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Original Article

Surgical Outcomes of Blepharoptosis in Ocular Prosthesis Patients

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Abstract

Objectives: To evaluate the surgical outcomes of blepharoptosis in patients with no light perception (NLP) who used prostheses and to assess eyelid symmetry and functional improvement following appropriate surgical management.

Methods: This retrospective study included 15 patients with prosthesis-related ptosis treated between 2020 and 2024. Demographic characteristics, prosthesis type and duration of use, type of ptosis, preoperative levator function, and surgical technique were recorded. Margin reflex distance 1 (MRD-1) was measured preoperatively and at postoperative 1 week, 1 month, 3 months and 6 months, using standardized digital photographs. Eyelid symmetry, complications, and need for revision surgery were evaluated. Repeated measurements were analyzed using the Friedman test with Wilcoxon signed-rank post hoc comparisons.

Results: The mean age was 40.13±17.41 years (range 15–70 years); 10 patients were female and 5 were male. The mean preoperative levator function was 11.80±3.52. Regarding the underlying causes of eye loss/prosthesis use, 9 (60.0%) were due to trauma, 1 (6.7%) was due to infection, 2 (13.3%) were due to glaucoma, and 3 (20.0%) were due to other causes. 12 patients had evisceration, and 3 patients used a prosthesis over a phthisis bulbi eye. 13 patients underwent Müller Muscle-Conjunctival Resection (MMCR) and 2 patients underwent levator surgery. MRD-1 increased significantly from 1.20±0.94 mm preoperatively to 3.27±0.70 mm at 6 months. Further analysis to determine the source of the difference revealed statistically significant differences between preoperative MRD-1 and postoperative MRD1 at 1 week, 1 month, 3 months, and 6 months. The Friedman test showed a significant improvement over time ($p<0.001$). Technique comparisons were exploratory due to the small levator subgroup. No significant difference was found between the duration of eye prosthesis use and preoperative MRD-1 ($p=0.761$).

Conclusion: MRD-1 improved from 1.20±0.94 mm preoperatively to 3.27±0.70 mm at 6 months, and eyelid symmetry (≤1 mm) was achieved in 86.6% of patients, demonstrating that ptosis of the upper eyelid in ocular prosthesis patients can be effectively corrected with appropriately selected surgical techniques based on levator function.

Keywords: Eyelid symmetry, margin reflex distance-1, müller muscle conjunctival resection, ocular prosthesis, phenylephrine test

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Introduction

Blepharoptosis is defined as the abnormal drooping of the eyelid during straight gaze, which can affect vision and appearance. It can be unilateral, bilateral, congenital or acquired. Ptosis occurs in 4.7% to 13.5% of the adult population, and this rate may increase with age (1–3). The upper eyelid typically covers the cornea by 1–2 mm. Ptosis can be minimal (1–2 mm), moderate (3–4 mm) or severe (>4 mm) and the pupil may be completely covered. Treatment for ptosis varies depending on age, aetiology, whether one or both eyelids are affected, the severity of ptosis, levator function, and the presence of ophthalmological/neurological comorbidities.

Ptosis treatment generally comprises follow-up, medication, and surgical procedures. Surgically, for mild to moderate ptosis, Müller muscle conjunctival resection (MMCR) or the Fasanella-Servat procedure is recommended in patients with mild to moderate ptosis who respond to the 2.5% phenylephrine test and have levator function >10 mm. Levator muscle procedures are recommended for ptosis with levator function >5 mm. Brow/frontal suspension is recommended for severe ptosis with levator function <4 mm (4).

Ptosis in patients with ocular prostheses may occur either alone or as part of socket syndrome following enucleation and is a common finding. Post Enucleation Socket Syndrome (PESS) was first described in 1982 (5). It is a multifactorial, variable syndrome resulting from the rotational displacement of the orbital contents from the top to the back and from the posterior to the inferior, the retraction of the extraocular muscles, and the possible volume loss due to resorption of the orbital implant if it is made of hydroxyapatite. These orbital changes occur rapidly in the months following eye loss and continue at a reduced rate for the rest of the patient's life. It is more pronounced in cases where the orbital implant is very small during surgery or if no implant is used. PESS typically results in posterior tilting of the superior fornix, a deep superior sulcus, pseudo-ptosis, elongation and laxity of the lower eyelid, a shallower inferior fornix, and enophthalmos, and may prevent the fitting of ocular prostheses (6).

In patients undergoing evisceration, the most common clinical findings in the eyelid are deepening of the superior sulcus and ptosis (35.0%), while lower eyelid entropion and lower eyelid retraction are the second most common findings (25.0%). Among patients who underwent enucleation, the most common eyelid change was lower eyelid entropion (45.5%). Ptosis and lower eyelid socket contracture were the second most common changes (36.4%) (7).

Prosthetic application is a procedure performed to alleviate aesthetic concerns in patients with no functional expectations; therefore, the ptosis and asymmetry that develop in these patients are critical. A previous study reported that participants were equally concerned about discharge, visual perception, and appearance in the first 3 months after eye loss and at least 2 years later, although concerns decreased. Older participants were less concerned about appearance, while women were more concerned about current discharge and appearance (8). Appearance and concealability are among the most important concerns for patients with prosthetic eyes (9).

The aim of this study was to evaluate the surgical success of ptosis in patients with prosthetic eyes based on the margin reflex distance-1 (MRD-1) and symmetry status, compare different surgical techniques in this patient population, and to evaluate intraoperative and postoperative complications.

Methods

Data on 15 patients with ptosis associated with ocular prosthesis use who were treated at the Oculoplasty Clinic of Beyoglu Eye Training and Research Hospital between 2020 and 2024 were retrospectively extracted from their files.

This study was conducted in accordance with the Declaration of Helsinki and approved by the Non-Interventional Clinical Research Ethics Committee of Istanbul Training and Research Hospital (date: 07/25/2025; no:196). Written informed consent was obtained from all patients prior to surgery. Written consent was also obtained for the use of clinical images and documented in the medical records.

The following data were evaluated and recorded: patient age; sex; type of prosthesis used; duration of prosthesis use; type of ptosis; preoperative levator function; preoperative and postoperative 1-week, 1-month, 3-month, and 6-month MRD-1; whether additional surgery was performed with ptosis surger;, symmetry between both eyelids; follow-up periods; development of postoperative complications; and whether revision surgery was required. Surgical success was defined as a postoperative MRD-1 ≥3.0 mm at 6 months without the need for revision surgery. Eyelid symmetry was defined as an absolute inter-eyelid MRD-1 difference ≤1.0 mm.

Patients with good socket-prosthesis fit, adequate fornix width, ptosis associated with ocular prosthesis, regular prosthesis use, no previous ptosis surgery, and comprehensive records were included in the study. Patients with insufficient sockets, narrow fornices, ptosis or ptosis surgery prior to prosthesis use, or incomplete records were excluded.

To determine the MRD-1, standardized frontal photographs were obtained in primary gaze under consistent lighting conditions. MRD-1 was measured digitally using Fiji (ImageJ, National Institutes of Health, USA). All measurements were obtained by the same investigator and independently verified by a second investigator. Masking was not applied due to the retrospective design. Regardless of levator function, 2.5% phenylephrine hydrochloride was administered to every patient with an ocular prosthesis. An appropriate surgical plan was developed for each patient based on the response to the phenylephrine test.

All patients were first evaluated at the prosthesis center. Socket volume deficiencies or prosthesis-related problems were corrected prior to ptosis surgery. Surgical intervention was considered only after prosthesis optimization. In levator surgery, levator reinsertion was performed through an upper eyelid crease incision. In MMCR, the amount of resection of the Müller-conjunctiva complex was adjusted according to the phenylephrine response. Where MRD_1 became symmetrical with the contralateral eye after 5 minutes, a 9 mm resection was planned; a 10 mm resection was performed where the ptotic eyelid remained lower despite a positive response. Conversely, where the ptotic eyelid reached a position higher than the contralateral side without significant unmasking of the Hering phenomenon in the fellow eye, an 8 mm resection was selected (1). No significant ptosis was observed in the contralateral eye due to the Hering effect during the intraoperative and postoperative periods.

Statistical Analysis

Analyses were performed using SPSS version 22.0 (IBM Corporation, Armonk, NY, USA). Descriptive statistical methods (mean, standard deviation, median, minimum, maximum) were used. Normality was assessed using the Shapiro-Wilk Test. Repeated MRD-1 measurements were analyzed using the Friedman test. Where significant, pairwise post hoc comparisons were performed using Wilcoxon signed-rank tests with Holm–Bonferroni correction. A p-value<0.05 was considered statistically significant.

Results

The mean patient age was 40.13±17.41 years (min 15–max 70 years). Of the 15 patients included, 10 (66.6%) were female and 5 (33.3%) were male. The preoperative levator function was 11.80±3.52. Examining the causes of evisceration, it was found that 9 cases (60.0%) were due to trauma, 1 case (6.7%) was due to infection, 2 cases (13.3%) were due to glaucoma, and 3 cases (20.0%) were due to other causes. A total of 12 patients had evisceration, while 3 patients used prostheses on phthisic bulbi eyes. The average follow-up period was 86.00±63.57 months (12-180 months); the average prosthesis usage period for patients was 28.64±41.22 months (1-156 months) (Table 1).

Differences between preoperative MRD-1 (1.20±0.94 mm) and postoperative MRD-1 values at 1 week (2.40±0.63 mm), 1 month (2.93±0.70 mm), 3 months (3.20±0.67 mm), and 6 months (3.27±0.70 mm) were statistically significant (p<0.001) (Table 2). Further analyses revealed statistically significant differences between preoperative and postoperative MRD-1 values at week 1, month 1, month 3, and month 6. The Friedman test showed a significant improvement over time (p<0.001). No significant difference was found between the duration of ocular prosthesis use and preoperative MRD-1 levels (p=0.761).

Table 1. Findings regarding some sociodemographic characteristics and prosthetic ptosis surgery in patients

	n	%
Gender		
Female	10	66.7
Male	5	33.3
Average age	40.13±17.41 years (min 15- max 70 years)	
Preoperative levator function	11.80±3.52 mm	
Etiology of ptosis		
Mechanical	1	6.7
Aponeurotic	14	93.3
Cause of anophthalmia		
Trauma	8	57.1
Infection	1	7.1
Glokoma	2	14.3
Due to other reasons	3	21.4

Table 2. Relationship between preoperative and postoperative (1 week, 1 month, 3 months, 6 months) MRD-1

Time Point	MRD-1 (mm), mean±SD
Preoperative	1.20±0.94
Week 1	2.40±0.63
Month 1	2.93±0.70
Month 3	3.20±0.67
Month 6	3.27±0.70
p value*	**<0.001**

* Friedman test. MRD-1: Margin reflex distance-1, SD: Standard deviation.

A total of 13 patients (86.6%) underwent MMCR (Figure 1), and 2 (13.4%) underwent levator surgery (Figure 2). Technique comparison was exploratory only, as the levator group was too small to allow meaningful statistical inference.

Eyelid symmetry (MRD-1 difference≤1.0 mm) was achieved in 13 patients (86.6%); asymmetry was present in 2 patients (13.4%). Revision surgery was recommended for these 2 patients but they declined as they were satisfied with their appearance. Revision surgery was not performed on any of the 15 patients and no intraoperative complications were encountered. Ecchymosis and edema were detected at varying levels in the surgical area in all patients during the postoperative period; These resolved with medical treatment.

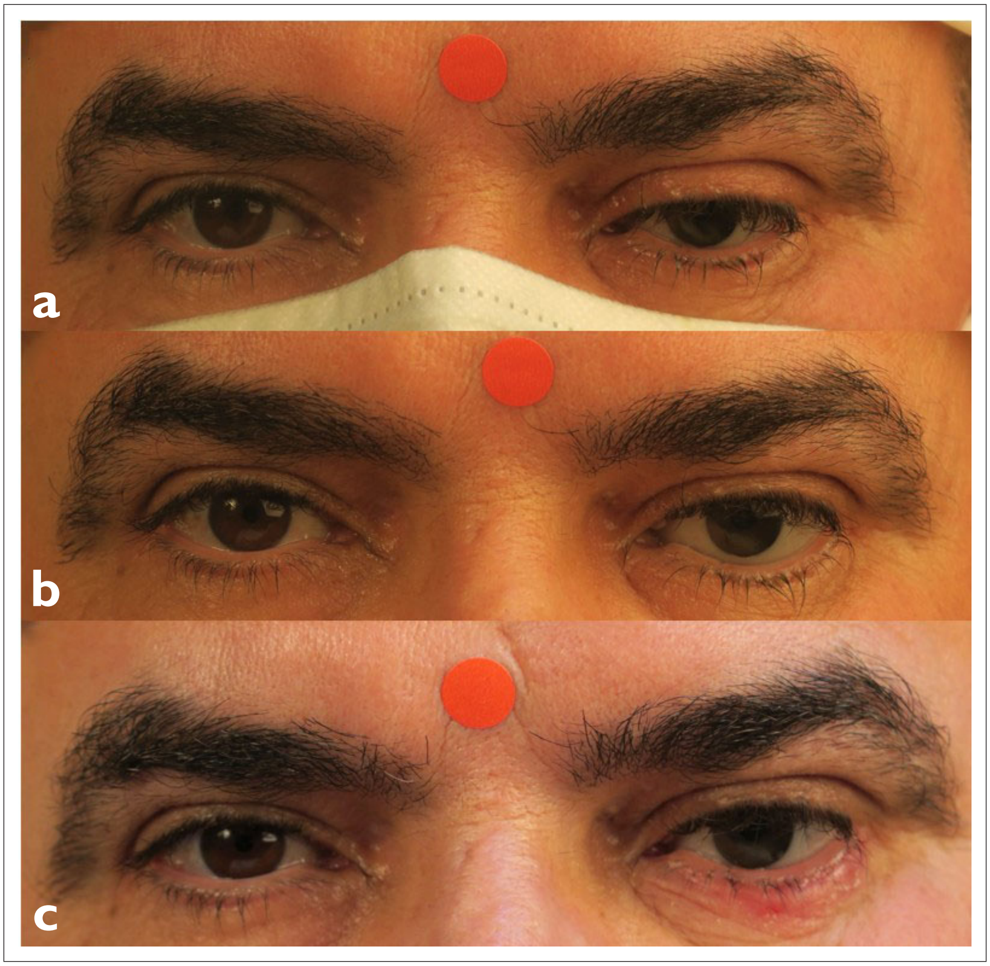

Figure 1. Preoperative left upper eyelid ptosis **(a)**; elevation of the left upper eyelid 10 minutes after instilling 2.5% phenylephrine **(b)**; and postoperative result at 3 months after MMCR surgery **(c)**.

Discussion

Ocular prostheses are artificial eyes designed to restore appearance and psychological well-being in individuals who have lost an eye due to trauma, disease, or congenital causes. Prostheses are manufactured through processes requiring significant skill, time, and craftsmanship, often resulting in variable quality and accessibility (10,11). Recent advances in digital technologies such as computer-aided design, 3D printing, and imaging have revolutionized this field by enabling the more precise, repeatable, and efficient production of customized ocular prostheses (12–14).

Blepharoptosis is a common complication following eye removal (15). Psychosocial adjustment and patient satisfaction are influenced by factors such as prosthesis mobility, appearance, and the quality of care provided (16–18). Blepharoptosis is associated with significant functional, cosmetic, and psychosocial effects (19–21). Aesthetically favourable results are achievable in many patients without the need for additional surgical intervention. Enlarging the upper part of the prosthesis can mechanically elevate or curve the upper eyelid. However, this may be limited due to lower eyelid retraction, hypoglobus, and loss of mobility (5,22). Socket rehabilitation is achievable by changing the prosthesis to increase orbital volume. A thicker prosthesis can generally lift the upper eyelid with the help of posterior support; however, prosthesis thickness is inversely proportional to mobility. Thick or heavy prostheses may result in a hypoglobus appearance or lower eyelid retraction, or both (23).

Volume deficiency can be corrected using autologous or alloplastic orbital implants (24,25). There is a direct relationship between the resudial volume replacement percentage and ptosis formation: the likelihood of ptosis occurring in patients with a volume replacement of 40.0% is 2.27 times higher than in patients with a volume replacement of 80.0%. Ptosis resolved in 30.0% of patients following orbital volume replacement (26). It is recommended that upper eyelid blepharoptosis is corrected after volume deficiency is addressed (15). There was no orbital volume deficiency in the patients in the present study, and each patient was evaluated for prosthesis suitability. In patients with prosthesis

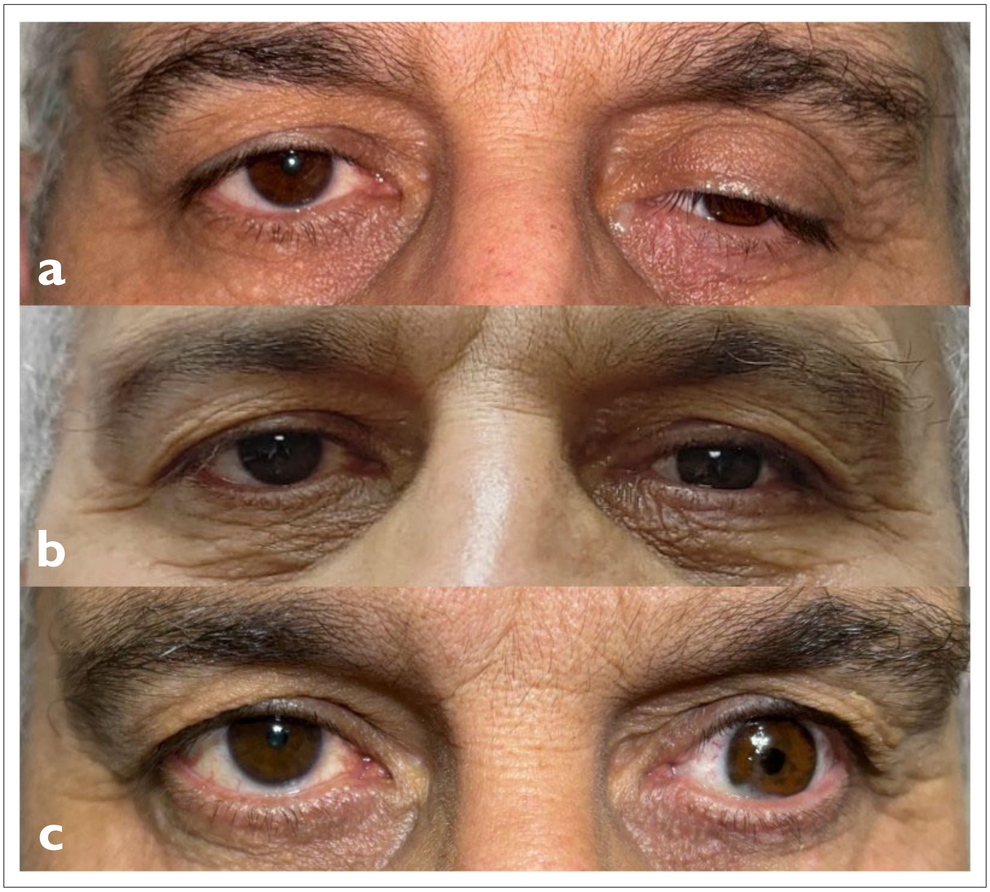

Figure 2. Preoperative left upper eyelid ptosis **(a)**; postoperative apperence at 1 month after levator reinsertion **(b)**; and postoperative apperence at 6 months after levator reinsertion **(c)**.

incompatibility, related procedures were performed prior to ptosis surgery. Patients whose ptosis did not improve were referred for surgery and the appropriate surgical approach was selected.

Ptosis in anophthalmic eyes may result from various factors such as volume loss, soft tissue rotation, lower eyelid laxity, and socket fibrosis. PESS is characterized by fat atrophy, soft tissue rotation, lower eyelid laxity, and socket fibrosis; ptosis and an upper lid deep sulcus appearance are frequently observed in PESS. Clinical symptoms usually onset within the first 2 years after enucleation (5). In this study, PESS findings were present in 12 (80.0%) of the patients. No fornix insufficiency or socket volume deficiency was observed.

Detachment or dysfunction of the levator palpebrae superior insertion site can be considered as one of the main causes of anophthalmic blepharoptosis. Despite adequate orbital volume, ptosis was reported in 18.0% of anophthalmic patients (n=66); the cause of ptosis in these cases was attributed to a shift in the center point of the levator palpebra superior muscle and the resulting mechanical imbalance (15). In a series of 32 cases, levator function was significantly lower on the anophthalmic side (10.43±1.48 mm) than on the normal side (12.74±1.81 mm). In this study, levator function was also found to be significantly lower on the anophthalmic side (11.80±3.52) than on the normal side (14.01±2.05). The cause of the ptosis mechanism can be similarly explained. Levator function was better in those eyes with appropriate height in suitable prostheses. Levator function in anophthalmic eyes was directly proportional to the increase in the anterior surface of the implant and the increase in implant size, and inversely proportional to age and superior sulcus deepening (15).

A study evaluating 186 patients following enucleation demonstrated that 62.3% of postoperative complications could be treated by adjusting the prosthesis (25). Procedures performed during prosthesis adjustment may increase the weight of the prosthesis, potentially limiting its mobility and causing deformities. In this study, all patients were evaluated by the prosthesis center specialist who was consulted prior to the establishment of the surgical indication. No socket volume deficiency or prosthesis-related problems were noted; ptosis was identified as requiring surgical correction.

Downward shift of the lower eyelid and socket tissues can occur at the upper weight limit for prosthesis enlargement. In a series of 70 cases, it was reported that the prosthesis volume ranged from 0.75-4.2 mL, with the ideal volume being 2.2 mL at the lower limit and 4.2 mL at the upper limit. (22) Smaller prostheses are associated with implant malposition and socket narrowing. Larger prostheses are associated with ptosis and lower eyelid laxity.

In a case series, blepharoptosis was the most common postoperative enucleation complication and required surgical intervention in 7.0% of patients (25). The reported consensus was that in surgical repair, upper eyelid ptosis in anophthalmia should be addressed after volume deficiency and lower eyelid malposition have been corrected (15). In another study, blepharoptosis was corrected in 12 of 18 patients after volume replacement with dermal fat grafting; the other 6 patients subsequently required surgery to correct eyelid ptosis (27) In the present study, patients with volume deficiency or prosthesis incompatibility were excluded if their upper eyelid ptosis resolved after volume replacement or prosthesis-related problems were addressed. Patients who underwent upper eyelid ptosis surgery, despite all problems being resolved, were included.

As surgical interventions, techniques used to correct upper eyelid ptosis in anophthalmic sockets include levator reinsertion, frontal suspension, and MMCR (24,28,29). Levator surgery was once the most frequently used method for correcting ptosis in anophthalmia. The internal approach has also become common in recent years (28–30). Phenylephrine is commonly used for pupil dilation (mydriasis) and diagnostic purposes in ptosis. Both 2.5% and 10.0% phenylephrine produce upper eyelid elevation, with 10.0% inducing a slightly greater effect (0.2 mm more) than 2.5% (31). Both concentrations are considered safe, with no significant changes in blood pressure or heart rate following single-dose administration in healthy individuals (32,33). Karesh et al. (34) performed MMCR on 35 patients with anophthalmic ptosis who responded to 10.0% phenylephrine eye drops. Postoperative symmetry was observed in both eyelids in 31 patients, overcorrection in 2 patients, and undercorrection in 2 patients. No patient experienced socket dryness or upper fornix narrowing. In this study, patients underwent surgical levator reinsertion and MMCR was performed in those who responded to 2.5% phenylephrine eye drops. Levator reinsertion was performed in 2 patients and MMCR was performed in 13 patients. Eyelid symmetry was achieved in 13 patients. Undercorrection developed in 2 patients; overcorrection did not develop in any patient. There were no surgical complications in the postoperative period, and the postoperative success rate was consistent with the literature. Following prosthesis optimization, surgical correction of ptosis in properly fitted sockets resulted in stable MRD-1 improvement at 6 months. MMCR did not result in socket dryness or fornix narrowing.

Limitations of this study include the small sample size, the unequal distribution of surgical techniques which precluded meaningful comparison between procedures, and the lack of patient-reported satisfaction outcomes.

Conclusion

In conclusion, insufficient orbital volume is important in the pathophysiology of anophthalmic socket ptosis. The consensus in the literature is that orbital volume is key in ptosis of the anophthalmic socket; treating orbital volume can correct ptosis. Adjusting the prosthesis can provide volume change. This adjustment can elevate the upper eyelid but may impact the fit or mobility of the prosthesis. Persistent ptosis despite an appropriate prosthesis and adequate socket volume can be successfully treated surgically.

Disclosures

Ethics Committee Approval: This study was approved by the Clinical Research Ethics Committee of Istanbul Training and Research Hospital (Date: 07/25/2025, Number: 196) and conducted in accordance with the tenets of the Declaration of Helsinki.

Informed Consent: Written informed consents were obtained from all patients.

Conflict of Interest: None declared.

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