400**

Bold values indicate statistical significance, p* Wilcoxon test, r** Effect size

SF-36: Short-Form 36, WHOQOL-BREF: World Health Organization quality of life-BREF, HDSS: Hemorrhoidal Disease Symptom Score, VAS: Visual analogue scale, PROMs: Patient-reported outcome measures

Table 3. Symptoms before and 1-month after surgery

Symptoms	Preoperative n (%)	Postoperative n (%)	OR	CI	p-value
Bleeding	24 (70.59)	2 (5.88)	-	0.967-1.231	**<0.001**
Pain	21 (61.76)	4 (11.7)	2.29	0.213-24.67	**<0.001**
Protrusion	22 (64.71)	1 (2.94)	-	0.956-1.148	**<0.001**

Bold values indicate statistical significance, p* McNemar test

OR: Odds ratio, CI: Confidence interval

Discussion

The DG-HAL technique is a minimally invasive surgical technique that has been introduced as an alternative to conventional hemorrhoidectomy, primarily with the aim of reducing postoperative morbidity and facilitating recovery. Although generally favorable clinical outcomes have been reported, concerns regarding postoperative recurrence remain a topic of ongoing discussion.[13,14] Although several studies have focused on clinical efficacy, data regarding QoL outcomes following DG-HAL remain limited. In the present study, DG-HAL was associated with postoperative improvements in QoL measures among patients with grade III and IV hemorrhoidal disease. To evaluate postoperative QoL, a combination of validated instruments was used, including the SF-36, WHOQoL-BREF, HDSS, Wexner score, and VAS. The HDSS is a disease-specific tool designed to assess symptom severity in hemorrhoidal disease, whereas the SF-36 and WHOQoL-BREF are generic instruments intended to evaluate broader aspects of physical, psychological, and social well-being. Although disease-specific instruments may provide more focused information on hemorrhoidal symptoms, the inclusion of generic QoL tools allowed for a more comprehensive assessment of overall well-being. Despite the absence of condition-specific validation, the SF-36 has been frequently used in studies evaluating treatment outcomes in hemorrhoidal disease.[12,15,16] In this cohort, postoperative increases in SF-36 scores were observed, findings that are generally consistent with those reported in previous studies evaluating QoL following DG-HAL using this instrument.[17,18] The study by Talha et al.[17] evaluated 13 patients, whereas the HAL group in the study by Carvajal López et al.[18] included 20 patients. With 34 patients, the present study represents a moderately sized cohort for assessing SF-36 outcomes following HAL. Compared with the literature, this sample size can be considered acceptable; however, it remains relatively small given the heterogeneity of the clinical outcomes assessed. The study remains underpowered to detect small but clinically relevant differences, particularly in recurrence rates, and yields other non-significant findings. Accordingly, the results should be interpreted with caution, and prospective studies with larger sample sizes are warranted to validate these findings. Unlike the study by Talha et al.[17], the present study did not perform domain-specific analyses of SF-36 scores, which should be considered a limitation. Potential associations between changes in SF-36 scores and patient-related variables were also explored. Although the relationship between preoperative bleeding and postoperative changes in SF-36 scores did not reach statistical significance (p=0.09), this observation may warrant further investigation in larger cohorts.

The WHOQoL-BREF, a shortened version of the WHOQoL-100 developed by the WOH, is a widely used instrument for assessing QoL across various patient populations.[10,19,20] Although it has been applied in studies involving hemorrhoidal disease, disease-specific validation has not yet been established. Nevertheless, given the symptom burden associated with hemorrhoidal disease and its potential impact on daily functioning, the inclusion of a broad QoL assessment tool may still be considered informative. The concurrent use of two different QoL instruments may also help reduce the influence of measurement bias inherent to subjective patient-reported outcomes. To the best of our knowledge, this study is among the first to report WHOQoL-BREF outcomes following DG-HAL.

These changes in SF-36 and WHOQoL-BREF likely reflect not only symptom relief but also improvements in the physical, psychological, and social aspects of QoL, as well as enhanced functional capacity in both daily activities and occupational settings. Although significant changes were observed in the SF-36 and WHOQoL-BREF scores following DG-HAL treatment, the minimal clinically important difference (MCID) for these questionnaires in these patients has yet to be determined. Consequently, the clinical importance of the change could only be assessed by the magnitude of score improvements and their respective effect sizes, rather than by MCID values. The increase in SF-36 and WHOQoL-BREF scores indicates a considerable improvement in patients' QoL, which would be clinically significant.

Moreover, the baseline VAS and Wexner scores were relatively low, indicating no severe symptoms during the initial period. This may have caused a floor effect, making it difficult to see any substantial improvement following surgery using the same tools.

Symptom control represents an important objective in the management of hemorrhoidal disease. In the present study, patient-reported symptoms were documented preoperatively and reassessed following treatment. Symptoms such as itching (n=1), soiling (n=1), and tenesmus (n=2) were excluded from individual symptom analyses due to their low frequency, which limited meaningful statistical evaluation. However, these symptoms were included within the overall HDSS assessment. The HDSS, developed by Rørvik et al.[21] as a modification of the Hemorrhoidal Symptom Score originally described by Nyström[22] in 2009, evaluates five key symptoms: pain, itching, soiling, bleeding, and prolapse. In this cohort, postoperative reductions in HDSS scores were observed. Given the limited data available regarding HDSS outcomes following DG-HAL, these findings may add to the existing literature.

Reduced postoperative pain is often cited as a potential advantage of DG-HAL compared with more invasive surgical approaches. In this study, lower VAS pain scores were observed in the early postoperative period. Although concomitant anal botulinum toxin injections could theoretically influence pain perception, they are unlikely to fully explain the observed early postoperative findings. In addition, although not systematically recorded, the use of pudendal nerve blocks in some patients should be acknowledged as a potential confounding factor in early pain assessment.

Recurrence remains an important parameter when evaluating long-term outcomes in hemorrhoidal surgery. Despite the inclusion of patients with advanced-stage (grade IV) hemorrhoidal disease and a relatively long follow-up period, the recurrence rate observed in this cohort (5.88%) was lower than rates reported in some previous studies, which have been reported to reach up to 59%.[23] Several factors may have influenced this observation, including surgeon experience (the procedure has been performed by the operating surgeon for over 15 years), selective use of mucopexy in patients with prominent prolapse, and demographic characteristics of the study population (relatively lower BMI values and an older mean age compared with other study populations). Although the literature reports mixed findings on factors associated with recurrence, hemorrhoid grade is generally considered an important determinant.[5,24-26] Notably, both patients who developed recurrence in the current study had grade IV disease.

We acknowledge that concomitant procedures may have influenced the observed outcomes. In the current study, mucopexy was performed in six patients, anal botulinum toxin injection in six patients, fistulotomy in one patient, and laser treatment for pilonidal disease in one patient. Among these, mucopexy may have affected recurrence rates; however, it is widely considered an integral component of DG-HAL in many centers and is routinely performed. Regarding botulinum toxin, although it may influence postoperative pain, its effect typically becomes evident after days, and therefore may not fully explain the lower early postoperative pain scores observed. The relatively small sample size limits the reliability of subgroup and correlation analyses; therefore, these findings should be interpreted with caution and considered exploratory.

Postoperative follow-up assessments and patient-reported outcome measures (PROMs) were collected by a clinician independent of the operating surgeon, thereby providing a degree of assessor separation; however, formal blinding was not implemented, which represented a source of assessment bias. In addition, the inherently subjective nature of QoL assessments, being based on PROMs, constitutes another limitation of the study.

Conclusion

This study suggests that DG-HAL is a safe and well-tolerated treatment option for patients with grade III and IV hemorrhoidal disease and is associated with postoperative improvement in hemorrhoidal symptoms. However, these findings should be interpreted with caution, given the retrospective, single-center design, and further studies with larger cohorts and longer follow-up periods are warranted to more comprehensively assess recurrence rates and late postoperative outcomes.

Ethics

Ethics Committee Approval: The study was approved by the local Ethics Committee of Memorial Şişli Hospital with decision no: 001, date: 28.03.2025.

Informed Consent: Informed consent was obtained from all patients.

Footnotes

Authorship Contributions

Surgical and Medical Practices: O.B., Y.Y., İ.E.B., Concept: O.B., Y.Y., İ.E.B., Design: O.B., Y.Y., Data Collection or Processing: O.B., Y.Y., M.K., Analysis or Interpretation: O.B., Y.Y., M.K., Literature Search: O.B., Y.Y., İ.E.B., Writing: O.B., Y.Y., İ.E.B.

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