Recurrent orbital solitary fibrous tumor: clinical and pathological insights from a Case Report and literature review

Case Report

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ABSTRACT

Solitary fibrous tumor (SFT) is an uncommon spindle cell neoplasm primarily originating in the pleura, with the orbit being its most frequent extra-pleural site, often leading to progressive unilateral exophthalmos. Immunohistochemical staining, particularly utilizing y CD34 and STAT6 markers, aids in its diagnosis. Tumors within the SFT spectrum are typically categorized as benign or showing low-grade malignancy; however, prevailing histological features lack prognostic predictive capability. Full surgical resection remains the key prognostic factor. Despite meticulous surgical removal, recurrences and metastases can arise. Surgical excision remains the preferred strategy for recurrent tumors, complemented by limited-efficacy adjunctive treatments. Prolonged and rigorous postoperative monitoring is vital. The rarity of orbital solitary fibrous tumor (OSFT) and its diagnostic challenges underscore the importance of continued research and clinical awareness. This study underscores the value and importance of early intervention and a comprehensive approach in addressing recurrent OSFT, thus augmenting patient outcomes and progressing treatment strategies.

Key Words: Orbit; Solitary fibrous tumor; Recurrence .

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INTRODUCTION

Solitary fibrous tumor (SFT) is a rare spindle-cell tumor of mesenchymal origin, first described in the pleura by Klemperer and Rabin in 1931[1]. It was later reported at several extrapleural sites, including peritoneum [2], liver [3], mediastinum [4], soft tissues [5] and skin [6]. The soft tissues of the orbit, yet another site unrelated to mesothelium, have also been reported as an additional extrapleural location.

Orbital Solitary Fibrous Tumor (OSFT) represents a rare and intriguing entity within the realm of ocular neoplasms. Despite its infrequency, OSFT has garnered increasing attention due to its unique clinical presentation, diagnostic challenges, and potential therapeutic implications.

the complex nature of OSFT holds paramount importance for oral and maxillofacial surgeons, ophthalmologists, and pathologists, as accurate diagnosis and effective therapeutic interventions rely on a thorough grasp of its distinctive features.

Through a case presentation, this article aims to provide a comprehensive exploration of OSFT, synthesizing current knowledge and shedding light on its clinical, pathological, and radiological intricacies. Moreover, the study delves into the multidisciplinary management approach for OSFT, concentrating on intricate surgical techniques and essential considerations for tumor removal to avoid recurrence.

CASE PRESENTATION:

An 81-year-old patient with a medical history of chronic smoking for 35 years, which ceased four years ago, and chronic alcoholism for 20 years, which stopped seven years ago, underwent enucleation of a solitary fibrous tumor in the left orbit seven years prior, with limited functional recovery.

The patient presented to the ophthalmology department complaining of painful exophthalmos of the left eyeball persisting for the past ten months. Ophthalmological examination revealed an infero-temporally misaligned exophthalmos that was painful, non-pulsatile, and non-blowing, yet irreducible and not exacerbated by bending forward or the Valsalva maneuver. No palpable mass was detected in the orbital region. Visual acuity was 1010/ in the right eye but limited to negative light perception in the left eye. Ocular motility was restricted in all directions in the left eye. Slit-lamp examination revealed elevated ocular pressure (35 mmHg) alongside optic nerve atrophy, thereby substantiating the reduced visual acuity observed in the left eye. Fundus examination showed no significant findings.

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The orbital MRI unveiled a left intraorbital tissue mass situated in the lower posteromedial region. This mass, characterized by a bilobed oval shape, displayed well-defined and regular contours. It manifested an intermediate signal intensity on both T1 and T2-weighted sequences and exhibited enhancement in a predominantly homogeneous manner following contrast administration (figure 1). The dimensions of the mass were measured at 40 x 38 x 34 mm. Notably, this mass induced grade 1 exophtalmos, lateral displacement of the optic nerve, medially lytic disruption of the papyraceous lamina, and infiltration of the lacrimonasal and frontonasal canal. Additionally, it demonstrated inferior infiltration into the infraorbital fissure.

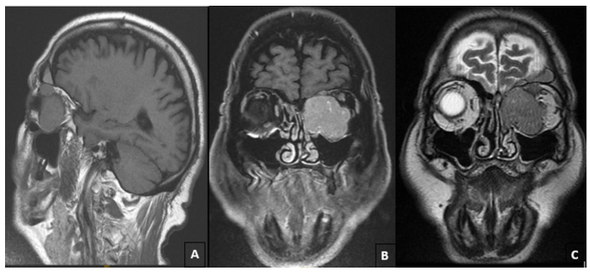

Figure 1. Magnetic resonance images showing a well-circumscribed bilobed tumor in the lower posteromedial quadrant of the left orbit. A: Isointense mixed-signal on T1 weighted image; B: homogeneous enhancement on contrast-enhanced T1 weighted image; C: Intermediate signal on T2 weighted image.

A biopsy was conducted using local anesthesia, leading to the identification of a solitary fibrous tumor. Subsequently, the decision was made to refer the patient to the maxillofacial surgery department for exenteration, ensuring complete removal with healthy margins. The histological study revealed a benign fusocellular tumor proliferation, while the immunohistochemical analysis demonstrated CD34 and STAT6 expression, confirming the diagnosis of solitary fibrous tumor (figure 2).

Post-operatively, the patient experienced no significant complications. A follow-up orbital CT scan performed six months later showed no signs of recurrence.

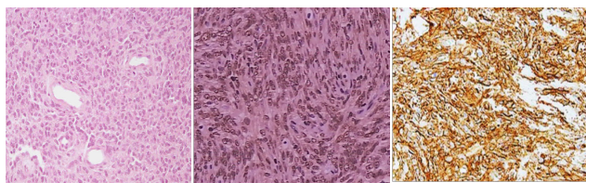

Figure 2. A: Densely arranged spindle-shaped cells. H&E stain, original magnification × 20; B: CD34, original magnification × 200; C: STAT6, original magnification × 200. STAT6: signal transducer and activator of transcription 6

DISCUSSION

Recent studies have revealed that solitary fibrous tumor (SFT) manifest in various anatomical sites, displaying a wide range of clinical and radiological characteristics [7]. Within this spectrum, Orbital SFT, categorized as an extrapleural SFT, is recognized as an uncommon orbital tumor with indistinct clinical features. Recent advancements in our understanding of OSFT have indicated that it exhibits a higher degree of aggressiveness compared to its pleural counterpart, leading to an unpredictable prognosis [8]. Consequently, there is a pressing need to delve into the clinical attributes and underlying mechanisms of this tumor, given its significant implications in clinical practice.

Based on the findings of previous studies, OSFT can occur across a wide age range (from five months to 94 years; mean 43.6 years), but it predominantly affects adults [9] with no significant sex ratio [10,11].

Solitary fibrous tumors exhibit a diverse distribution throughout the orbit, lacking lateralization, and can occur within both intra- and extra-conical regions, including involvement of the optic nerve sheath. Additionally, SFT may manifest in palpebral, conjunctival, bulbar, or caruncular locations. The growth pattern of SFT is typically slow and characterized by gradual progression [11]. Tumor sizes vary considerably, with dimensions ranging from centimeters to tens of centimeters, depending on extensions originating from adjacent sites [7]. Within the orbital context, these tumors can attain lengths exceeding 50 mm [12]. Notably, SFTs have the capacity to extend into neighboring structures, such as the intracranial region through the sphenoidal fissure, or medially via sinus cavities to reach the pituitary lodge.

Symptoms of OSFTs exhibit variations based on tumor size and location. Common presentations include proptosis, eyelid swelling, diplopia, ptosis, ocular motility restriction, and a slow-growing painless palpable mass in the periocular region [13]. Visual acuity is generally preserved or slightly impaired in large tumors, as a result of corneal ulceration, optical nerve or vascular (especially venous) compression leading sometimes to potential blindness of the affected eye [14]. Fundus examination typically appears unremarkable, although some patients may exhibit dilated vessels, optic disc, and macular edema, as well as optic nerve atrophy due to elevated intraorbital and intraocular pressure [1,15]. In the context of our presented case, the initial surgery resulted in impaired visual acuity, attributed to the compression of the optic nerve.

The imaging characteristics of OSFT can vary depending on the size, location, and histological features of the tumor. The computed tomography (CT) images reveal well-defined, compact tumors with isodense to muscle or brain tissue, exhibiting diffuse or focal enhancement upon contrast injection. Erosion, bone remodeling, or imprinting may also be observed, irrespective of the subsequent clinical course [16].

In some cases, infiltration of the oculomotor muscles or optic nerve may be apparent. The presence of cystic components or calcifications is possible. CT plays a valuable role in characterizing, measuring, and categorizing the tumor based on its location within the orbit. Additionally, it aids in surgical approach selection.

On magnetic resonance imaging (MRI), the majority of TFS demonstrate isosignal or hyposignal intensity relative to muscle tissue on T1-weighted sequences [17]. T2-weighted sequences frequently exhibit heterogeneous signals, allowing for the identification of fibrous and cellular components, as well as the presence of edema and peri-tumoral vascularization. Enhancement with contrast administration is consistently observed. Moreover, MRI provides detailed information of intracranial extension, including intradural involvement.

It is important to note that these imaging characteristics are not specific to OSFT and can overlap with other orbital neoplasms. Therefore, a combination of imaging findings, histopathological examination, and immunohistochemical analysis is essential for accurate diagnosis and differentiation from other orbital tumors. Macroscopically, OSFT present distinct boundaries with smooth edges, displaying varying degrees of lobulation and a color ranging from yellow to brown. They possess an elastic consistency and may occasionally be enclosed by a translucent pseudocapsule. Adhesion to neighboring tissues is sometimes observed, as well as potential encasement of peripheral nerves and blood vessels [10].

Histologically, OSFT is typified by a proliferation of spindle-shaped cells arranged in a "patternless" pattern or a "hemangiopericytomatous" pattern. The neoplastic cells exhibit uniformity in both shape and size, featuring oval to elongated nuclei with scant cytoplasm. The tumor stroma displays a collagen-rich composition, lending the tumor a fibrous appearance. Mitotic activity is generally low, though certain cases may present higher mitotic rates, suggestive of potential aggressiveness. Notably, OSFT typically lacks necrosis, a characteristic distinguishing it from malignant sarcomas.

For confirmation of diagnosis and differentiation from other spindle cell neoplasms, immunohistochemical staining plays a crucial role. CD34 emerges as the most consistent and reliable marker for OSFT, displaying strong positivity in nearly all cases. Additionally, other markers such as CD99, BCL-2, and STAT6 are frequently expressed in OSFT.

In contrast, markers like smooth muscle actin (SMA) and desmin tend to be negative, facilitating the differentiation of OSFT from smooth muscle and myofibroblastic tumors. In the case presented, the accurate diagnosis of SFT was achieved through the application of STAT6 and CD34 markers, which collectively guided the diagnostic process.

Recent investigations have unveiled insights into the molecular attributes of OSFT. The NAB2-STAT6 gene fusion is recognized as a recurrent genetic alteration in OSFT [18]. This genetic fusion entails the NAB2 (NGFI-A-binding protein 2) gene located on chromosome 12q13 and the STAT6 (signal transducer and activator of transcription 6) gene located on chromosome 12q13.3. Consequently, the NAB2-STAT6 fusion culminates in constitutive activation of STAT6, assuming a pivotal role in the pathogenesis of OSFT. Such advancements in molecular characterization hold promising implications for future research, aiding in refined diagnostic approaches and potentially informing targeted therapeutic strategies.

Owing to the rarity of OSFT, the existing body of literature exploring treatment approaches is limited. However, akin to numerous soft tissue tumors, the primary therapeutic approach for OSFT entails en bloc surgical resection to achieve negative margins while preserving visual function and minimizing morbidity. However, the location and extent of the tumor can pose challenges in achieving complete excision, especially when the tumor involves critical structures such as the optic nerve or extraocular muscles. In our case, the tumor invaded the infraorbital fissure and the homolateral nasolacrimal and frontonasal ducts.

To overcome these challenges, orbital surgeons (ophthalmologist, neurosurgeon, maxillofacial surgeon) employ various surgical techniques, such as transconjunctival, transcranial, or lateral orbitotomy approaches. The choice of surgical approach is contingent upon the lesion's location. A systematic orbital division, employing a system of four quadrants based on anatomical landmarks, proves valuable in guiding surgical decisions. Notably, a lateral orbitotomy is commonly employed for lesions situated in the superomedial or inferomedial quadrant, positioned behind the globe, or within the muscle cone. The importance of achieving complete initial excision is underscored, as incomplete resection may lead to tumor recurrence and further complications during subsequent surgical interventions. In cases of recurrence, as seen in our presented case, more extensive excision leading to exenteration is required, and careful examination of the surgical margin should be performed, if deemed necessary [19].

Following an exhaustive examination of postoperative recurrence factors in OSFT across a span of two decades of literature, P. Yang [20] observed that a limited number of ophthalmologists possessed the expertise to perform osteotomies on bones affected by OSFTs. Two primary reasons accounted for this: firstly, an underestimation of the nature of OSFTs led some ophthalmologists to opt for in situ resection only, neglecting the potential for more interventions; secondly, inadequate attention to details in orbital CT and MRI readings led to oversight of the tumor's propensity for intracranial structure invasion through the cranio-orbital junction. In the course of our investigation, we encountered an impediment in obtaining an MRI scan of

the primary tumor, thereby precluding an analysis of tumor extension and potential factors contributing to recurrence. In cases where complete tumor resection is challenging or not achievable, adjuvant therapies play a vital role in improving treatment outcomes and reducing the risk of tumor recurrence. Gamma Knife radiosurgery has been employed to target residual tumor cells post-surgery, although its efficacy remains yet to be substantiated [21]. Additionally, the exploration of chemotherapy as an adjuvant therapy for OSFT has been undertaken, particularly in instances where non-operable recurrence or metastatic disease is present [11].

CONCLUSION

Orbital SFT exhibits diverse and non-specific clinical presentations. Radiological characteristics demonstrate significant variability, with only a limited number of consistent features. To distinguish SFT from histologic mimics, nuclear staining for STAT6, in conjunction with positive CD34 staining, serves as a diagnostic adjunct. In the majority of cases, complete gross resection or more aggressive wide excision represents the preferred treatment approach. Managing OSFT recurrence demands a multidisciplinary approach, emphasizing meticulous preoperative evaluation and targeted therapies. By enhancing our understanding and vigilance, we can achieve improved patient outcomes and advance treatment strategies.

Conflicts of interest

There are no conflicts of interest

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