American Journal of Ophthalmology Case Reports 26 (2022) 101513

Contents lists available at ScienceDirect

American Journal of Ophthalmology Case Reports

journal homepage: www.ajocasereports.com/

An intraocular solitary fibrous tumor/hemangiopericytoma with extrascleral extension: Case report and review of literature

Lucy I. Mudie [a], E. Lacey Echalier [a], Matthew A. Powers [a], Ahmed Gilani [b], Ryan D. Larochelle [a], Scott C.N. Oliver [a], Sophie D. Liao [a,*]

[a] Sue Anschutz-Rodgers Eye Center, Department of Ophthalmology, University of Colorado School of Medicine, 1675 Aurora Court FS 731, Aurora, CO, 80045, USA
[b] Department of Pathology, University of Colorado School of Medicine, 13123 East 16th Ave, Aurora, CO, 80045, USA

ARTICLE INFO

Keywords:
Intraocular hemangiopericytoma
Solitary fibrous tumor
Extrascleral extension

ABSTRACT

Purpose: To report a case of intraocular solitary fibrous tumor/hemangiopericytoma (SFT/HPC) complicated by extrascleral extension and to review the current literature regarding intraocular SFT/HPC.
Observations: A twenty-two year old male presented with decreased vision in his left eye and was found to have a subretinal mass with extrascleral extension. He underwent enucleation of his left eye and histopathology confirmed a diagnosis of SFT/HPC.
Conclusions and importance: To our knowledge, this is the seventh case of intraocular SFT/HPC ever reported and the first to report extrascleral extension. At the time of publication, there was no evidence of metastases. Extensive clinical, ophthalmic and radiographic imaging, and histopathologic data are presented to contribute to the current understanding of intraocular SFT/HPC.

1. Introduction

Hemangiopericytoma (HPC) is a rare tumor of mesenchymal origin. The term was first described in 1942 by Stout & Murray[1] in a case series of nine patients, one of which involved infraorbital soft tissue. Previously it was thought that HPC should be differentiated from other (but closely related) tumors of mesenchymal origin such as solitary fibrous tumors (SFT) and fibrous histiocytomas.[2] Identification of an oncogenic fusion between *NAB2* and *STAT6* genes on both entities led to the understanding that they represent a histologic spectrum of the same tumor rather than distinct diseases. In 2016 the World Health Organization Classification of Tumors of the Central Nervous System was revised to include SFT and HPC as the same neoplasm, now designated as SFT/HPC.[3] On histology, both SFT/HPC show a haphazard or "patternless" architecture, with HPC classically having "staghorn" branching vessels and SFT showing a spindle-cell matrix with "ropey" collagen. SFT/HPC which show a typical SFT pattern and less than 5 mitoses/10 HPF are considered grade I, those with an HPC pattern and less than 5 mitoses/10 HPF are grade II, and those with an HPC pattern and at least 5 mitoses/10 HPF are grade III. All of these categories have nuclear STAT6 expression and share fusion of *NAB2-STAT6*.[3]

SFT/HPC can occur in any tissue, although the ophthalmologist usually encounters them in orbital soft tissues where they represent <1% of orbital tumors.[4] Common presenting signs and symptoms are related to mass effects on adjacent structures such as proptosis and restriction of extraocular motility. Patients are usually diagnosed in middle age without sex or racial predilection.[4] Extraocular orbital SFT/HPC are usually slow-growing tumors with variable malignant potential.[4] The frequency of histologic malignant transformation and metastatic spread has been reported to be 15–30%.[2] Intraocular SFT/HPCs are extremely rare, with only six cases previously reported.[3,5–9] Four of these cases report SFT/HPC arising from the choroid,[3,7–9] one reported supraciliary origin,[5] and the sixth reported ciliary body origin of the tumor.[6] None reported extrascleral extension. Here we report the first case of SFT/HPC arising from the choroid with extrascleral extension and review the literature published to date surrounding intraocular SFT/HPC.

2. Case report

A twenty-two-year-old Hispanic male presented to the Ocular Oncology service at the University of Colorado Hospital with no significant past medical or ocular history. He had no personal or family history of melanoma or tuberculosis. He was a current daily smoker of

* Corresponding author. Sue Anschutz-Rodgers Eye Center, University of Colorado School of Medicine, 1675 Aurora Court, F731, Aurora, CO, 80045, USA.
E-mail address: sophie.liao@cuanschutz.edu (S.D. Liao).

https://doi.org/10.1016/j.ajoc.2022.101513
Received 23 December 2020; Received in revised form 31 January 2022; Accepted 3 April 2022
Available online 10 April 2022

0.25 packs/day, but he was not immunosuppressed and had no other risk factors for malignancy. He reported distorted vision in his left eye with some areas of "missing" vision over the past month. On his initial eye exam, his visual acuity was 20/20-2 in the right eye and 20/150 in the left eye. He had a 2+ relative afferent pupillary defect in the left eye. His intraocular pressures were 15 mmHg in the right eye and 12 mmHg in the left eye. Slit lamp exam and indirect ophthalmoscopy of the right eye were normal. On slit lamp examination of his left eye, there was rare anterior chamber cell and 2+ vitreous cell. On indirect fundoscopy, there was an inferior serous retinal detachment involving the macula and fovea, and an inferior, mottled, partially pigmented subretinal mass with white foci extending up into the fovea and peripapillary region. Fundoscopic images are shown in Fig. 1 and Brightness scan (B-scan) ultrasonography is shown in Fig. 2a. There was no evidence of extrascleral extension at this initial presentation.

A full laboratory workup was unrevealing. Transscleral biopsy was recommended, but was not pursued by the patient due to lack of insurance. Seventeen months later, he was seen by an outside optometrist for worsening vision. An MRI of the brain without contrast demonstrated a large intraocular mass with extrascleral extension (Fig. 2b). His exam showed no light perception vision in his left eye, and a large intraocular mass associated with a total retinal detachment and sub retinal hemorrhages. His B-scan at this follow-up visit further confirmed extrascleral extension (Fig. 3).

Urgent enucleation was performed, augmented by a medial lid crease anterior orbitotomy to directly visualize the extraocular component of the mass as well as transection of the optic nerve. The globe and mass were removed en bloc with 20 mm of optic nerve attached without complication.

The gross specimen showed a well-circumscribed mass, 17 mm in largest dimension (anterior-posterior) and 11 mm in the supero-inferior dimension (Fig. 4a). The extraocular portion of the tumor measured 10 mm in largest dimension. Microscopically, the mass showed a spindle cell neoplasm with jumbled and storiform architecture and prominent branching vascular pattern (Fig. 4b and c). It was strongly and diffusely positive for vimentin and STAT6 (Fig. 4d), weakly positive for CD34, and negative for Smooth Muscle Actin (SMA), S100, SOX10, MelanA, HMB45 and SSTR2A. Increased mitosis was present (up to 8/10 High-Powered-Field). MIB-1 expression was overall less than 3% but focally reached up to 5%. No necrosis was identified. The tumor was grossly and microscopically separate from the optic nerve, abutting but not involving the optic nerve dura. Although focal retinal calcification was noted, no involvement of the retina was seen. Given the histology and the immunopositivity for STAT6 (a surrogate for *NAB2-STAT6* fusion), a diagnosis of SFT/HPC was made. The patient's post-operative course was uncomplicated, although he was again lost to follow up after one month so no metastatic work up was completed.

3. Discussion and literature review

To our knowledge this is the first reported case of intraocular SFT/HPC with extrascleral extension. Six other case reports of intraocular SFT/HPC exist (see Table 1), none of which had extrascleral extension.[3,5–9] Orbital SFT/HPC are less rare, although they are still found in less than 1% of all orbital biopsies.[10,11] No data exists on the epidemiology of intraocular SFT/HPC beyond the aforementioned case reports. All six cases originated from the uvea, with four of choroidal origin,[3,7–9] one of ciliary origin[6] and one supraciliary.[5] Interestingly, a case report by Diniz et al.[11] reported a SFT/HPC arising in the orbit behind the globe causing compression of the globe and mimicking an intraocular tumor. No race, ethnicity or gender predilection is known for SFT/HPC. Including our case report, 4 cases of intraocular SFT/HPC have been reported in men and three in women. Although the tumor usually presents in patients aged 20–70 years,[11] the supraciliary SFT/HPC was reported in a ten-year-old child.[5]

When intraocular SFT/HPC is first encountered, it is often suspected

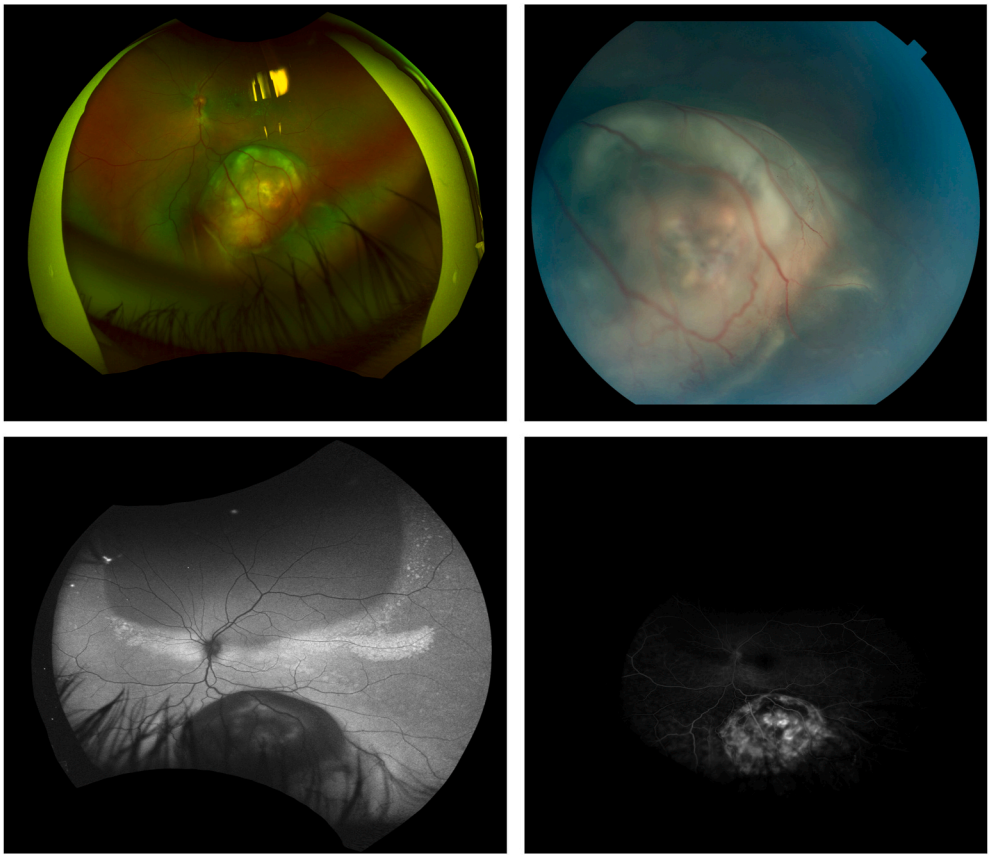

Fig. 1a. (top left). Ultra-wide field optomap images of left fundus at initial presentation, showing a large subretinal mass in the left eye with surrounding subretinal fluid.
Fig. 1b (top right). Close-up color photo of left eye subretinal mass, displaying overlying telangiectatic retinal vessels, subretinal fluid, and mottled appearance of the tumor.
Fig. 1c (bottom left). Ultra-wide field fundus autofluorescence of left eye showing a hypoautofluorescent mass with surrounding subretinal fluid and high-water mark through the macula and superior retinal periphery.
Fig. 1d (bottom right). Ultra-wide field image of fluorescein angiogram of left eye at 1 minute and 50 seconds, showing peripheral perivascular retinal vascular leakage and ferning, as well as patchy leakage from the mass and pooling into the subretinal space. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

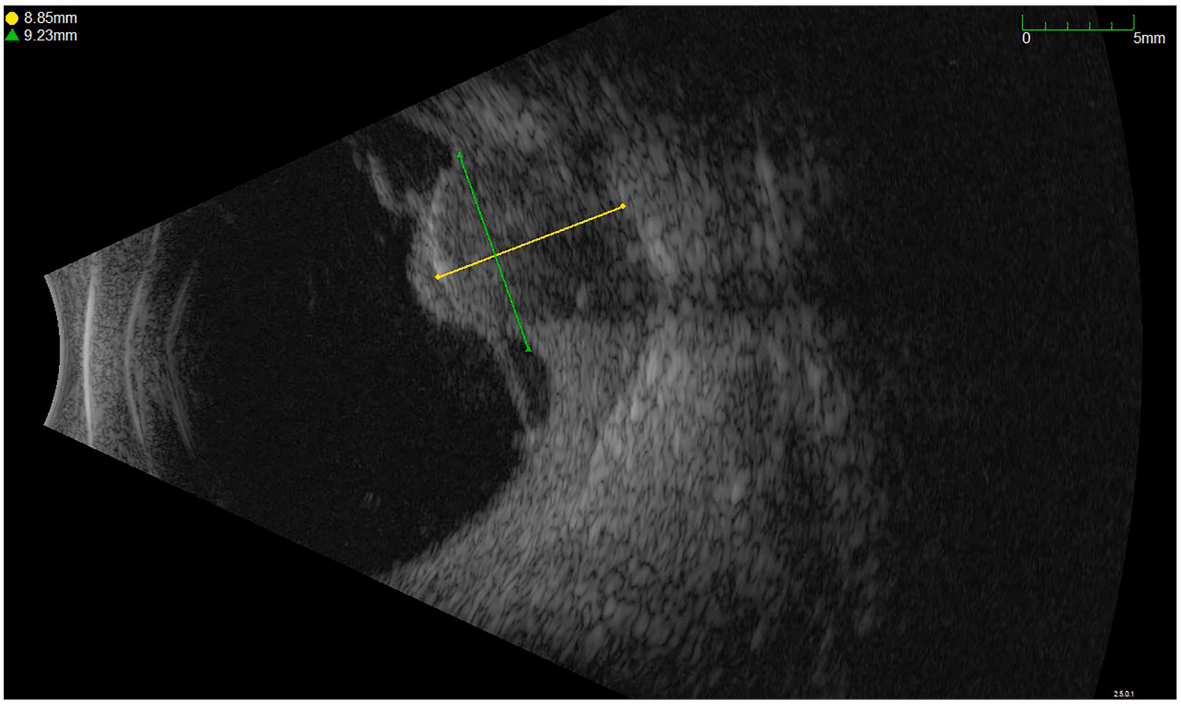

Fig. 2a. Brightness scan of left eye subretinal mass, 8.85mm × 9.23mm hypoechoic choroidal mass with hyperechoic areas on the surface and associated shadowing. The mass had low internal reflectivity on amplitude scan (not pictured).

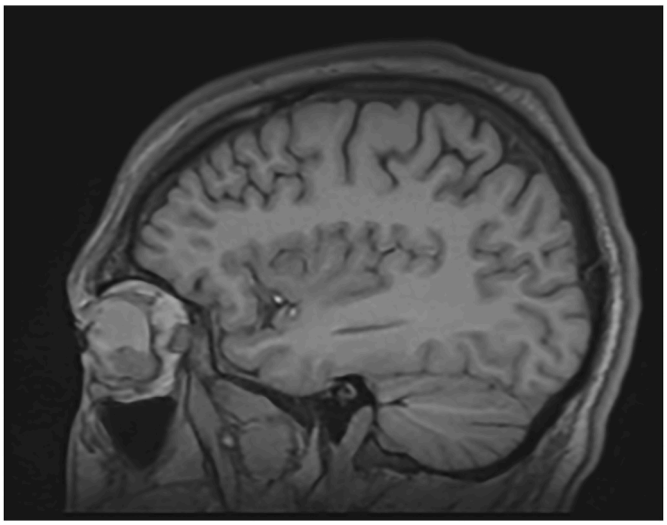

Fig. 2b. MRI brain without contrast, T1-weighted sagittal image showing inferior intraocular mass of left eye with extrascleral extension.

to be amelanotic melanoma or spindle cell melanoma with a differential diagnosis of leiomyoma, choroidal hemangioma or metastatic carcinoma.[3,10] Extraocular orbital SFT/HPC typically arises as a painless, unilateral tumor within the muscle cone.[11,12] Patients may present with painless proptosis, visual disturbances, ocular motility restriction, a palpable mass, or blepharoptosis.[11,12] The presentation of intraocular SFT/HPC ranges broadly, including serous retinal detachments,[7,8] blurred vision,[6,9] intermittent eye pain,[5] and in one case was an incidental finding on a routine eye exam.[3] No sensitive or specific radiographic features are known for SFT/HPC. Prior reports suggest the tumor is usually isointense on MRI T1 weighted images and strongly enhances with contrast.[4–6,11,12]

Accurate diagnosis requires histopathologic evaluation. The classic histologic signs of SFT/HPC include dense, vascular, hypercellular spindle-shaped cells and branching blood vessels, often called "staghorn vessels".[2,4] Immunohistostaining helps further identify SFT/HPC. Our specimen was strongly and diffusely positive for vimentin and STAT6 (a highly specific surrogate for NAB2-STAT6 fusion), weakly positive for CD34 and negative for SMA. It was also negative for S100, SOX10, MelanA, HMB45, and SSTR2A. The STAT6 immunostain became routinely available around ten years ago, so only the more recent case reports mentioned this stain. Rinaldo et al.[3] reported diffuse positivity for STAT6 and vimentin in their specimen, while it was negative for CD34, S100, MelanA and HMB45. Case reports published prior to the availability of STAT6 report tumor positivity for vimentin and SMA, and negativity for melanoma markers including S100, MelanA and HMB45.[5,6,8,9] SFT/HPC from outside the globe (including the orbit, nasal cavity, pleura and viscera) have also been found to show vimentin and CD34 positivity.[2,13,14] Current WHO Classification of Tumors of the Eye however does not specify a consensus criteria for SFT/HPC of the orbit or globe, given the rarity of the disease and lack of data on long-term prognosis. Although our patient's tumor can be classified as HPC WHO grade III according to the criteria established for CNS tumors, whether this applies to orbital or intraocular SFT/HPC is unclear.

Given the rarity of intraocular SFT/HPC, no clear management guidelines exist. In our case, and in five out of the six prior case reports, the affected eye was enucleated due to concern for malignancy.[3,5,6,8,9] The one eye that was not enucleated had a choroidal mass found on exam in 1973; it was manged with Xenon arc photocoagulation for associated serous retinal detachment, and then observed with serial exams every 6–12 months.[7] The intraocular mass remained stable in size, and no extension of the retinal detachment occurred after photocoagulation. Eventually, in 1981, the patient succumbed to end-stage liver disease secondary to alcohol misuse, and examination of the globes at autopsy confirmed diagnosis of intraocular SFT/HPC. Three cases of intraocular SFT/HPC had no evidence of metastases at diagnosis but did not have any significant follow up at the time of publication.[5,6,9] One case was followed for two years after enucleation without evidence of recurrence or metastatic spread,[8] and the final case had no evidence of extrascleral extension or metastasis at time of enucleation and diagnosis, but at four years follow up was found to have hepatic and calvarial

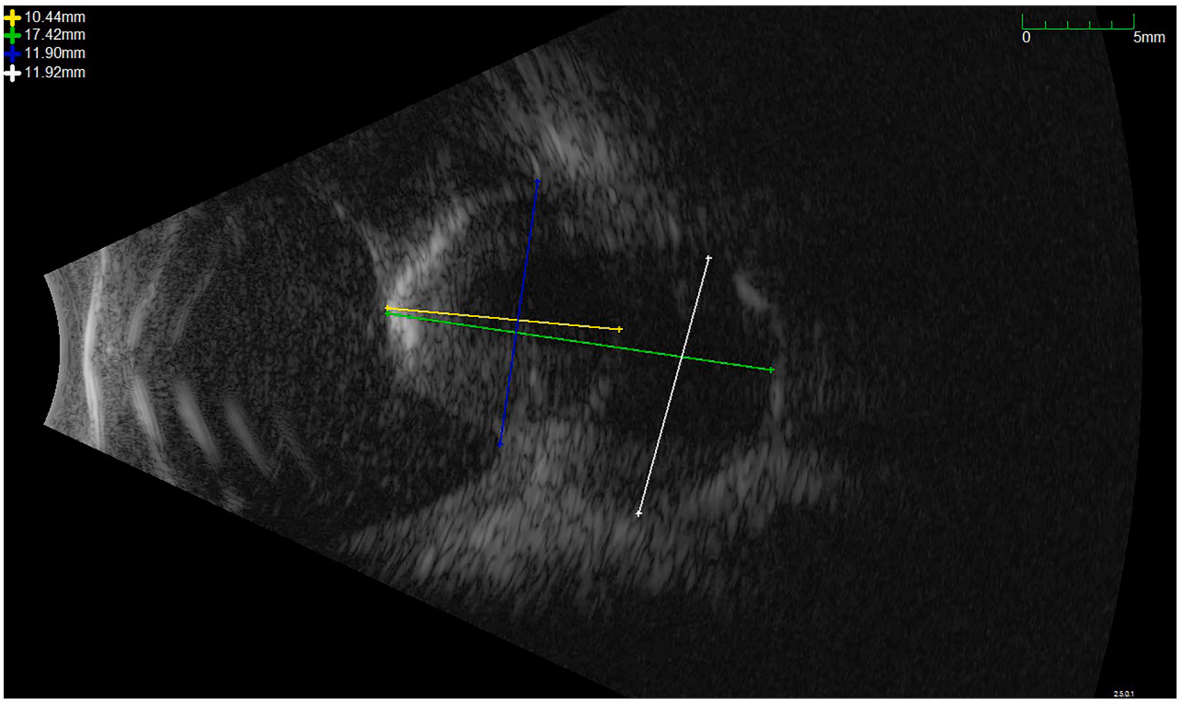

Fig. 3. B-scan ultrasonography of the left eye at follow up, showing the choroidal mass, now with clear extrascleral extension.

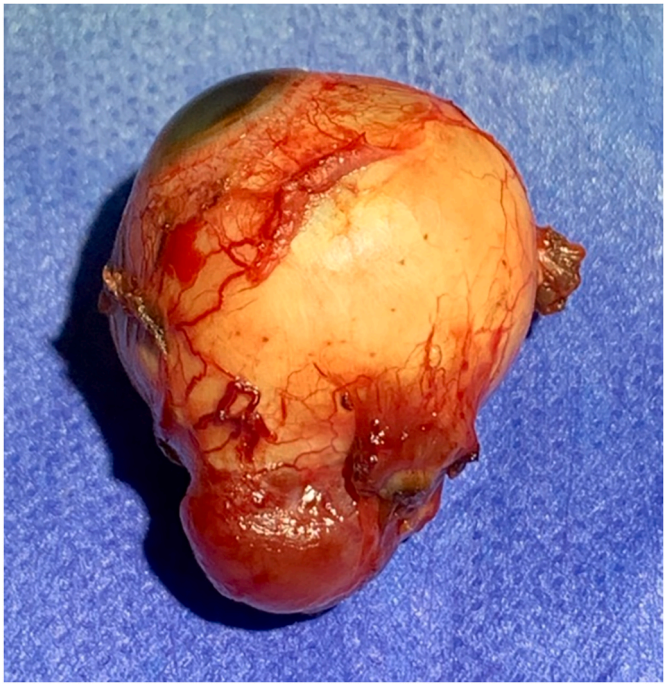

Fig. 4a. Gross photo of globe after removal en bloc.

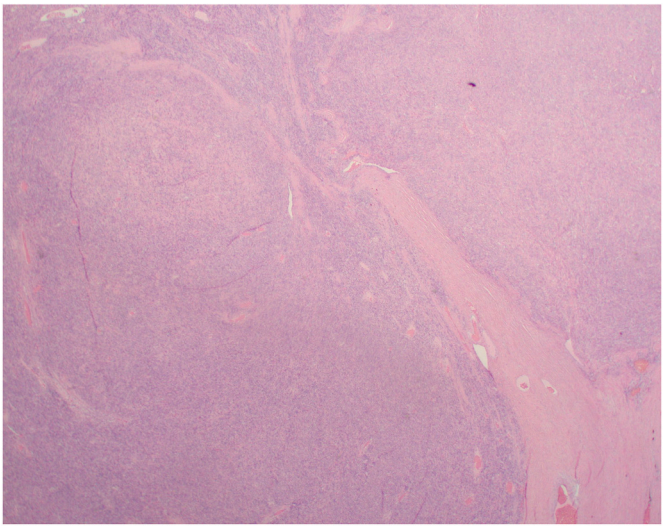

Fig. 4b. Hematoxylin & eosin (H&E) stain of tumor showing spindle cell lesion with branching vessels, 40x magnification.

metastases.[3] This patient ultimately died due to his metastatic disease eight years after diagnosis of his intraocular tumor.

Similar to intraocular SFT/HPC, orbital SFT/HPC is a primarily surgical disease, usually managed with complete excision of the tumor and adjuvant radiation therapy when available.[2]

There are no known prognostic factors for intraocular SFT/HPC, and the rate of malignant transformation is unknown. For orbital SFT/HPC, the frequency of histologic malignant transformation and metastatic disease has been estimated to be 15–30%.[2] The prognosis for recurrence and survival appears to depend on larger tumor size (>5 cm), metastatic disease at presentation and mitotic index >4 mitoses per 10 high-power fields.[2,4] In one study of orbital SFT/HPC, the median time to recurrence was five years, suggesting close follow up is warranted during this period.[2]

The major limitations of this case report are the lack of metastatic work up and lack of follow up at the time of publication. Although these were planned, the patient's lack of insurance has resulted in delays in care. Furthermore, our management of a single patient cannot be generalized to other cases. Despite these limitations, we have reported a unique case of intraocular SFT/HPC, with extensive ophthalmic and radiographic imaging and immunohistochemistry to add to the current body of knowledge of intraocular SFT/HPC.

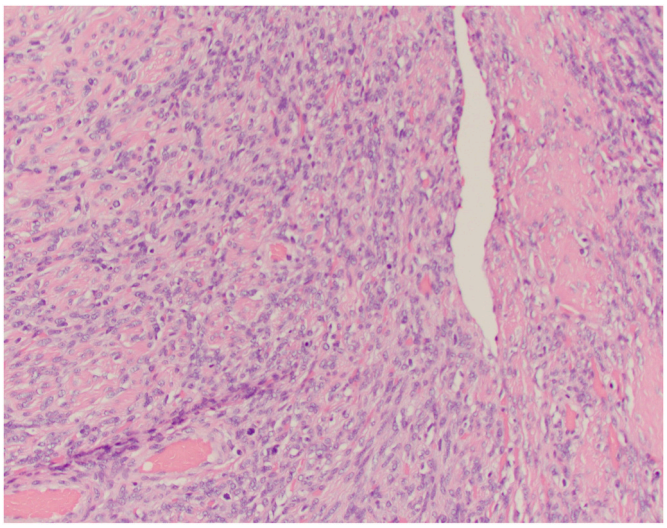

Fig. 4c. Thin branching vessels (H&E stain), 200x magnification.

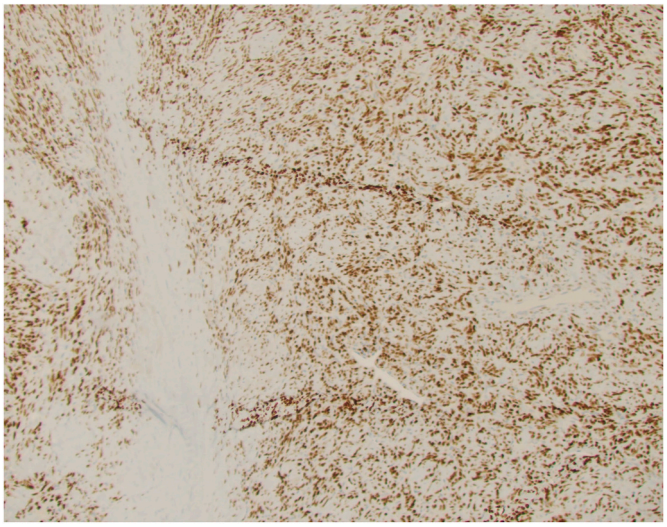

Fig. 4d. STAT-6 immunostain positive.

4. Conclusion

Intraocular SFT/HPC are rare, with only six prior cases reported in the literature. In this paper, we have presented the first known case of intraocular SFT/HPC with extrascleral extension at diagnosis. This report adds to our understanding of this exceptionally rare tumor and its possible manifestations.

Patient consent

Consent to publish the case report was not obtained. This report does not contain any personal information that could lead to the identification of the patient.

Funding

No funding or grant support.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Table 1
All reported cases of intraocular SFT/HPC.

First Author (Year)	Patient Demographics	Tumor Location	Disease Course
Papale[7] (1983)	40yo Female, race/ethnicity not reported	Choroid	Observed without change in tumor size, deceased 8 years later due to unrelated causes, globes examined postmortem
Geiser[6] (1988)	60yo Female, race/ethnicity not reported	Ciliary body	Enucleation, no ESE seen, no further details reported
Brown[5] (1991)	10yo Black Female	Supraciliary	Enucleation, no ESE seen, no further details reported
Toth[9] (1996)	84yo Male, race/ethnicity not reported	Choroid	Enucleation, no ESE, no metastasis on limited work up
Shimura[8] (2001)	55yo Male, race/ethnicity not reported	Choroid	Enucleation, no ESE seen, no further details reported
Rinaldo[3] (2017)	51yo Male, race/ethnicity not reported	Choroid	Hepatic & calvarial metastasis, deceased 8 years later
Mudie (2022)	22yo Hispanic Male	Choroid	Enucleation, ESE found however no metastasis on imaging of head and chest

Abbreviations: Extrascleral Extension (ESE).

Declaration of competing interest

The following authors have no financial disclosures: LM, EE, MP, AG, RL, SO, SL.

Acknowledgements

None.

References

1. Stout AP, Murray MR. HEMANGIOPERICYTOMA. *Ann Surg*. 1942;116(1):26–33.
2. Sagiv OMD, Bell DMD, Guo YBS, et al. Pathological features and clinical course in patients with recurrent or malignant orbital solitary fibrous tumor/hemangiopericytoma. *Ophthalmic Plast Reconstr Surg*. 2019;35(2):148–154. https://doi.org/10.1097/IOP.0000000000001189.
3. Rinaldo L, Xu SCY, Eggers SD, Salomão DR, Chen JJ, Raghunathan A. Rare occurrence of an intraocular choroidal solitary fibrous tumor/hemangiopericytoma. *Ocul Oncol Pathol*. 2018;4(4):213–219. https://doi.org/10.1159/000481947.
4. Francis AW, Setabutr P, Aakalu V. Proptosis in a healthy young woman. *JAMA Ophthalmol*. 2016;134(7):837–838. https://doi.org/10.1001/jamaophthalmol.2015.6106.
5. Brown HH, Brodsky MC, Hembree K, Mrak RE. Supraciliary hemangiopericytoma. *Ophthalmology*. 1991;98(3):378–382. https://doi.org/10.1016/s0161-6420(91)32286-3.
6. Gieser SC, Hufnagel TJ, Jaros PA, MacRae D, Khodadoust AA. Hemangiopericytoma of the ciliary body. *Arch Ophthalmol*. 1988;106(9):1269–1272. https://doi.org/10.1001/archopht.1988.01060140429046.
7. Papale JJ, Frederick AR, Albert DM. Intraocular hemangiopericytoma. *Arch Ophthalmol*. 1983;101:1409–1411.
8. Shimura M, Suzuki K, Fuse N, et al. Intraocular hemangiopericytoma. *Ophthalmologica*. 2001;215(5):378–382. https://doi.org/10.1159/000050890.
9. Tóth J, Kerényi ÁÁ, Süveges I, Futó G. Leiomyoma of the ciliary body and hemangiopericytoma of the choroid. *Pathol Oncol Res POR*. 1996;2(1-2):89–93. https://doi.org/10.1007/bf02893958.
10. Shields C, Shields J. *Intraocular Tumors: An Atlas and Textbook*. third ed. LWW; 2015.
11. Diniz W, Shields C, Shields J, Gunduz K, Brackup A. Orbital haemangiopericytoma simulating an intraocular mass. *Br J Ophthalmol*. 1999;83(6):753.
12. Gupta S, Verma R, Sen R, Singh I, Marwah N, Kohli R. Solitary fibrous tumor of the orbit. *Asian J Neurosurg*. 2016;11(1):78. https://doi.org/10.4103/1793-5482.165804.
13. Westra WH, Gerald WL, Rosai J. Solitary fibrous tumor. Consistent CD34 immunoreactivity and occurrence in the orbit. *Am J Surg Pathol*. 1994;18(10):992–998. https://doi.org/10.1097/00000478-199410000-00003.
14. Tihan T, Viglione M, Rosenblum MK, Olivi A, Burger PC. Solitary fibrous tumors in the central nervous System. *Arch Pathol Lab Med*. 2003;127:8.