Research Square

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Multidisciplinary Surgical Management of Orbital Tumors: A 16-Year Retrospective Analysis of Ophthalmology, ENT, and Neurosurgery Approaches

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Abstract

Background

The orbit is an anatomically complex region containing critical visual and neurovascular structures, making surgical management of orbital tumors technically demanding and inherently multidisciplinary. Optimal outcomes often require close collaboration between ophthalmology, otorhinolaryngology (ENT), and neurosurgery. This study aimed to evaluate surgical approaches used across three specialties in the management of orbital tumors and to analyze clinical outcomes.

Methods

A retrospective multicenter analysis was conducted including adult patients who underwent orbital tumor resection between 2009 and 2025 at two tertiary referral centers. Demographic data, clinical presentation, tumor location and histology, surgical approach, extent of resection, and postoperative outcomes were collected from electronic medical records. Statistical analyses were performed to assess associations between tumor characteristics, surgical techniques, and resection completeness.

Results

A total of 144 patients (mean age 55.4 ± 16.4 years) were included. Most tumors were primary orbital lesions, with benign pathologies predominating. Ophthalmologists most commonly performed anterior orbitotomies for extraconal anterior lesions, ENT surgeons favored external orbitotomies depending on tumor location, and neurosurgeons applied lateral orbitotomy or fronto-orbital craniotomy for complex or deep-seated tumors. Complete tumor removal was achieved in 57.6% of cases. A statistically significant association was found between tumor location and extent of resection ($p = 0.01$), no significant correlation was observed between surgical approach and resection completeness ($p = 0.22$). The most frequent postoperative complication was extraocular muscle dysfunction.

Conclusions

Effective surgical management of orbital tumors requires a tailored, multidisciplinary strategy integrating ophthalmology, otorhinolaryngology, and neurosurgery expertise. Tumor location is a key determinant of the extent of safe resection and should guide surgical decision-making.

Introduction

The orbit is an anatomically complex region formed as a cone-shaped space with an apex limited by the superior orbital fissure and optic canal [1]. It contains eyeball, ocular muscles, fat, glands, nerves, veins, and arteries which together with surrounding bones make an intricate structure. The orbit can be

affected by heterogeneous pathologies and because it also forms part of the skull base the region is considered a high-risk and technically demanding region in surgical practice [2].

Orbital tumors may originate from any tissue in the orbit and may be primary, secondary, or metastatic. Their etiology is influenced by patient age, tissue of origin, genetic predisposition, and environmental factors [3]. They are considered rare, with an estimated incidence of 8.6 per million individuals [4]. Notably, epidemiological data from the United States and South Korea indicate a rising incidence of malignant orbital tumors over the past two decades. [5, 6]. The most common types of orbital neoplasms differ depending on the patient's age. In adults, lymphoma is the predominant primary malignant tumor, whereas in children, benign lesions occur more frequently [7]. It is estimated that approximately 60% of tumors in adults are benign and 40% are malignant [5].

The orbital cavity is an area of shared clinical interest for ophthalmologists, otorhinolaryngologists, plastic surgeons, maxillofacial surgeons, and neurosurgeons who often collaborate to achieve optimal management outcomes. For asymptomatic benign tumors, the treatment of choice is usually watch-and-wait. Patients with symptomatic benign tumors should undergo a thorough evaluation by an interdisciplinary treatment team to determine the expected benefits of surgical treatment versus the risk of postoperative complications. Malignant orbital tumors are usually resected if possible without significant risk to the patient [5]. Depending on the size of the tumor, location and experience of the surgeon, different approaches to the orbit can be used (Fig. 1).

This study aimed at evaluating different surgical approaches used in ophthalmology, otorhinolaryngology and neurosurgery. A series of patients diagnosed with orbital tumors was included, and clinical outcomes as well as the factors influencing the extent of tumor resection were analyzed.

Materials and methods

Patient population

This retrospective study involving human participants was conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. Ethics approval was obtained from the Bioethics Committee of the Medical University of Silesia in Katowice (No. BNW/NWM/0052/KB/359/25, dated 12/09/2025). Due to the retrospective nature of the study, the requirement for informed consent was waived by the aforementioned committee. A retrospective multicenter analysis was conducted on the data from patients who underwent orbital tumor resection in years 2009–2025 in Ophthalmology, ENT, Neurosurgery Departments in Professor K. Gibinski University Clinical Center of the Medical University of Silesia or A. Mielecki Memorial Independent Public Hospital of the Medical University of Silesia.

Demographic and clinical baseline characteristics together with outcomes for all patients were gathered from the electronic medical records. We included adult patients who underwent surgery for a tumor located in the orbit. Primary and secondary lesions together with metastases were taken into account.

We excluded patients who had prior orbital surgery, thyroid eye disease, surgery performed outside the institution or missing clinical data.

Perioperative protocol

Patients before the surgery had a number of examinations and imaging studies (CT and/or MRI scans). During ophthalmology examination visual acuity using Snellen chart was tested along with the examination of the fundus. Degree of proptosis, eyeball mobility and visual field were also assessed.

Sometimes before the surgery a fine-needle aspiration (FNA) biopsy was performed. But because of the anatomically complex structure of the orbit, FNA is often difficult and is associated with high risk of complications and false-negative results.

After surgery when the histopathological diagnosis was confirmed, an applicable management was introduced. In cases of benign lesions depending on the location of the tumor several approaches were used: transconjunctival or transcutaneous orbitotomy (anterior; lateral; medial; superior; inferior), fronto-orbital craniotomy. In patients with the confirmed diagnosis of malignant tumor (excluding lymphomas) the surgery was followed by adjuvant chemo- or/and radiotherapy. In cases of lymphoma patients were referred to the Department of Hematology to receive systemic treatment. All patients were strictly followed up in the outpatient clinics of the mentioned above departments.

Statistical analysis

Statistical analysis was performed with Statistica software (TIBCO Software INC., version 13.3). For quantitative data the Shapiro-Wilk test was performed to test for normal distribution. Statistical comparison of categorical variables was performed by chi-squared test, using the Fisher exact test. A p-value less than 0.05 was considered statistically significant.

Results

Between 2009 and 2025, 144 patients underwent orbital tumor resection in one of three units: Ophthalmology (113), ENT (26), Neurosurgery (5). None of the patients underwent orbital surgery previously. The mean age was 55.4 ± 16.4 years (mean ± standard deviation). The youngest patient was 19 years old while the oldest was 90 years of age. Baseline characteristics are presented below in Table 1.

Table 1
Characteristics of the study group.

Patients, n	**144**
Age range (mean ± SD)	19–90 (55.4 ± 16.4)
Female/Male	72/72
Mean follow-up ± SD (months)	11.3 ± 8.9
Left/Right orbit	81/63

On admission to ENT department patients most commonly presented with symptoms: proptosis occurred in 9 of 26 patients (34,6%), orbital edema (7; 26.9%), decreased visual acuity (6; 23.1%), epiphora (6; 23.1%), pain (4; 15.4%), visual field defect (4; 15.4%). Diplopia (2; 7.7%), headache (2; 7.7%) and blindness (1; 3.8%) were less frequent. All patients who were treated in the Neurosurgery Department suffered from proptosis (5/5). Other clinical manifestations included: pain (3), decreased visual acuity (3), diplopia (1), decreased color vision (1), orbital edema (1).

Among all patients 127 cases were primary tumors of the orbit and seven were metastases of different neoplasms. The remaining six cases were primarily extraorbital tumors with orbital extension. The right orbit was more frequently involved (81 right, 63 left).

Tumors were most likely located in the lower-medial quadrant of the orbit. Only 6.3% of orbital tumors were located intraconally. Tumors were observed statistically more often in upper-lateral quadrant of the orbit. Figure 2. Shows tumor location and the number of cases.

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Depending on tumor location and involved department, different surgical approaches were used. Ophthalmologists favored anterior orbitotomy for extraconal tumors located in the anterior two-thirds of the orbit. 23.4% used transconjunctival approach and 76,1% transcutaneous one for lesion removal. ENT surgeons preferred external orbitotomies: medial orbitotomy (23.1%), lateral orbitotomy (50%), superior orbitotomy (18.8%), inferior orbitotomy (18.8%). Neurosurgeons performed either fronto-orbital craniotomy (2/5 cases) or lateral orbitotomy (3/5 cases).

Complete removal was achieved in 57.6% of cases and partial removal in 42.4% of patients. There was statistically significant association found between tumor location and the extent of surgical removal ($p = 0.01$). The analysis showed that complete removal dominated in upper-lateral, upper-medial and lateral quadrants of the orbit. Partial removal was more frequent in tumors that were bigger and occupied the whole upper part of the orbit or entire eye socket. These findings suggest that anatomical location of the lesion plays an important role in determining the feasibility of complete surgical removal. Figure 3. shows distribution of total and partial removals across different tumor locations.

There was no statistically significant association found between surgical approach and the extent of surgical removal (p = 0.22) The follow-up ranged from 1.5 months to 36 months. In 6 patients the pathology reports revealed normal tissues like fat or connective tissue therefore we excluded those patients from further analysis. Summarized pathological results categorized by gender and median age are summarized in Table 2.

Table 2
Tumor histology

Pathology report	**No. of patients, (%)**	**Sex, M/F**	**Median age, (range)**
lymphoma	31	15/16	65 (32–89)
Metastatic tumor	7	4/3	66 (54–78)
Secondary orbital tumor	6	3/3	63 (27–76)
Cystic lesion	39	18/21	50 (19–72)
Inflammatory condition	24	13/11	55 (29–90)

Histopathological results with total number of cases are summarized in Table 3.

Table 3
Full tumor histology

Histology	No. of patients, (%)
Malignant tumor	
Lymphoma	31
Basal cell carcinoma	4
Hemangioblastoma	1
Lacrimal gland adenocarcinoma	1
Benign tumor	
Cystis simplex	20
Cystis dermoidalis	13
Haemangioma cavernosum	8
Cystis epidermalis	5
Schwannoma	3
Neurofibroma	2
Dermolipoma	2
Pilomatrixoma benignum	2
Xanthogranuloma	2
Solitary fibrous tumor	2
Choriostoma	1
Cystis serosa	1
Naevus sheeth myxoma	1
Fibrolipoma	1
Lipoma	1
Meningioma	1
Papillary squamous cell carcinoma	1
Carcinoma planoepitheliale	1
Metastatic	
Breast cancer	3
Small cell lung carcinoma	2

Histology	No. of patients, (%)
Colon adenocarcinoma	1
Prostate adenocarcinoma	1
Others	
Inflammatory condition	24
Reactive lymphoid hyperplasia	3

Postoperative outcomes

All surgical procedures are associated with the risk of complications. The most common complication was paralysis of extraocular muscles.

Illustrative cases

Case 1

This 63-year-old patient reported with decreased visual acuity, decreased color vision, proptosis, eyelid swelling and pain. MRI revealed a rounded lesion located intraconally (Fig. 4.) She was treated with front-orbital craniotomy. Dural tear during the craniotomy has been noticed. Reconstruction with use of DuraGen® (Interga) allowed for water tight reconstruction with no postoperative cerebrospinal fluid leak. Gross total resection has been achieved. Postoperative visual acuity improved with no change in color vision, diplopia worsened postoperatively with recovery of single vision. Pathology report result indicated IgG4-related disease with progression to lymphoplasmacytoid lymphoma. Follow-up treatment consisted of adjuvant chemotherapy.

Case 2

This 70-year-old male was treated due to decreased visual acuity and proptosis. MRI (Fig. 5) showed a well-delineated tumor with a homogeneous, intense enhancement pattern, exerting mass effect on the extraocular muscles. Lateral orbitotomy was performed. During the resection abducens nerve has been noticed, sharp microdissection from the nerve allowed for maintaining nerve in continuity. Gross total resection has been achieved. A pathology report revealed schwannoma. Postoperative visual acuity improved, no postoperative diplopia. Follow up treatment was not necessary.

Case 3

The 43-year-old male had a history of decreased visual acuity and proptosis. MRI (Fig. 6) T1 FS + iv showed a mass located intraconally. He was treated with lateral orbitotomy. After the orbital cone and Zinn ring have been visualized, adhesions between tumor capsule and neurovascular structures have been cut with the use of microscissors. No dissection of the cranial nerves has been observed. The tumor cavity was filled with autologic fat to reduce the risk of enophthalmos. Total removal has been

achieved. Postoperative visual acuity in the beginning was decreased but started to improve after 3 days. After 18 months the patient still suffers from decreased visual acuity. The other complication was the dysfunction of medial rectus muscle – recovered completely after 4 weeks. Pathology report result indicated meningioma. There was no follow-up treatment.

Case 4

Male, 78 y.o., treated duo to severely decreased visual acuity, decreased eye movement, extreme proptosis and pain. Patient received surgical treatment in 1998 with good outcome, improvement is visual acuity and bulb movement, tumor recurrent since 2018, reoperated in 2020 with no benefit and without significant resection. Second reoperation performed in 2023. Treated with fronto-orbital craniotomy expanded duo to the size of the previous craniotomy. Near total (> 95%) resection has been achieved. Small tumor remnant adherent to the optic nerve and ciliary arteries was left in place in order to reduce risk of blindness and advanced patient age (Fig. 8). Postoperative visual acuity improved; diplopia improved with much better globe mobility. Histopathology solitary fibrous tumor.

Discussion

The demographic characteristics observed in our cohort are consistent with those reported in other original studies. In adults, the peak incidence of orbital tumors occurs in the sixth decade of life, as demonstrated, among others, in a 2020 study from the United States including over 15,000 patients and based on the SEER database [4]. Divergent results were reported in a 2005 review from Japan including 244 patients, in which the seventh decade of life was identified as the peak incidence period. Owing to the substantially smaller sample size, the reliability of the latter findings may be limited, although the observed difference may also reflect population-specific characteristics. Other studies also confirm the lack of a significant association between sex and the occurrence of orbital tumors, as observed in our center. In contrast, an opposite effect was demonstrated in studies based on smaller cohorts, which reported a sex predilection [8–12].

Clinical manifestations of orbital tumors vary across the literature. Proptosis is often reported as the most common presenting symptom. In computed tomography, proptosis is assessed on axial sections of the orbit by measuring the perpendicular from the line connecting the lateral orbital margins to the posterior corneal surface; values greater than the quantitative norm and a difference between the eyes > 2 mm indicate pathological proptosis [13]. Prevalence of proptosis differs markedly between studies - from 100% in the series by Markowski to 31.8% in the most recent cohort described by Mohammad [14, 15]. One study, however, conducted on a much smaller group of patients (n = 29), contradicts this pattern, identifying decreased visual acuity as the most frequent initial symptom [9]. This heterogeneity in reported clinical features may reflect the biological diversity of tumors arising in the orbit, as well as the relatively small sample sizes in many cohorts. Such variability in the clinical picture poses a diagnostic challenge for clinicians and may contribute to delays in establishing the diagnosis. This pattern is also evident in our study, where reported symptoms differed depending on the department in

which the patient was initially evaluated. Owing to the small number of cases, these interdepartmental differences did not reach statistical significance, but they warrant further investigation. The absence of standardized, widely adopted diagnostic pathways for patients with orbital tumors suggests that different departments may emphasize distinct elements of the clinical examination and work-up.

The predominance of extraconal lesions in our series is in line with reports from other centers, as is the finding that most tumors were primary orbital lesions. However, the right-sided predominance observed in our cohort contrasts with previous studies, which suggested that the left orbit is more frequently involved [14, 15]. With regard to tumor location within the orbit, the upper-lateral quadrant predominated, followed by the upper and lower intermediate regions. This finding contrasts with the results of another study conducted in a Polish population, in which lower-medial as well as upper- and lower-lateral locations were reported as the most common [15]. However, our findings have been confirmed on populations from other countries, including a report from Italy describing 2,480 orbital lesions, and a study from Iran involving 375 lesions [16, 17]. The frequent occurrence of tumors in the upper-lateral area may be related to the presence of the lacrimal gland in this region, which is a typical site for pleomorphic adenoma, adenoid cystic carcinoma and lymphoma [18].

Malignant tumors in our cohort accounted for 37% of all cases, whereas benign lesions comprised 63%. This distribution closely mirrors that reported in an Irish series of 1264 patients [19]. Among malignant orbital tumors, lymphoproliferative disorders are considered the most common entities, with lymphoma representing approximately 70–90% of such lesions in adults over 60 years of age [20, 21]. In a recent review estimating the global prevalence of malignant orbital tumors based on MEDLINE database records, the proportion of lymphoma among malignant tumors of the eye and orbit was estimated at 47–54% [22]. In our material, this predominance is even more pronounced, with lymphomas accounting for 84% of all malignant tumors.

The most prevalent group of lesions in our study were orbital cysts, which represented 27% of all cases. This finding is consistent with the results of a 1984 study based on 645 orbital biopsies from an ophthalmic hospital, in which cystic lesions also constituted the largest group, accounting for 30% of cases [23]. However, in many other reports - including a 2002 article by the same author based on 1264 cases from the Oncology Service at Wills Eye Hospital - cystic lesions represented a substantially smaller proportion of the cohort (6% in that study). As the author suggests, the discrepancy between the 1984 and 2002 series likely reflects the fact that small dermoid cysts are frequently managed by general ophthalmologists, and such patients are therefore less likely to be referred to an oncology service [23]. This hypothesis also provides a plausible explanation for the high proportion of cysts in our study, as the majority of our patients (78%) were initially seen in the Department of Ophthalmology. It is further supported by data from a study conducted exclusively in our ENT Department by Markowski et al., in which only 2 cases of epidermal cysts were identified among 122 patients, with no additional cystic lesions reported [14].

The percentage of complete tumor resection in our study (57.6%) is relatively low compared with rates reported by other authors. Reyes-Soto et al. reported an 82.8% rate of complete resection in a cohort of 29 patients, Joon Park et al. achieved complete removal in 63.2% of 19 patients, Montano et al. reported a 74.3% rate of complete resection in a series of 70 patients, and Aftahy et al. achieved total removal in 73.5% of 34 patients [9, 12, 24, 25]. The reasons for this discrepancy between our results and those reported in other, comparable studies are difficult to determine. In our cohort, a clear association was observed between the extent of surgical radicality and tumor location, with lesions located in the lower-medial compartment of the orbit being associated with a 100% rate of complete resection. In contrast, the lowest degree of radical resection was observed in large tumors involving the entire orbital cavity. Notably, the extent of resection was not associated with the surgical approach employed. This finding suggests that the most important factor influencing the radicality of tumor removal is early detection and surgical intervention, before the lesion reaches a large size.

Our study inevitably has several limitations. Although we included patients from three different departments across two hospitals, the majority were evaluated and treated in the Department of Ophthalmology; consequently, both the spectrum of tumors and the presenting symptoms may be influenced by department-specific referral patterns and case selection. The relatively small sample size, reflecting the rarity of the condition, further limits the generalizability of our findings. In addition, short follow-up period precludes a robust assessment of tumor recurrence rates after different surgical approaches, thereby limiting our ability to compare their long-term effectiveness. Studies involving larger cohorts and longer follow-up are warranted to validate and extend our observations.

Conclusions

Effective surgical management of orbital tumors requires a tailored, multidisciplinary strategy integrating ophthalmology, otorhinolaryngology, and neurosurgery expertise. The determining factors for the radicality of resection are the location and size of the lesion; therefore, early detection of orbital tumors is crucial for their effective treatment. Tumor location is a key determinant of the extent of safe resection and should guide surgical decision-making.

Declarations

The authors declare no competing interests. The authors declare that no funds, grants, or other support were received during the preparation of this manuscript. Clinical trial number: not applicable

Author Contribution

Conceptualization - J.M., P.P., D. P-W., M. W., ;J.M., A. D.-K., P.P., N.K. and M.P. wrote the main manuscript text and prepared the figures. All authors reviewed the manuscript.

References

1. Bleier BS, Castelnuovo P, Battaglia P, Turri-Zanoni M, Dallan I, Metson R, Sedaghat AR, Stefko ST, Gardner PA, Snyderman CH, Nogueira JF, Ramakrishnan VR, Muscatello L, Lenzi R, Freitag S (2016) Endoscopic endonasal orbital cavernous hemangioma resection: global experience in techniques and outcomes. Int Forum Allergy Rhinol 6(2):156–161. 10.1002/alr.21645. Epub 2015 Dec 1. PMID: 26623968
2. Lieber S, Fernandez-Miranda JC. Anatomy of the Orbit., Neurol Surg J, B Skull Base (2020). ;81(4):319–332. doi: 10.1055/s-0040-1715096. Epub 2020 Sep 17. PMID: 33072474; PMCID: PMC7561454
3. Ohtsuka K, Hashimoto M, Suzuki Y (2005) Jan-Feb;49(1):49–55 A review of 244 orbital tumors in Japanese patients during a 21-year period: origins and locations. Jpn J Ophthalmol. 10.1007/s10384-004-0147-y. PMID: 15692775
4. El-Habashy DM. 971P Clinical and pathological characteristics of orbital tumours in patients diagnosed at the united states. Annals of Oncology 2020 Sep 31. S683. 10.1016/j.annonc.2020.08.1086
5. Kisser U, Heichel J, Glien A (2021) Rare Diseases of the Orbit. Seltene Erkrankungen der Orbita. Laryngorhinootologie 100(01):S1–S79. 10.1055/a-1384-4641
6. Zhang W, Rokohl AC, Guo Y, Yao K, Fan W, Heindl LM (2024) Global incidence and prevalence of malignant orbital tumors. Adv Ophthalmol Pract Res 4(3):128–133 PMID: 38952566; PMCID: PMC11215945
7. Patel BCK (2014) Malignant Orbital Tumors. In: Perry J, Singh A (eds) Clinical Ophthalmic Oncology. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-40492-4_13
8. Mohammad NK (2025) Orbital tumors: A retrospective analysis of cases from Iraq and orbital anatomical perspectives. Surg Neurol Int 16:62 Published 2025 Feb 28. 10.25259/SNI_38_2025
9. Reyes-Soto G, Carrillo-Hernández JF, Cacho-Díaz B et al (2024) Surgical treatment of orbital tumors in a single center: Analysis and results. Surg Neurol Int. ;15:122. Published 2024 Apr 5. 10.25259/SNI_1016_2023
10. Shinder R, Al-Zubidi N, Esmaeli B (2011) Survey of orbital tumors at a comprehensive cancer center in the United States. Head Neck 33(5):610–614. 10.1002/hed.21498
11. Ohtsuka K, Hashimoto M, Suzuki Y (2005) A review of 244 orbital tumors in Japanese patients during a 21-year period: origins and locations. Jpn J Ophthalmol 49(1):49–55. 10.1007/s10384-004-0147-y
12. Park HJ, Yang SH, Kim IS, Sung JH, Son BC, Lee SW (2008) Surgical treatment of orbital tumors at a single institution. J Korean Neurosurg Soc 44(3):146–150. 10.3340/jkns.2008.44.3.146
13. Park SJ, Huh J, Lee JK et al (2020) Measurement of proptosis using computed tomography based three-dimensional reconstruction software in patients with Graves' orbitopathy. Sci Rep 10:14554. 10.1038/s41598-020-71098-4

14. Markowski J, Jagosz-Kandziora E, Likus W et al (2014) Primary orbital tumors: a review of 122 cases during a 23-year period: a histo-clinical study in material from the ENT Department of the Medical University of Silesia. Med Sci Monit 20:988–994 Published 2014 Jun 16. 10.12659/MSM.890433
15. Mohammad NK (2025) Orbital tumors: A retrospective analysis of cases from Iraq and orbital anatomical perspectives. Surg Neurol Int 16:62 Published 2025 Feb 28. 10.25259/SNI_38_2025
16. Bonavolontà G, Strianese D, Grassi P et al (2013) An analysis of 2,480 space-occupying lesions of the orbit from 1976 to 2011. Ophthalmic Plast Reconstr Surg 29(2):79–86. 10.1097/IOP.0b013e31827a7622
17. Bagheri A, Ashtar-Nakhaie P, Aletaha M, Kheiri B, Veisi A (2023) A Survey on Orbital Space-Occupying Lesions during a Twelve-Year Period from a Referral Center in Iran. J Ophthalmic Vis Res 18(2):202–211 Published 2023 Apr 19. 10.18502/jovr.v18i2.13187
18. Vogele D, Sollmann N, Beck A et al (2022) Orbital Tumors-Clinical, Radiologic and Histopathologic Correlation. Diagnostics (Basel) 12(10):2376 Published 2022 Sep 30. 10.3390/diagnostics12102376
19. Shields JA, Shields CL, Scartozzi R (2004) Survey of 1264 patients with orbital tumors and simulating lesions: The 2002 Montgomery Lecture, part 1. Ophthalmology 111(5):997–1008. 10.1016/j.ophtha.2003.01.002
20. Demirci H, Shields CL, Karatza EC, Shields JA (2008) Orbital lymphoproliferative tumors: analysis of clinical features and systemic involvement in 160 cases. Ophthalmology 115(09):1626–1631 1631.e1–1631.e3
21. Laplant J, Cockerham K (2021) Primary Malignant Orbital Tumors. J Neurol Surg B Skull Base 82(1):81–90. 10.1055/s-0040-1722635
22. Zhang W, Rokohl AC, Guo Y, Yao K, Fan W, Heindl LM (2024) Global incidence and prevalence of malignant orbital tumors. Adv Ophthalmol Pract Res 4(3):128–133 Published 2024 Apr 13. 10.1016/j.aopr.2024.04.002
23. Shields JA, Bakewell B, Augsburger JJ, Flanagan JC (1984) Classification and incidence of space-occupying lesions of the orbit. A survey of 645 biopsies. Arch Ophthalmol 102(11):1606–1611. 10.1001/archopht.1984.01040031296011
24. Montano N, Lauretti L, D'Alessandris QG et al (2018) Orbital Tumors: Report of 70 Surgically Treated Cases. World Neurosurg 119:e449–e458. 10.1016/j.wneu.2018.07.181
25. Aftahy AK, Krauss P, Barz M et al (2021) Surgical Treatment of Intraorbital Lesions. World Neurosurg 155:e805–e813. 10.1016/j.wneu.2021.09.011

Figures

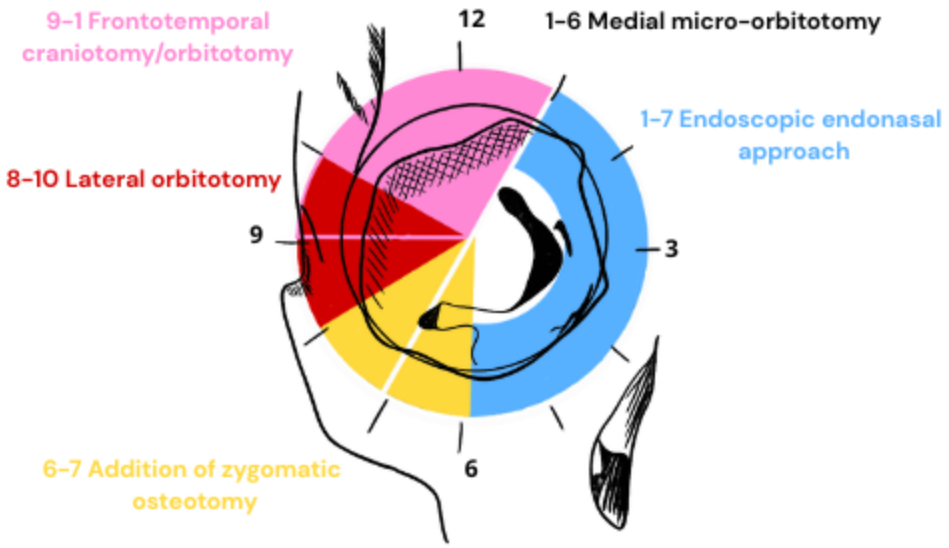


Figure 1

Clock diagram illustrating surgical access to the orbit, own sketch.

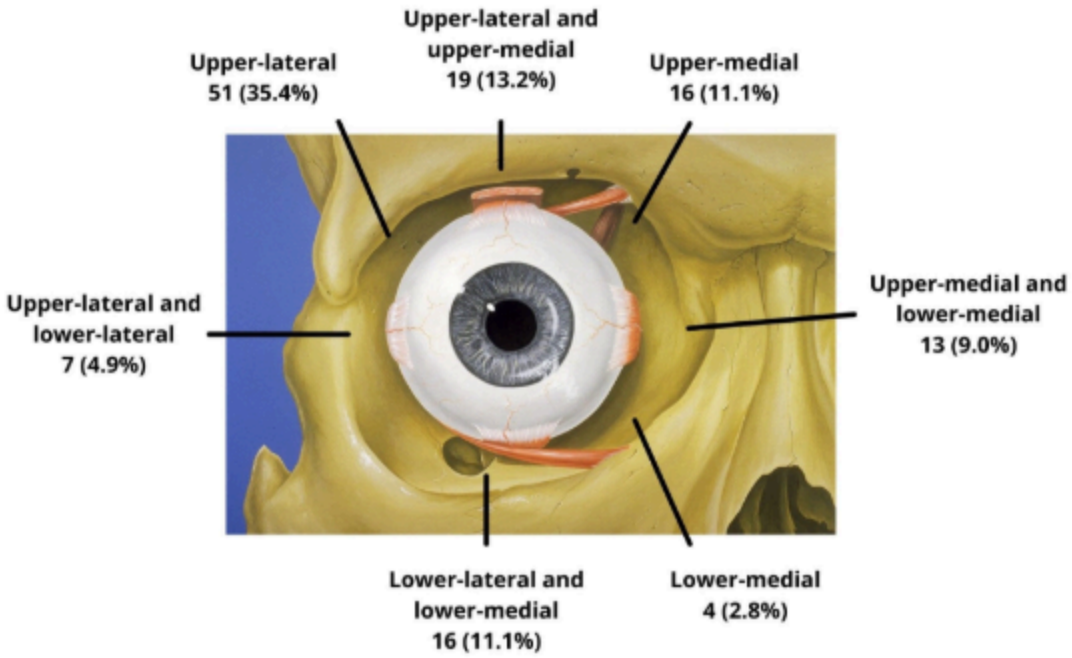


Figure 2

Tumor location

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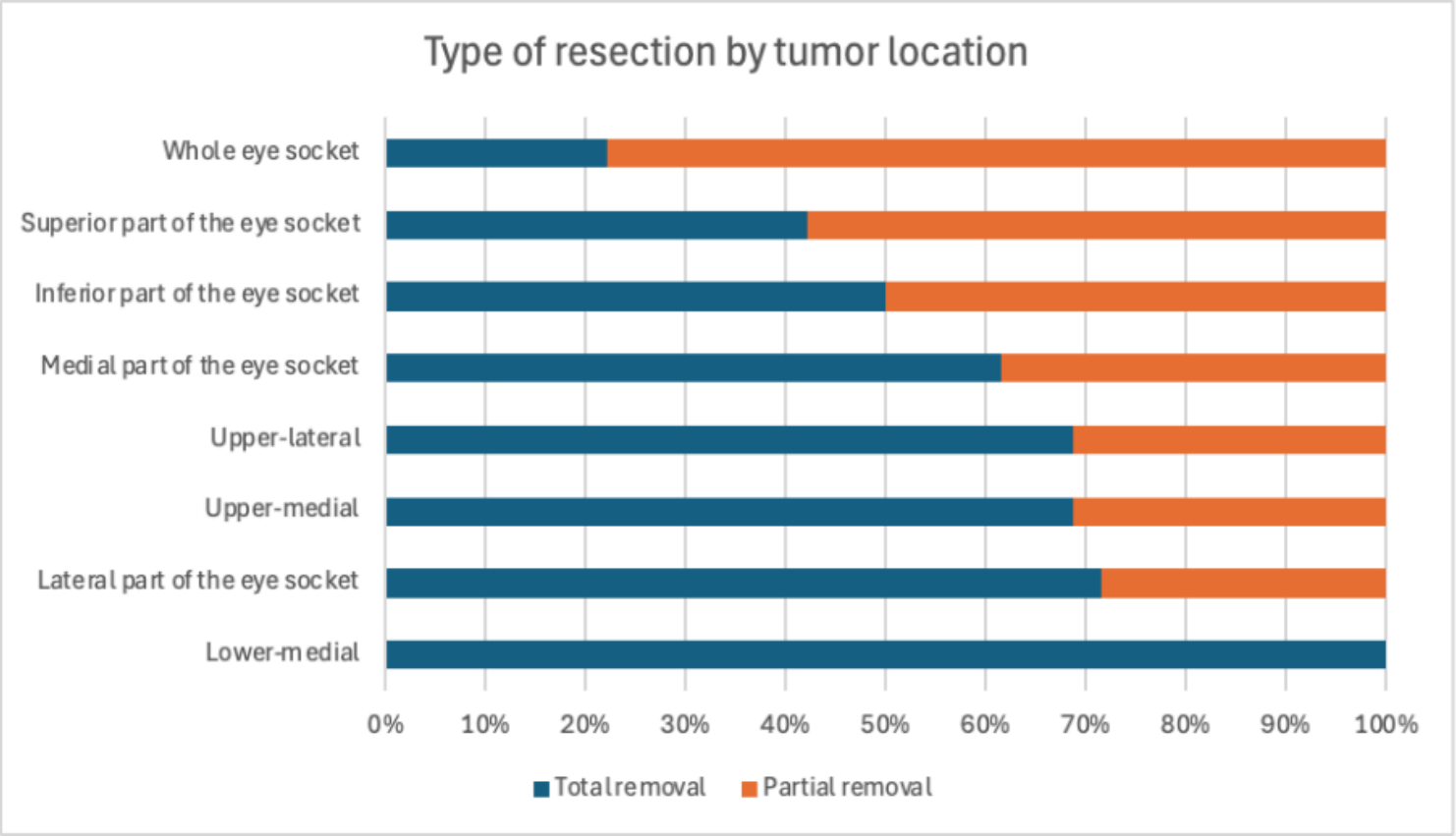


Figure 3

Distribution of total and partial removals across different tumor locations.

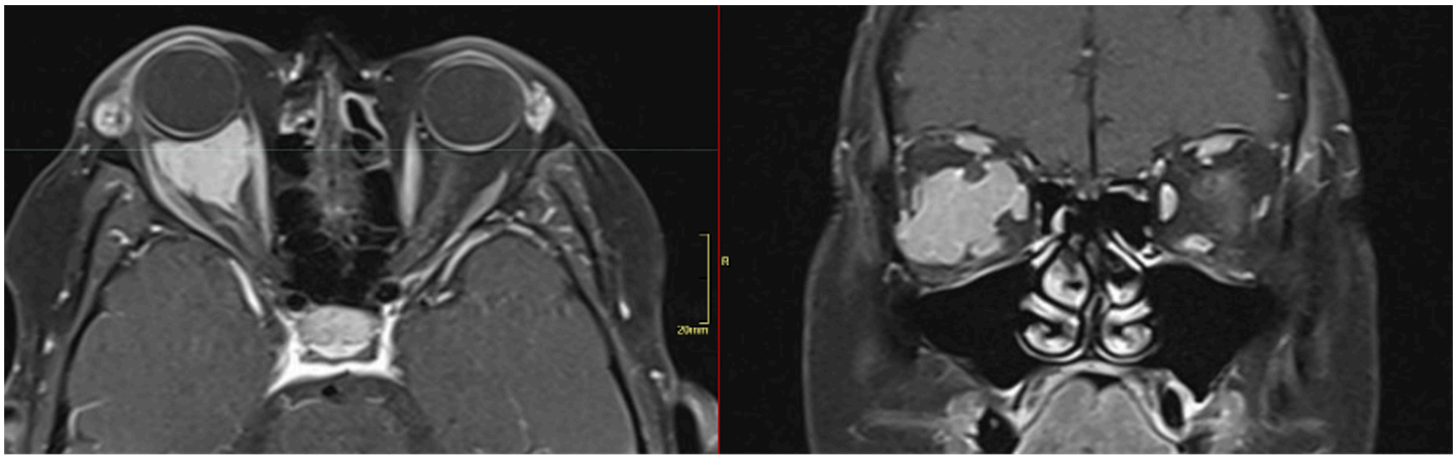


Figure 4

Case 1, rounded lesion located intraconally on the right sight in MRI.

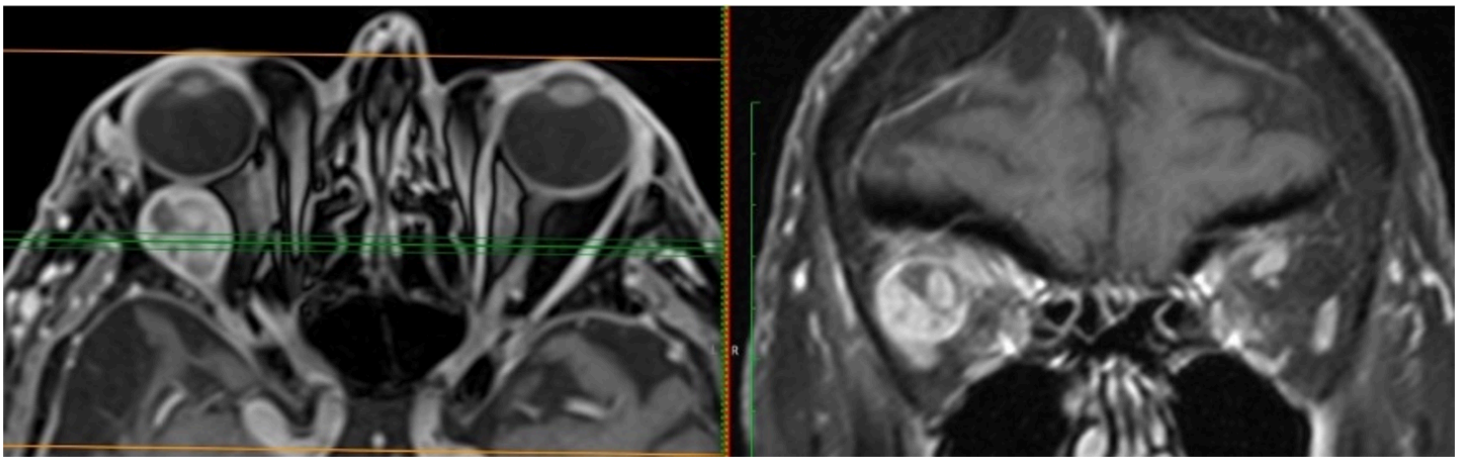


Figure 5

Case 2, well-delineated tumor with a homogeneous, intense enhancement pattern, exerting mass effect on the extraocular muscles on the right sight in MRI.

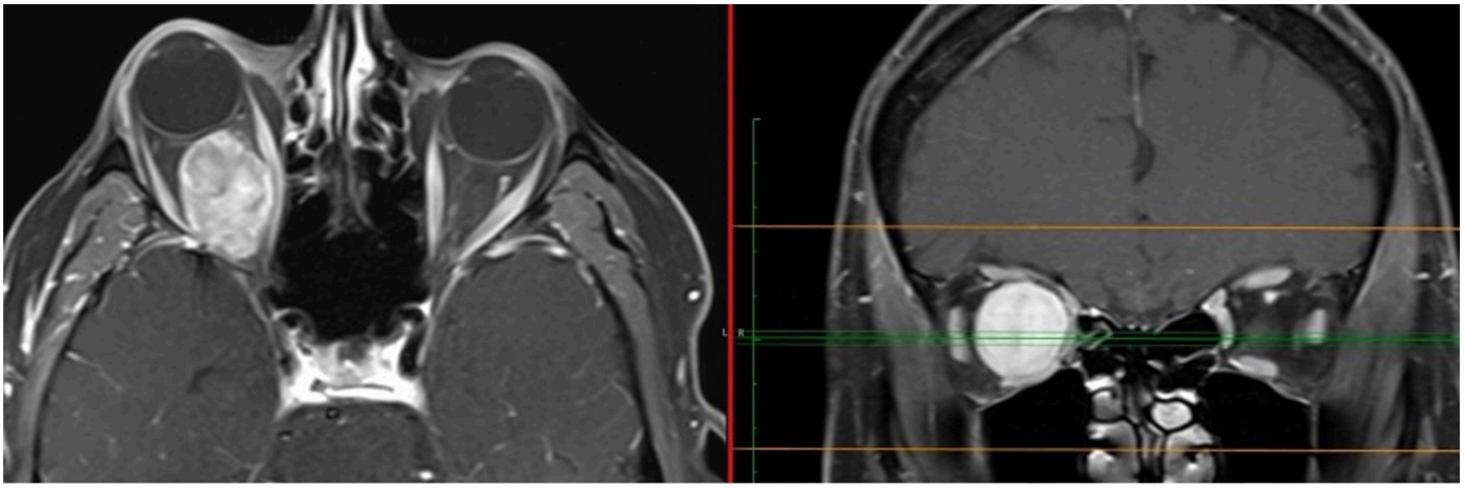


Figure 6

Case 3, mass located intraconally on the right side in MRI T1 FS +iv.



Figure 7

Case 3, CT scan after the removal of the tumor with the free fat graft filling the bed.

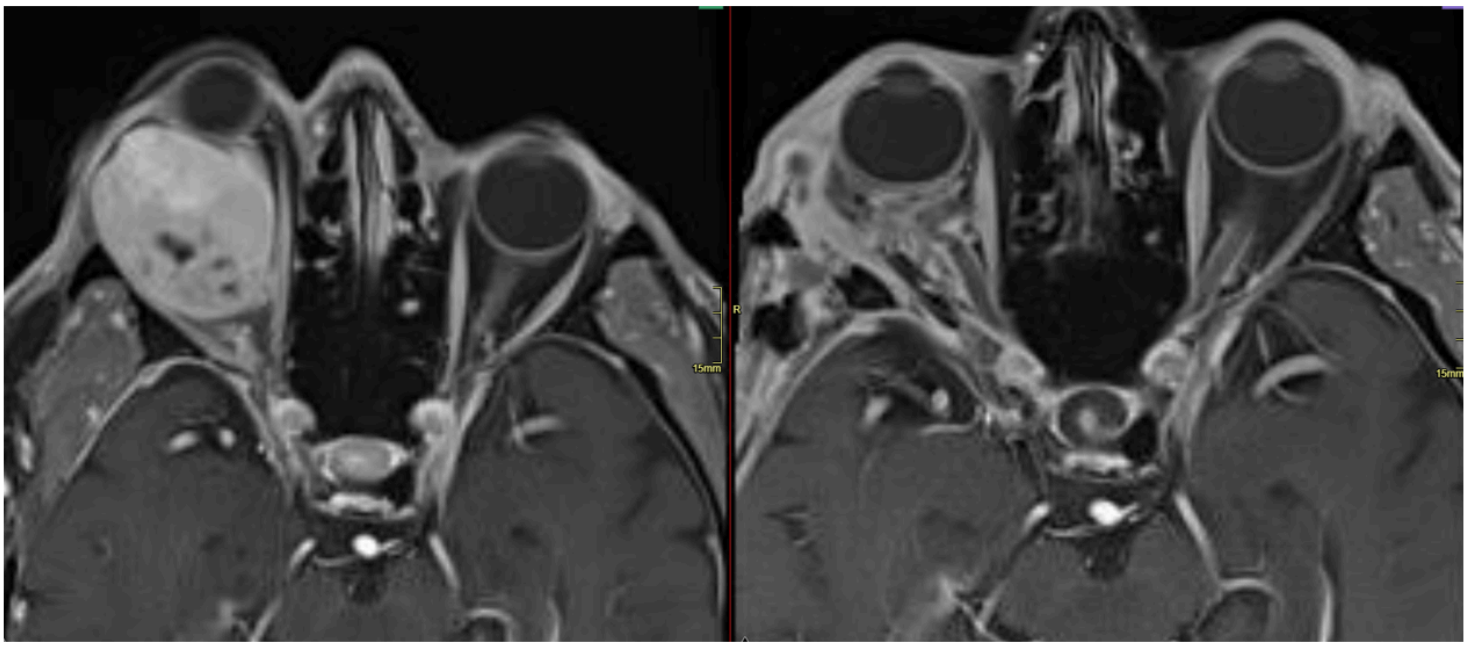


Figure 8

Case 4, on the left MRI preoperative, on the right after surgery.