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A Comparative Analysis of Lateral Suspension Techniques and Sacrocolpopexy for Pelvic Organ Prolapse Repair in a Tertiary Care Center

Pelvik Organ Prolapsusu Cerrahisinde Üçüncü Basamak Bir Merkezde Yapılan Sakrokolpopeksi ile Lateral Süspansiyon Tekniklerinin Karşılaştırılması

Deniz Taşkıran[1], Sadettin Oğuzhan Tutar[1], Salih Kolsuz[1], Öznur Tosun[2]

[1]*Giresun University Faculty of Medicine, Department of Obstetrics and Gynecology, Giresun, Türkiye*

[2]*University of Health Sciences Türkiye, Antalya City Hospital, Clinic of Gynecology and Obstetrics, Antalya, Türkiye*

ABSTRACT

Background: Pelvic organ prolapse (POP) is a common condition in elderly women and has an enormous quality-of-life impact. Various surgical techniques, including vaginal, abdominal, open (laparotomy), and laparoscopic approaches, are utilized based on patient symptoms and clinical presentation. This study aimed to compare the perioperative outcomes and clinical results of laparotomic sacrocolpopexy (L-SCP), considered the gold standard for POP repair, with those of laparoscopic lateral suspension (LLS).

Materials and Methods: A retrospective analysis was conducted of 186 POP surgeries performed at a tertiary care center between 2022 and 2024. Patients who met the inclusion criteria were divided into two groups. 24 of these patients underwent L-SCP, and 25 underwent LLS. The parameters compared included age, body mass index, operative time, length of postoperative hospital stay, perioperative hemoglobin change, postoperative POP stage, and recurrence and complication rates. The primary outcome was the objective anatomical success rate, assessed using the POP Quantification system.

Results: The mean operative time was significantly longer in the L-SCP group than in the LLS group. Duration of hospital stay and perioperative hemoglobin changes were similar between the two groups. Preoperative POP-Q stage distribution differed significantly between the groups, with Stage 4 prolapse being more frequent in the L-SCP group and Stage 3 prolapse in the LLS group. At 12 months postoperatively, POP-Q stage distribution was comparable between the groups, with no significant difference ($p = 0.196$). In the L-SCP group, complications included one common iliac vein injury (4.1%), one ureteral injury (4.1%), and three surgical-site infections (12.5%). In the LLS group, two bladder injuries (8%), one ureteral injury (4%), two mesh-related inflammatory reactions (8%), and one surgical-site infection (4%) were observed.

Conclusion: Laparotomic and laparoscopic approaches showed similar short-term anatomical outcomes and recurrence rates. Laparotomic SCP was associated with longer operative time and higher infection risk, while laparoscopic LS had a different complication profile. The surgical approach should be guided by patient characteristics and the surgeon's experience, rather than by presumed superiority.

Keywords: Pelvic organ prolapse, sacrocolpopexy, lateral suspension

ÖZ

Amaç: Pelvik organ prolapsusu (POP), özellikle ileri yaş kadınlarda sık görülen ve yaşam kalitesini düşüren klinik bir durumdur. Hastaların semptom ve şikayetlerine göre farklı tekniklerle hastalara uygun cerrahi yapılmaktadır. Vajinal, abdominal, laparatomik ya da laparoskopik cerrahi teknikler kullanılabilir. POP'da altın standart teknik olan laparotomik sakrokolpopeksi (L-SCP) ile son yıllarda popüler olan laparoskopoik lateral süspansiyon (LLS) yapılan hastalar karşılaştırılmıştır.

Gereç ve Yöntemler: 2022 – 2024 yılları arasında üçüncü basamak bir hastanede gerçekleştirilen 186 POP cerrahi vakaları retrospektif olarak değerlendirildi. Yirmidört tane L-SCP ve 25 tane LLS cerrahi teknik olmak üzere iki gruba ayrıldı. Yaş, vücut kitle indeksi, operasyon süresi, postoperatif hastanede kalış süresi, perioperatif hemoglobin değişimi, postoperatif prolapsus evresi, nüks sayısı

Address for Correspondence: Deniz Taşkıran, Giresun University Faculty of Medicine, Department of Obstetrics and Gynecology, Giresun, Türkiye

E-mail: deniztaskiran93@gmail.com **ORCID ID:** orcid.org/0000-0001-7270-4566

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ÖZ

ve komplikasyon oranları karşılaştırıldı. Çalışmanın birincil sonucu olarak Pelvik Organ Prolapsusu Kantifikasyon sistemine göre objektif kür sağlama oranı değerlendirildi.

Bulgular: Ortalama ameliyat süresi L-SCP grubunda LLS grubuna kıyasla anlamlı olarak daha uzundu. Hastanede yatış süresi ve perioperatif hemoglobin değişimi iki grup arasında benzerdi. Preoperatif POP-Q evre dağılımı gruplar arasında anlamlı farklılık gösterdi; Evre 4 prolapsus L-SCP grubunda, Evre 3 prolapsus ise LLS grubunda daha sık görüldü. Postoperatif 12. ayda POP-Q evre dağılımı iki grup arasında benzerdi ve anlamlı farklılık saptanmadı (p = 0,196). L-SCP grubunda bir common iliak ven yaralanması (%4,1), bir üreter yaralanması (%4,1) ve üç cerrahi alan enfeksiyonu (%12,5) görüldü. LLS grubunda ise iki mesane yaralanması (%8), bir üreter yaralanması (%4), iki mesh ile ilişkili inflamatuvar reaksiyon (%8) ve bir cerrahi alan enfeksiyonu (%4) gözlendi.

Sonuç: L-SCP ve laparoskopik lateral süspansiyon kısa dönem anatomik sonuçlar ve nüks oranları açısından benzer gözlemsel sonuçlar göstermiştir. Bununla birlikte, cerrahi yaklaşım farklılığı ve gruplar arasındaki preoperatif prolapsus şiddeti eşitsizliği nedeniyle bu bulgular dikkatle yorumlanmalıdır. L-SCP daha uzun ameliyat süresi ve enfeksiyon riski ile ilişkiliyken, LLS farklı bir komplikasyon profili sergilemiştir. Bu nedenle cerrahi teknik seçimi, yöntemlerin mutlak üstünlüğü yerine hasta özellikleri ve cerrah deneyimi doğrultusunda bireyselleştirilmelidir.

Anahtar Kelimeler: Pelvik organ prolapsusu, sakrokolpopeksi, lateral süspansiyon

Introduction

Pelvic organ prolapse (POP) is a clinical syndrome in which pelvic organs sag into or below the vaginal canal, typically resulting in vaginal bulging and pelvic pressure. It results primarily from a defect or weakness within the connective tissue and supporting structures of the pelvic floor. POP most often occurs in women aged 45–85 years (1). It has been estimated that nearly 13% of women will require surgical correction for POP at some stage in their lives (2). As life expectancy increases, the prevalence of symptomatic POP among women is projected to rise to 46% by 2050 (3).

Although several factors associated with POP have been ascertained, the precise associations between these factors and established risk factors remain to be identified (4). Known risk factors include menopause, increased parity, obesity, advanced age, genetic predisposition, and connective tissue disorders.

Diagnosis of prolapse is based on patient history and physical examination, with the physical examination assessing the anterior vaginal wall, vaginal apex, and posterior vaginal wall. POP staging is performed based on these findings, typically using the POP Quantification (POP-Q) system. When surgery is indicated, the surgical approach (transvaginal, laparoscopic, or open laparotomy) and the choice between native-tissue repair and mesh use are determined by the patient's overall health status and specific characteristics. The vaginal route is less invasive and is associated with lower morbidity than laparotomy and laparoscopy (5).

In recent years, increasing complication rates associated with mesh use have been reported (6). These complications include vaginal mucosal erosion, pain, infection, prolapse recurrence, and bladder or bowel injury during mesh implantation (7). Even in carefully selected patients, judicious use of mesh prevents recurrence of prolapse and improves long-term quality of life by ensuring pelvic floor support (8). Effective treatment of POP development and postoperative recurrence requires careful preoperative counseling, understanding patient expectations, and individualized surgical planning (9).

Abdominal sacrocolpopexy (SCP) involves attaching the vaginal apex to the anterior longitudinal ligament using mesh (10). This procedure, described by DeLancey (11), is indicated for all POP patients with level 1 defects. In young, sexually active women, SCP remains the gold standard for apical prolapse repair. However, data on its short- and long-term success rates and complication rates are conflicting. SCP demands extensive pelvic dissection and advanced suturing skills. To mitigate the risk of complications, a less complex lateral suspension (LS) technique was developed. LS is performed by placing a T-shaped mesh in the vesicovaginal space and securing it with sutures to the anterior vaginal wall, cervix, and isthmus (12). Over the past decade, multiple studies have assessed the efficacy and complication profile of this technique.

The present study aims to compare the short-term outcomes of abdominal SCP, the gold standard for POP and apical prolapse repair, with those of laparoscopic LS, a technically less demanding procedure with a potentially lower risk of complications.

Materials and Methods

A retrospective review was conducted of 186 POP cases performed at a tertiary care hospital between January 2022 and January 2024. Twelve cases were excluded due to vaginal cuff prolapse, 42 due to isolated anterior colporrhaphy, 24 due to isolated posterior colporrhaphy, and 59 due to incomplete data (Figure 1).

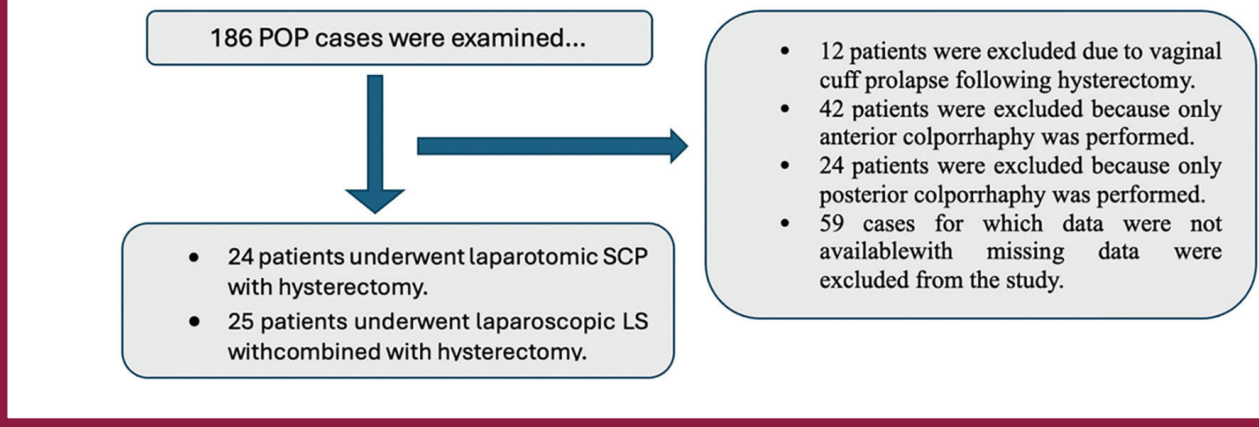


Figure 1. Study design.
POP, pelvic organ prolapse; SCP, sacrocolpopexy; LS, lateral suspension.

Due to the limited number of surgeons experienced in performing laparoscopic SCP at our center, various suspension techniques were compared across different surgical approaches.

The final analysis included 25 patients who underwent laparoscopic LS with hysterectomy and 24 who underwent open SCP with hysterectomy, constituting a retrospective cohort. Patients who underwent a hysterectomy planned for prolapse were included in the study. Patients who underwent a hysterectomy for myoma uteri or other indications were excluded.

The demographic and clinical variables compared included age, operative time, body mass index (BMI), postoperative hospital stay, postoperative change in hemoglobin, postoperative prolapse stage, and recurrence and complication rates. Patients with preoperative apical prolapse stage 2 or higher, according to the POP-Q system, were included. Recurrences were defined as stage III or higher prolapse occurring within one year postoperatively. The primary outcome was the objective cure rate evaluated by the POP-Q system.

The study protocol was approved by the Scientific Research Ethics Committee of Giresun Training and Research Hospital (decision number: 30.10.2024/04, dated: 04.11.2024). All procedures were conducted in accordance with the Ethical Principles for Medical and Health Research Involving Human Subjects.

Statistical Analysis

All statistical analyses were performed using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). The normality of continuous variables was assessed using the Shapiro–Wilk test. Continuous variables that were not normally distributed were summarized as medians and interquartile ranges while categorical variables were presented as numbers and percentages (n, %). Comparisons between the two groups were performed using the Mann–Whitney U test for non-normally distributed continuous variables and the chi-square test or Fisher's exact test for categorical variables, as appropriate. Preoperative and postoperative POP-Q stages were treated as ordinal variables and summarized using the median (range) and frequencies for each stage. A p-value <0.05 was considered statistically significant. Due to the retrospective nature of the study and the small sample size, no formal post hoc power analysis was performed; however, the effect sizes were calculated where relevant to assess clinical relevance.

Results

This retrospective cohort study included 49 patients with POP who underwent either laparotomic SCP (L-SCP) (n = 24) or laparoscopic LS (n = 25), all of whom underwent concomitant hysterectomy (Figure 1). Baseline characteristics, including age (median 60.5 vs. 63.5 years), duration of menopause, BMI, gravidity, parity, and comorbidities such as hypertension and diabetes, did not differ significantly (all $p > 0.05$). Operative time was significantly shorter in the LS group than in the SCP group (median 150 vs. 177.5 minutes, $p = 0.002$), reflecting the minimally invasive nature of the laparoscopic approach. Preoperative hemoglobin levels were slightly higher in SCP patients (13.45 vs. 12.65 g/dL, $p = 0.033$), and postoperative values were also higher (11.95 vs. 11.20 g/dL, $p = 0.012$); however, the magnitude of the hemoglobin drop and transfusion rates did not differ significantly (Table 1).

Preoperative POP-Q stage distribution differed significantly between the groups (p = 0.027). Stage 4 prolapse was more frequent in the L-SCP group (54.1% vs. 28.0%), whereas Stage 3 prolapse was more common in the laparoscopic LS group (68.0% vs. 41.6%). At the 12-month postoperative assessment, POP-Q stage distribution did not differ significantly between the groups (p = 0.196). Stage 1–2 prolapse was observed in the majority of patients in both groups, while Stage 3–4 prolapse was uncommon. These findings indicate that, despite differences in the distribution of baseline POP-Q stages, postoperative anatomical stage distributions were comparable between the two surgical groups at 12 months (Table 2).

Complication profiles were comparable, though bladder injury (8%) and mesh-related inflammatory reaction (8%) occurred exclusively in the LS group, whereas vascular injury (4.1%) and higher surgical-site infection rates (12.5%) occurred in the SCP group. Length of hospital stay and rates of injury to adjacent organs were similar between the groups (Table 3). Collectively, these data support the conclusion that

Table 1. Comparison between groups.

	L-SCP (n = 24)	Laparoscopic LS (n = 25)	p-value
Age (years), median (IQR)	60.5 (54–67)	63.5 (55–71)	0.441
Menopause Duration (years), median (IQR)	12 (6–18)	14 (7–21)	0.507
BMI (kg/m²), median (IQR)	26.15 (24–31)	28.3 (25–31)	0.395
Gravidity, median (IQR), median (IQR)	3 (2–4)	4 (2–5)	0.975
Parity, median (IQR)	2 (2–3)	3 (2–4)	0.819
Normal vaginal delivery, median (IQR)	2.5 (2–3)	3 (2–4)	0.758
Cesarean delivery, median (IQR)	0 (0–0)	0 (0–0)	0.584
Operative time (minutes), median (IQR)	177.5 (160–210)	150.00 (120–180)	0.002*
Hospital stay (days), median (IQR)	3 (3–4)	3 (3–4)	0.078
Preoperative hemoglobin (g/dL), median (IQR)	13.45 (12.5–14.2)	12.65 (11.9–13.4)	0.033*
Postoperative hemoglobin (g/dL), median (IQR)	11.95 (10.8–12.6)	11.20 (10.5–12.0)	0.012*
Hemoglobin change (g/dL), median (IQR)	1.45 (1.0–2.0)	1.3 (1.0–2.1)	0.489
Blood transfusion, n (%)	1 (4.1%)	3 (12%)	0.301
Adjacent organ injury, n (%)	2 (8.3%)	3 (12%)	0.673
Hypertension, n %	14 (58.3%)	11 (44%)	0.199
Diabetes mellitus, n (%)	10 (41.6%)	12 (48%)	0.880
Smoking, n (%)	9 (37.5%)	6 (24%)	0.474

Data are presented as median (IQR) or number (%). p-values calculated using Mann–Whitney U test for continuous variables and Fisher's exact test for categorical variables. Statistically significant p-values are shown in bold. BMI, body mass index; IQR, interquartile range; L-SCP, laparotomic sacrocolpopexy; LS, lateral suspension; n, number of patients.

Table 2. Preoperative and 12-month postoperative POP-Q stages in L-SCP and laparoscopic LS groups.

POP-Q stage	Laparotomic SCP (n = 24)	Laparoscopic LS (n = 25)	p-value
Preoperative POP-Q stage			
Stage 1	0 (0%)	0 (0%)	**0.027***
Stage 2	1 (4.1%)	1 (4.0%)	
Stage 3	10 (41.6%)	17 (68.0%)	
Stage 4	13 (54.1%)	7 (28.0%)	
Postoperative POP-Q stage (12 months)			
Stage 1	14 (58.3%)	13 (52.0%)	0.196
Stage 2	8 (33.3%)	9 (36.0%)	
Stage 3	1 (4.1%)	2 (8.0%)	
Stage 4	1 (4.1%)	1 (4.0%)	

p-values calculated using Fisher's exact test. L-SCP, laparotomic sacrocolpopexy; LS, lateral suspension; n, number of patients; POP-Q, Pelvic Organ Prolapse Quantification.

Table 3. Postoperative complications and perioperative outcomes.

	Laparotomic SCP (n = 24)	Laparoscopic LS (n = 25)
Vascular injury (common iliac vein)	1(4.1%)	0 (0%)
Bladder injury	0 (0%)	2 (8%)
Ureteral damage	1 (4.1%)	1 (4%)
Mesh-related inflammatory reaction	0 (0%)	2 (8%)
Surgical site infection	3 (12.5%)	1 (4%)

LS, lateral suspension; n, number of patients; SCP, sacrocolpopexy.

both SCP and LS are effective and safe for POP correction, with the laparoscopic approach associated with reduced operative time and slightly lower perioperative blood loss without increasing the risk of complications.

Discussion

The clinical management of POP remains challenging, with varying success rates reported among different surgical approaches. Minimally invasive techniques have gained popularity because they reduce operative morbidity, shorten hospital stays, and accelerate recovery. In our study, LS demonstrated significantly shorter operative times than abdominal SCP, consistent with the literature (13,14). Despite these differences, 12-month postoperative prolapse descent was comparable between LS and SCP, regardless of preoperative POP severity. Several studies support the efficacy of LS. One series reported 92% anterior compartment and 100% apical compartment recovery at 12 months post-laparoscopic LS (13). For an inexperienced surgeon, laparoscopic LS takes approximately 184 minutes (14). Learning-curve analyses indicate that LS is technically less demanding than laparoscopic SCP, while achieving similar objective success at 12 months (LS 89.1% vs. SCP 90.7%) (14). Laparoscopic LS is a less complex procedure to learn, and its success rate matches that of SCP. The degree of descent was the same for both procedures when compared at the 12-month postoperative follow-up in our study. Laparoscopic LS and SCP have equal efficacy and success rates in the management of POP (15). In another study, the primary cure rate of apical prolapse after laparoscopic LS was 87.5%, and after laparoscopic SCP was 100%. Laparoscopic LS, as a procedure with a low-risk of complications and short-term objective outcomes, may be an alternative to laparoscopic SCP (16). In our study, both techniques demonstrated similar effectiveness and short-term success. Our finding that LS was associated with shorter operative time and higher 12-month success rate is fully consistent with the literature. While some literature favors SCP for apical support, the findings of the present study suggest that LS does not compromise anatomical success despite its technical simplicity. While SCP remains a robust technique for advanced prolapse, LS offers a shorter operative duration and comparable short-term objective success. Given its shorter learning curve and equivalent efficacy at 1 year, LS should be considered a first-line minimally invasive option, particularly in surgical settings where reducing anesthesia time and technical complexity is prioritized. LS is a strong, reliable, and minimally invasive alternative to SCP, with its advantages in learning curve and operative time.

Comparing abdominal SCP and abdominal LS, apical prolapse repair rates were 94% and 92%, respectively, with both being equally effective at 12-month follow-up for severe apical prolapse (17). Anatomical success rates of 81.8% for SCP and 90% for LS were reported in a series of 93 patients; the treatments were considered equally effective (18). In our cohort, two patients in the SCP group and three patients in the LS group developed stage 3–4 prolapse at 12 months postoperatively, underscoring comparable success between the groups in managing advanced apical prolapse. The success rates in the literature parallel our low recurrence counts: 2 patients in SCP and 3 patients in LS. The primary finding is that the minimally invasive nature of LS does not compromise anatomical success. Since both techniques show similar efficacy in advanced apical prolapse, the choice should be based on logistical considerations and safety, rather than on success rates. The choice between SCP and LS may be guided more by surgical logistics and perioperative safety profiles than by differences in anatomical success, as both procedures offer high efficacy for long-term management of prolapse.

Pelvic dissection, particularly in the presacral region, carries inherent risks due to the proximity of critical structures. Previous studies report a 1.0% risk of ureteral injury and a 4.4% risk of vascular damage during pelvic surgery, with complications potentially exacerbated by anatomical variations, such as the more medial course of the left iliac vessels (19). Consistent with this, in our SCP cohort, vascular and ureteral injuries occurred in 4.1% of patients, highlighting the inherent intraoperative risks of the open approach. Wound-related complications, including surgical site infections and intra-abdominal abscesses, are also well-documented, with reported rates ranging from 2–12.5% for infections and 8% for abscesses (20). Bladder injury appears less common; a meta-analysis found no significant difference in bladder perforation rates between obese and non-obese patients undergoing SCP (21), and similarly, no bladder perforation was observed in non-obese women in our series. Surgical wound infection rates are

typically lower with laparoscopy because tissue damage is reduced and immune function is preserved (22). Our findings corroborate this, as the laparoscopic LS group demonstrated lower surgical site infection rates than SCP, supporting the advantages of minimally invasive techniques. Beyond surgical technique, patient-related factors also influence POP outcomes. Hormonal changes in menopause reduce estrogen levels, which, in turn, alter the collagen content and compromise pelvic tissue strength (23). Additionally, comorbidities such as diabetes mellitus and hypertension contribute to POP pathogenesis (24). In our study, a similar prevalence of these comorbidities in both groups suggests that the observed differences in complications were largely attributable to the surgical approach rather than to patient baseline characteristics. Overall, these findings emphasize the importance of surgical technique in minimizing perioperative complications and highlight the role of patient factors in POP management. Laparoscopic LS appears to offer a safer perioperative profile without compromising anatomical outcomes, particularly in patients with comparable comorbidity profiles.

Laparoscopic LS provides a safer perioperative profile than L-SCP, with lower rates of surgical site infections and major vascular or ureteral injuries. Both techniques achieve comparable 12-month anatomical success, making LS a highly effective and less invasive alternative for POP management. While LS is technically less demanding, it carries a distinct complication profile, including a higher risk of bladder injury and mesh-related inflammatory reactions, whereas SCP carries inherent risks of vascular and ureteral injury. The lower infection rates with LS and a similar distribution of comorbidities suggest that these outcomes primarily reflect the surgical approach rather than patient-related factors.

Study Limitations

This study has several important limitations. Its retrospective design and relatively small sample size restrict causal inference and the generalizability of the findings. The comparison of an open surgical approach (L-SCP) with a minimally invasive technique (laparoscopic LS) introduces potential confounding related to surgical access, rather than to the suspension method itself. Additionally, the limited number of experienced surgeons performing laparoscopic SCP at our center necessitated using different surgical approaches for the various suspension techniques, which represents a notable limitation. Preoperative hemoglobin levels differed significantly between groups; however, perioperative hemoglobin changes were analyzed without adjustment. This factor should be considered when interpreting the results and acknowledged as a limitation of the study.

Conclusion

In this retrospective cohort study, L-SCP and laparoscopic LS demonstrated comparable short-term anatomical outcomes and recurrence rates for POP surgery. L-SCP was associated with longer operative time and higher infectious morbidity, whereas laparoscopic LS showed a different complication profile, including mesh-related events. Given the methodological limitations and differences in surgical approach, no definitive superiority can be inferred. Surgical technique selection should, therefore, be individualized based on patient characteristics, disease severity, and the surgeon's experience. Prospective, approach-matched studies are needed to further clarify comparative effectiveness.

Ethics

Ethics Committee Approval: The study protocol was approved by the Scientific Research Ethics Committee of Giresun Training and Research Hospital (decision number: 30.10.2024/04, dated: 04.11.2024).

Informed Consent: Retrospective cohort study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: D.T., S.K., Ö.T., Concept: D.T., S.O.T., Design: D.T., S.K., Data Collection or Processing: D.T., S.O.T., Ö.T., Analysis or Interpretation: D.T., S.K., Literature Search: D.T., S.O.T., Ö.T., Writing: D.T., S.O.T., Ö.T.

Conflict of Interest: No conflict of interest was declared by the author(s).

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