Oncology
and Radiotherapy ©
1 (39) 2017: 019-027 • CASE REPORT

# Radiotherapy in patients with solitary fibrous tumor of the orbit – a case report and literature review

**A. Brzozowska[1], J. Juszczyńska[2], B. Jarosz[4], A. Mocarska[3], ·M. Janczarek[5], M. Mazurkiewicz[1]**

[1] Zakład Onkologii ,Uniwersytet Medyczny w Lublinie
[2] Zakład Radioterapii, Centrum Onkologii Ziemi Lubelskiej im. Św Jana z Dukli
[3] Zakład Radiologii, Centrum Onkologii Ziemi Lubelskiej im. Św Jana z Dukli
[4] Katedra i Klinika Neurochirurgii i Neurochirurgii Dziecięcej, Uniwersytet Medyczny w Lublinie
[5] Zakład Radiologii Zabiegowej i Neuroradiologii, Uniwersytet Medyczny w Lublinie

**AUTHORS' CONTRIBUTION:** **(A)** Study Design · **(B)** Data Collection · **(C)** Statistical Analysis · **(D)** Data Interpretation · **(E)** Manuscript Preparation · **(F)** Literature Search · **(G)** Funds Collection

SUMMARY

This article presents a rare case of solitary fibrous tumor (SFT) of the orbit. After a non-radical surgical procedure, the patient received stereotactic radiotherapy to the dose of 20 Gy with isodose of 100%. Thirty-six months later, progression in the form of a new cerebral metastatic lesion was detected. No local relapse or radiation complications were noted. The literature review analyzes clinical data, treatment methods and prognosis of all patients with orbital SFT reported in the literature.

**Key words**: radiotherapy, solitary fibrous tumor SFT

**Address for correspondence:** annabrzo@poczta.onet.pl

**Word count:** 1934 **Tables:** 1 **Figures:** 5 **References:** 80

**Received:** 06.09.2016
**Accepted:** 12.10.2016
**Published:** 31.03.2017

## INTRODUCTION

Up to 1994, solitary fibrous tumor (SFT) was believed to be extremely rare. After the publication of an article of Wester et al. [1], which appeared in 1994 and proposed a new method for SFT histological diagnosis, more case reports concerning this tumor appeared. It was reported to have occurred in various sites, but the orbit was one of the rarest locations [2,3].

This paper presents a literature review of publications available in the PubMed and Google Scholar databases, searched with the use of the following key words: *orbital solitary tumor* and *radiotherapy* as well as time descriptors: *1994–2015*. This search yielded 119 case reports on orbital SFT [1,2,4–66].

## CASE PRESENTATION

A white male, aged 51 years, was diagnosed due to left proptosis, which had been progressing for approximately 2 months and was accompanied by orbital mobility restriction, without pain or deteriorated vision.

MRI conducted on November 10 2011 revealed a solid–cystic tumor located medially in the superior and inferior quadrant of the left orbit. The tumor with radiological features of a malignancy, measuring 30 x 22 mm, was well-circumscribed and deformed the posteromedial aspect of the orbit with optic nerve displacement and without signs of orbital wall destruction. Fig. 1. On December 2 2011, subtotal tumor resection was performed.

### Histology and immunohistochemistry

Surgical specimens were preserved in 10% buffered formalin (pH 7.4) and routinely processed into paraffin blocks. Four mm thick

fragments were stained with hematoxylin and eosin (H+E) while fragments for immunohistochemical testing were placed on silanized slides (DAKO, Code No S3003) in order to prevent their detachment during the procedure. Immunohistochemical reactions were performed with the following reagents: CD99 (DAKO; Cat. No M3601; dilution 1:50), CD34 (DAKO; Cat. No M7165; dilution 1:25), EMA (DAKO; Cat. No N1504), S-100 (DAKO; Cat. No Z0311; dilution 1:400), AE1/AE3 (DAKO; Cat. No M3515; dilution 1:50) and MIB-1 (DAKO; Cat. No M7240; dilution 1:150), using the EnVision system (Dako RealTM EnVisionTM Detection

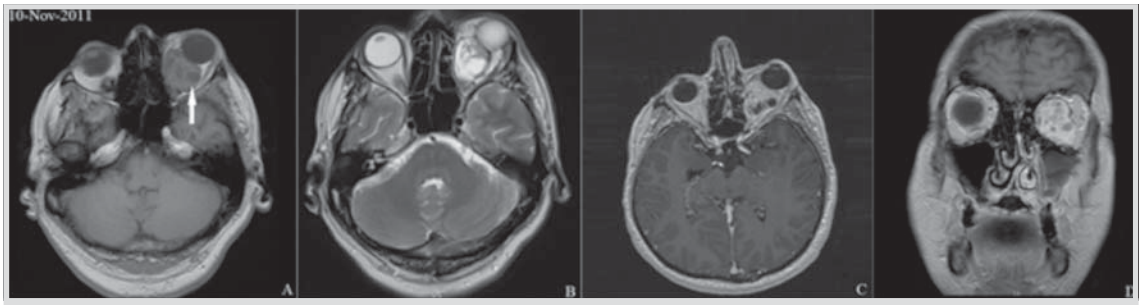


**Fig. 1.** MRI of left orbital tumor (before surgery), **A:** T1-weighted image, **B:** T2-weighted image, **C:** contrast-enhanced T1-weighted image (axial plane), **D:** contrast-enhanced T1-weighted image (coronal plane)

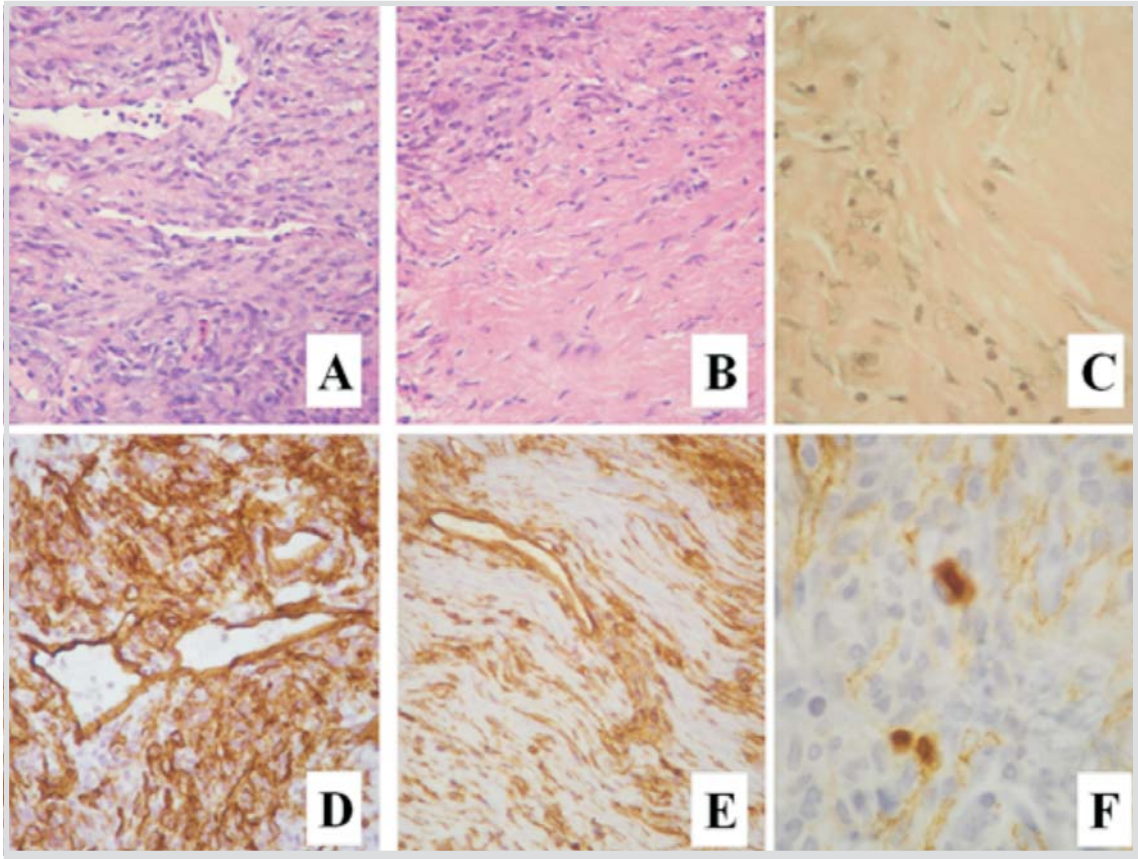


**Fig. 2.** Histology and immunohistochemistry. **A:** (H+E, 200x) – Areas of increased and decreased cellularity with oval and elongated nuclei as well as slit-like blood vessels. **B:** (H+E, 200x) – Area of decreased cellularity with dense collagen fiber bundles. **C:** (Van Gieson, 400x) – Dense collagen fiber bundles in areas of decreased cellularity, positive upon staining according to the Van Gieson protocol (pink–red). **D:** (CD34, 200x) – Strongly positive immunohistochemical reaction of tumor and vascular endothelial cells in a reaction with CD34 antibody. **E:** (CD99, 200x) – Strongly positive immunohistochemical reaction of tumor cells in areas of decreased cellularity in a reaction with CD99 antibody. **F:** (MIB-1, 600x) – Immunohistochemical reaction with MIB-1 antibody (proliferative index 2%).

System, Peroxidase/DAB+, Rabbit/Mouse, Cat. No K5007).

On histology, within the neoplastic lesion, there were areas of increased and decreased cellular density. Fig. 2A and 2B. Cancer cells had oval or elongated nuclei and formed bundles separated from one another by thick bundles of collagen fibers that were strongly positive in immunohistochemical staining according to the Van Gieson protocol. Fig. 2B and 2C. Moreover, round cells and branching "antler horn" vessels were also seen.

Immunohistochemistry revealed neoplastic cells with a strongly positive reaction to CD34 (Fig. 2D) and CD99 antibodies (Fig. 2E), and a negative reaction to S-100, EMA and AE1/AE3 antibodies. MIB-1 proliferative index was 2%. Fig. 2F.

Based on the microscopic image and immunohistochemical testing, the following histological diagnosis was established: "Solitary fibrous tumor (SFT) of a lower grade of malignancy. Long-term observation is indicated."

## Postoperative radiotherapy

Postoperative MRI revealed an oval 17 x 19 mm area of heterogeneous signal in the left orbit. In its solid fragment, it was hypointense in T2 sequence and normointense in T1 sequence. It also underwent slight contrast enhan-

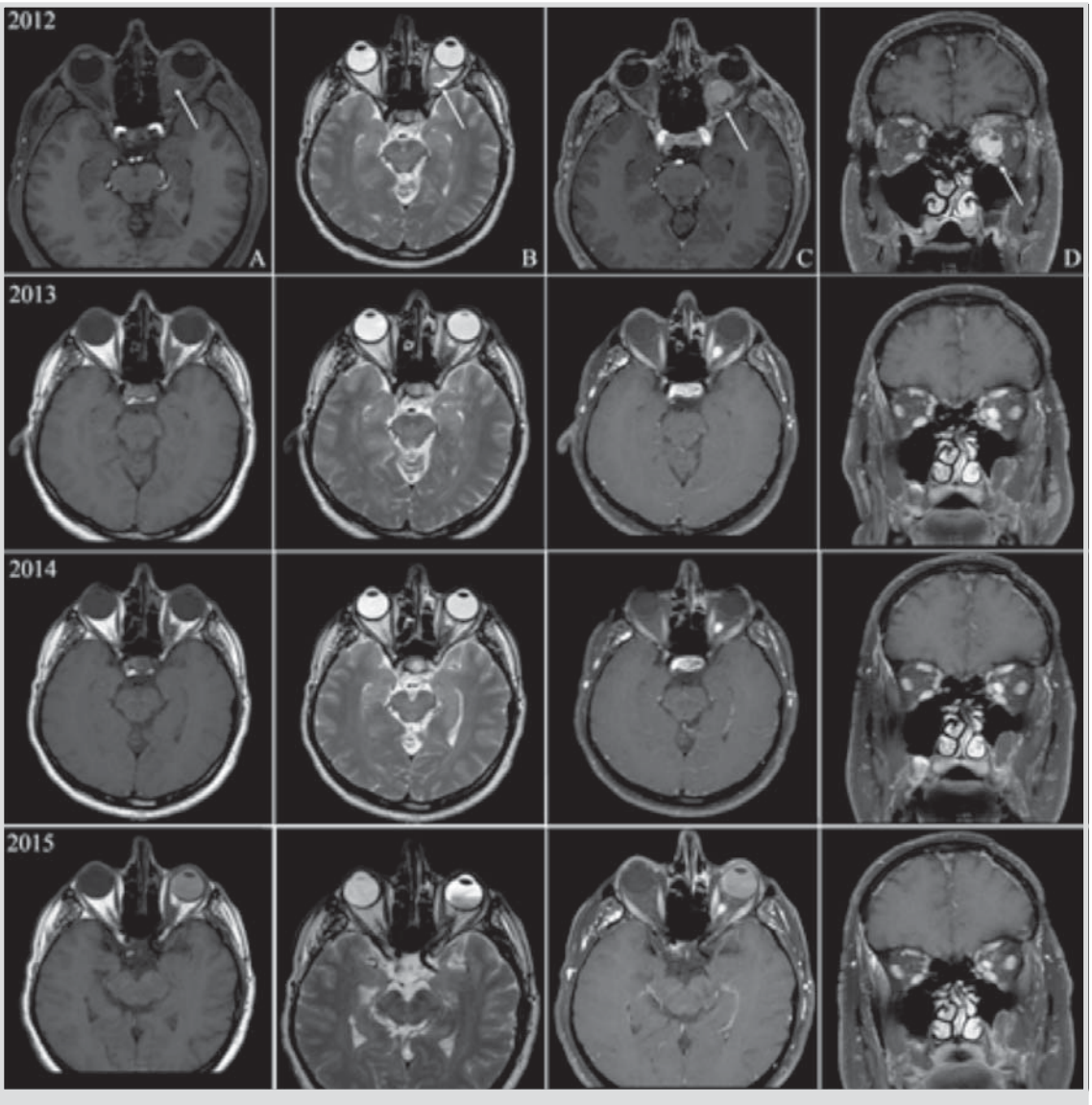


**Fig. 3.** Left orbital tumor during treatment. **A:** T1-weighted images, **B:** T2-weighted images, **C:** contrast-enhanced T1-weighted images (axial plane), **D:** contrast-enhanced T1-weighted images (coronal plane)

cement and showed the presence of two smaller crescent-shaped fluid areas. The lesion located medially in the posterior part of the left orbit compressed and deformed the medial rectus muscle and the optic nerve. Fig. 3.

Due to subtotal tumor resection, postoperative stereotactic radiosurgery (SRS) was conducted. The treatment plan was prepared in the iPlan system of BrainLab; 6 MV photon beams were applied. On May 18 2012, a dose of 20 Gy with a 100% isodose was delivered to the infiltration found on MRI. The tumor volume was 4.92 $cm^3$. Fig. 4.

### Observation

Within 36-month follow-up, slight proptosis of the left eyeball persisted and radiological stabilization of the lesion was observed. Control MRI scans performed in 2013 and 2014 revealed a solid–cystic pathological retrobulbar mass measuring 16 x 9 mm within the left orbit, located at medial and inferior rectus muscle and displacing the optic nerve. The lesion underwent intense enhancement upon contrast medium injection. Fig. 3. In 2015, 36 months after treatment, control MRI showed a stable image of the lesion in the left orbit, but a polycyclic metastatic lesion measuring 39 x 28 mm was found in the left frontal lobe. Fig. 5. The patient did not express consent to sampling of the new focus for histological examination.

## DISCUSSION

This paper presents the application of SRS after non-radical orbital SFT resection. Moreover, 119 cases of orbital SFT found in the literature up to 2015 were analyzed.

### Clinical course of SFT

SFT of the orbit was reported in patients from 9 to 76 years of age, but only 4 cases were noted in children below 10 years of age. SFT occurs equally frequently in both sexes [1, 2, 4–48, 50–57, 59–64, 66].

Orbital SFT is a slow-growing tumor, developing for months or even years (from 1 month to 20 years, average 26 months) in the orbit, usually causing no pain and leading to eyeball protrusion in 81% of cases [2, 4, 5, 7, 8, 10–16, 18, 22, 23, 27–42, 44–47, 50–53, 55, 56, 59, 62, 64, 66]. Other reported symptoms were: vision disorders (19%) including double vision (58%), eyeball mobility disorders (21%), edema and tumor mass (19%) or ptosis (14.5%) [2, 8, 12, 15, 16, 18, 27–38, 40, 41, 45–47, 50–53, 56]. Orbital SFT is usually (71%) located in the superior orbit. Its inferior orbital and


**Fig. 4.** Stereotactic radiotherapy (SRS) planning in orbital SFT. Target volume is marked red

retrobulbar location constitute 19% and 10%, respectively [2, 4, 6, 8, 9, 11–13, 17–23, 25, 27–32, 34–40, 42–48, 51–55, 60, 63, 66].

The clinical course of SFT of the orbit is usually slow, and symptoms develop in a period from 1 month to 20 years, on average 26 months. By contrast with SFT in other sites, which tends to recur and produce distant metastases, SFT of the orbit is rarely aggressive, and recurrences after surgery are observed in approximately 20% of cases [29, 32, 67, 68].

Moreover, certain recurring tumors present features of malignant transformation in the form of enhanced cellular atypia and increased mitotic activity. Complete tumor resection is the most significant prognostic factor in preventing a relapse [54, 4, 37, 28]. Distant metastases from orbital SFT were reported in only 2 cases. They were located in the foramen magnum, clivus, paraspinal muscles and peritoneum and occurred 3 years after surgery [41, 42]. In one patient, as in our case, intracranial spread was observed [43].

## Treatment

Due to rare occurrence of orbital SFT, an optimal treatment scheme has not been established thus far. According to the WHO classification, the risk of recurrence or distant metastases in SFT is approximately 10–15%, and it is believed that surgery is the treatment of choice in this type of cancer.

## Surgical treatment

All patients with orbital SFT described in the literature underwent a surgery: in 75 cases (63%) it was radical, in 10 (8.4%) it was non-radical and in 30 (25.2%) the type of surgery was not specified. In 3 (2.5%) cases, no treatment method was specified. One patient (0.8%) with non-operative SFT underwent palliative radiotherapy. Tumors recurred in 13 patients (11%). Average time to relapse was 38.4 months after radical procedure and 28 months after subtotal resection [4, 28, 32, 36, 43, 54, 63].

## Radiotherapy

Non-radical character of surgery and presence of so-called positive margins correlate with a higher risk of recurrence in patients with SFT. It therefore seems justified to apply postoperative radiotherapy in such cases [69]. To date, there have been no publications on the efficacy of radiotherapy in SFT of the orbit.

Among cases of orbital SFT described in the literature, postoperative radiotherapy was ap-

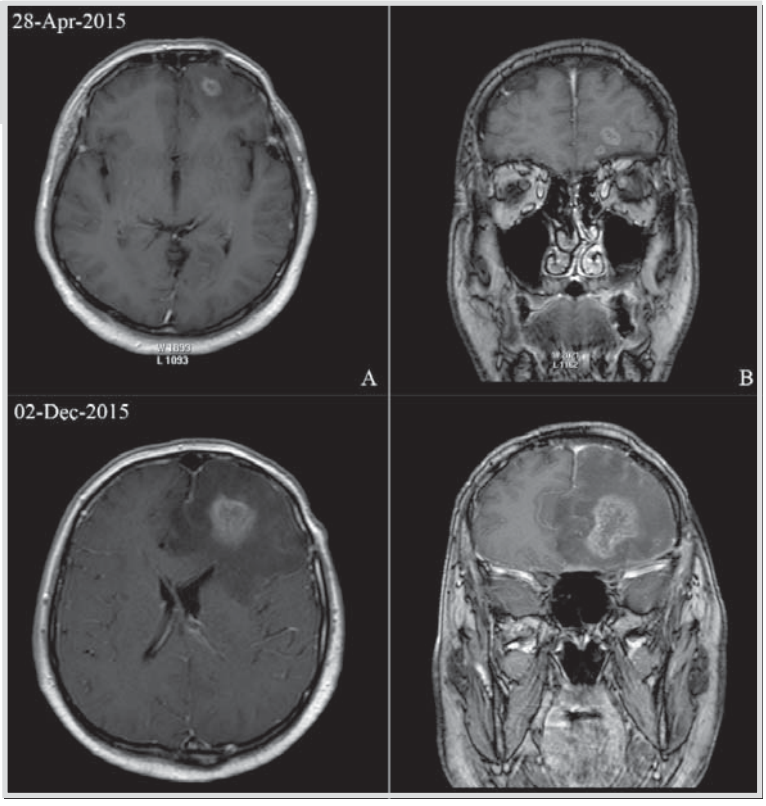


**Fig. 5.** Metastases in the left hemisphere, frontal lobe, contrast-enhanced T1-weighted images. **A:** axial plane, **B:** coronal plane

plied only in 2 patients after radical surgery and in 2 patients after subtotal tumor resection. Tab. 1. Only one patient, after non-radical surgery and delivery of 2 Gy to the total dose of 40 Gy, developed local relapse and distant metastases. In the remaining patients, stable disease was obtained with SRS. In our case, there was no local recurrence 36 months after SRS and the lobe.

Radiation doses and techniques were described in only in 2 of 4 patients with orbital SFT reported by other authors. One patient received a single dose of 15 Gy using radiosurgery, and the other patient received conventional fractionated doses of 2 Gy to the total dose of 40 Gy [41, 52]. In our case, a single dose of 20 Gy was delivered in SRS conditions.

Radiotherapy was also used for treatment of relapse as the only treatment in one patient or as adjuvant treatment after surgery in two patients. In the former case, the patient received a dose of 59.4 Gy (33 fractions), and in the other case – 50.4 Gy (28 fractions) [58, 64].

Due to tumor location and the presence of critical structures, the method of choice in orbital SFT is intensity-modulated radiotherapy (IMRT) or SRS. In our case, there were no acute radiation reactions or late symptoms of critical organ injury 36 months post-treatment.

Literature data evaluating the efficacy of radiotherapy in SFT in other locations than the orbit are contradictory. Sonabend et al. [70] assessed 227 patients with SFT in various locations and observed significantly longer survival in patients treated with postoperative radiotherapy. Wushou et al. [71], in turn, demonstrated that postoperative radiotherapy in patients with SFT within the head and neck region improved local control but did not affect survival. Moreover, the authors found no benefits of postoperative radiotherapy with respect to 5-year survival in patients with SFT in the chest [72]. On the other hand, Bisceglia et al. [73], having analyzed 220 cases of SFT of the central nervous system, noticed benefits of posto-

**Tab. 1.** Disease-free survival in patients with orbital SFT treated with surgery combined with radiotherapy

| Applied treatment | Number of patients | Follow-up period in months (average) | Relapse or distant metastases | Radiotherapy | Authors |
|---|---|---|---|---|---|
| Radical surgery | 5 | 48<br>48<br>48<br>36<br>12<br>(38,4) | Relapse<br>Relapse<br>Relapse<br>Relapse<br>Relapse | — | Dorfman [4]<br>Polito [36]<br>Polito [36]<br>Manousardis [54]<br>Blandamura [64] |
| Subtotal resection | 3 | 6<br>42<br>36<br>(28) | Relapse<br>Relapse<br>Relapse | — | Hayashi [28]<br>Tam [32]<br>Young [43] |
| Surgery – no data on the extent | 4 | 3<br>4<br>36<br>3<br>(11,5) | Relapse<br>Relapse<br>Relapse<br>Relapse | — | de Saint Aubain [16]<br>Aleksandrakis [20]<br>Carrera [23]<br>Kirshnakumra [2] |
| Radical surgery + radiotherapy | 2 | 48<br>18<br>(33) | No data<br>No data | No data<br>No data | Polito [36]<br>Wang [55] |
| Subtotal resection + radiotherapy | 2 | 42<br>12<br>(27) | Relapse/M<br>No data | 40 Gy/20fr<br>SRS 15 Gy | Parrozzani [41]<br>Cerda Nicolas [52] |
| Surgical treatment of relapse with adjuvant radiotherapy | 2 | 36<br>36<br>(36) | No data<br>No data | No data<br>59,4 Gy/33fr | Polito [36]<br>Monosourdis [54] |
| Treatment of relapse with radiotherapy | 1 | 84 | Relapse | 50,4 Gy/28fr | Blandamura [64] |
| Palliative radiotherapy | 1 | No data | PD | 50,4 Gy/28fr | Suzuki [31] |

SRS – stereotactic radiosurgery; PD – progressive disease; M – distant metastases

perative stereotactic radiotherapy or teleradiotherapy only in patients after non-radical surgery [73]. Other authors claim, however, that the usage of radiotherapy has no effects on survival [74].

Since postoperative radiotherapy was applied in only 4 patients with orbital SFT, as reported in the literature, its efficacy cannot be assessed in a reliable way. Based on our case of a patient with orbital SFT who underwent a non-radical procedure and case reports found in the literature, it can be claimed that postoperative irradiation can be a safe and effective treatment method. Administration of a single dose of 15–20 Gy enables local control. Our case shows that even large tumors (4.92 $cm^3$) can be effectively treated with a dose of 20 Gy. Administration of such a dose using SRS does not injure critical structures.

### Chemotherapy

The development of a new cerebral lesion 36 months after irradiation with complete local control means that systemic treatment must be considered. To date, there have been no clinical trials assessing the efficacy of chemotherapy in this group of patients. One of drugs that exhibits certain efficacy in SFT treatment is dacarbazine [75]. Moreover, promising results have been obtained after using Interferon alfa and a combination of bevacizumab and temozolomide in patients with recurring SFT [76, 77]. Another drug used in these patients is toremifene, with good response even in patients with STF presenting no estrogen receptor expression [78]. For malignant and aggressive SFT, tyrosine kinase inhibitors might prove useful. Animal tests have also shown effects after administration of Sunitinib, Pazopanib and Regorafenib [79, 80].

## CONCLUSION

SFT of the orbit is a rare cancer. Surgery remains the treatment of choice. Nonetheless, adjuvant radiotherapy should be considered due to frequent application of non-radical procedures and the risk of local recurrence. Based on our patient and literature reports, it can be stated that adjuvant radiotherapy, with a dose of 20 Gy, following a non-radical surgical procedure, is a safe and effective treatment method. However, due to a low number of cases of orbital SFT presented in the literature, clinical trials are needed to reliably assess the role of radiotherapy.

REFERENCES


1. 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.
2. Krishnakumar S, Subramanian N, Mohan ER, et al. Solitary fibrous tumor of the orbit: a clinicopathologic study of six cases with review of the literature. Surv Ophthalmol. 2003;48(5):544–554.
3. Furusato E, Valenzuela IA, Fanburg-Smith JC, et al. Orbital solitary fibrous tumor: encompassing terminology for hemangiopericytoma, giant cell angiofibroma, and fibrous histiocytoma of the orbit: reappraisal of 41 cases. Hum Pathol. 2011;42(1):120-128.
4. Dorfman DM, To K, Dickersin GR, et al. Solitary fibrous tumor of the orbit. Am J Surg Pathol. 1994;18(3):281–287.
5. Fukunaga M, Ushigome S, Nomura K, Ishikawa E. Solitary fibrous tumor of the nasal cavity and orbit. Pathol Int. 1995;45(12):952–957.
6. Lucas DR, Campbell RJ, Fletcher CDM, Garrity JA. Solitary fibrous tumor of the orbit. Int J Surg Pathol. 1995; 2(3):193–198.
7. Sciot R, Goffin J, Fossion E, et al. Solitary fibrous tumour of the orbit. Histopathology. 1996;28(2):188–191.
8. Scott IU, Tanenbaum M, Rubin D, Lores E. Solitary fibrous tumor of the lacrimal gland fossa. Ophthalmology. 1996;103(10):1613–1618.
9. Ruska KM, Westra WH. Pathologic quiz case 1. Solitary fibrous tumor (SFT) of the orbit. Arch Otolaryngol Head Neck Surg. 1996;122(10):1130–1132.
10. DeBacker CM, Bodker F, Putterman AM, Beckmann E.Solitary fibrous tumor of the orbit. Am J Ophthalmol. 1996;121(4):447–449.
11. Ramdial PK, Nadvi S. An unusual cause of proptosis:orbital solitary fibrous tumor: case report. Neurosurgery. 1996;38(5):1040–1043.
12. McElvanney AM, Noble JL, O'Donovan DG, et al. Solitary fibrous tumour: an atypical presentation within the orbit. Eye. 1996;10(Pt 3):396–399.
13. Cho NH, Kie JH, Yang WI, Jung WH. Solitary fibrous tumour with an unusual adenofibromatous feature in the lacrimal gland. Histopathology. 1998;33(3):289–290.
14. Ing EB, Kennerdell JS, Olson PR, et al. Solitary fibrous tumor of the orbit. Ophthal Plast Reconstr Surg. 1998;14(1):57–61.
15. Lanuza A, Lazaro R, Salvador M, et al. Solitary fibrous tumour of the orbit. Report of a new case. Int Ophthalmol. 1998;22(5):265–268.
16. de Saint Aubain Somerhausen N, Rubin BP, Fletcher CD. Myxoid solitary fibrous tumor: a study of seven cases with emphasis on differential diagnosis. Mod Pathol. 1999; 12(5):463–471.
17. Festa S, Lee HJ, Langer P, Klein KM. Solitary fibrous tumor of the orbit: CT and pathologic correlation. Neuroradiology. 1999;41(1):52–54.
18. Kim HY, Lee SY, Kang SJ, Kim HJ. Solitary fibrous tumor of the orbit: a poorly-recognized orbital lesion. Acta Ophthalmol Scand. 1999;77(6):704–708.
19. Woo KI, Suh YL, Kim YD. Solitary fibrous tumor of the lacrimal sac. Ophthal Plast Reconstr Surg. 1999;15(6):450–453.
20. Alexandrakis G, Johnson TE. Recurrent orbital solitary fibrous tumor in a 14-year-old girl. Am J Ophthalmol. 2000;130(3):373–376.

21. Havlik DM, Farnath DA, Bocklage T. Solitary fibrous tumor of the orbit with a t(9;22)(q31;p13). Arch Pathol Lab Med. 2000;124(5):756–758.
22. Fenton S, Moriarty P, Kennedy S. Solitary fibrous tumour of the orbit. Eye. 2001;15(1):124–126.
23. Carrera M, Prat J, Quintana M. Malignant solitary fibrous tumour of the orbit: report of a case with 8 years follow-up. Eye. 2001;15(1):102–104.
24. Gigantelli JW, Kincaid MC, Soparkar CN, et al. Orbital solitary fibrous tumor: radiographic and histopathologic correlations. Ophthal Plast Reconstr Surg. 2001;17(3):207–214.
25. Takamura H, Kanno M, Yamashita H, Maeda K. A case of orbital solitary fibrous tumor. Jpn J Ophthalmol. 2001; 45(4):412–419.
26. Lucci LM, Anderson RL, Harrie RP, et al. Solitary fibrous tumor of the orbit in a child. Ophthal Plast Reconstr Surg. 2001;17(5):369–373.
27. Giuffre I, Faiola A, Bonanno E, Liccardo G. Solitary fibrous tumor of the orbit. Case report and review of the literature. Surg Neurol. 2001;56(4):242–246.
28. Hayashi S, Kurihara H, Hirato J, Sasaki T. Solitary fibrous tumor of the orbit with extraorbital extension: case report. Neurosurgery. 2001;49(5):1241–1245.
29. Bernardini FP, de Conciliis C, Schneider S, et al. Solitary fibrous tumor of the orbit: is it rare? Report of a case series and review of the literature. Ophthalmology. 2003; 110(7):1442–1448.
30. Feuerman JM, Flint A, Elner VM. Cystic solitary fibrous tumor of the orbit. Arch Ophthalmol. 2010;128(3):385–387.
31. Suzuki S. A case of malignant solitary fibrous tumor presenting with exophthalmos. Jpn J Clin Oncol. 2007;37(5):401.
32. Tam ES, Chen EC, Nijhawan N, et al. Solitary fibrous tumor of the orbit: a case series. Orbit 2008;27(6):426–431.
33. Girnita L, Sahlin S, Orrego A, Seregard S. Malignant solitary fibrous tumour of the orbit. Acta Ophthalmol. 2009;87(4):464–467.
34. Leoncini G, Maio V, Puccioni M, et al. Orbital solitary fibrous tumor: a case report and review of the literature. Pathol Oncol Res. 2008;14(2):213–217.
35. Welling LC, Lynch JC, Ferreira LA, et al. Solitary fibrous tumor with intracranial invasion. Arq Neuropsiquiatr. 2009;67(3A):701–703.
36. Polito E, Tosi GM, Toti P, et al. Orbital solitary fibrous tumor with aggressive behaviorThree cases and review of the literature. Graefes Arch Clin Exp Ophthalmol. 2002; 240(7):570–574.
37. Romer M, Bode B, Schuknecht B, et al. Solitary fibrous tumor of the orbit—Two cases and a review of the literature. Eur Arch Otrhinolaryngol. 2005;262(2):81–88.
38. Holbach LM, Colombo F, Schlotzer-Schrehardt U, Kirchner T. Solitary fibrous tumor of the orbit presenting 20 years after Hodgkin's disease. Orbit. 2002;21(1):49–54.
39. O'Donovan DA, Bilbao JM, Fazl M, Antonyshyn OM. Solitary fibrous tumor of the orbit. J Craniofac Surg. 2002;13(5):641–644.
40. Griepentrog GJ, Harris GJ, Zambrano EV. Multiply recurrent solitary fibrous tumor of the orbit without malignant degeneration: a 45-year clinicopathologic case study. JAMA 2013;131(2):265–267.
41. Parrozzani R, Fusetti S, Montesco C, et al. Biphasic solitary fibrous tumor of the orbit with distant metastases. Int Ophthalmol. 2013;33(6):701-705
42. Patel MM, Jakobiec FA, Zakka FR, et al. Intraorbital metastasis from solitary fibrous tumor. Ophthal Plast Reconstr Surg. 2013;29(3):e76–e79. DOI: 10.1097/IOP.0b013e318272f311.
43. Young TK, Hardy TG. Solitary fibrous tumor of the orbit with intracranial involvement. Ophthal Plast Reconstr Surg. 2011;27(3):e74–e76.
44. Ha JK, Park BJ, Kim YH, Lim YJ. Orbital solitary fibrous tumor: A case report and diagnostic clues. J Kor Neurosurg Soc. 2009;46(1):77–80.
45. Ali MJ, Honavar SG, Naik MN, Vemuganti GK. Orbital solitary fibrous tumor: A clinicopathologic correlation and review of literature. Oman J Ophthalmol. 2011;4(3):147–149.
46. Meyer TN, Matos BH, Oliveira LR, Mendonca AT. Report of a case of solitary fibrous tumour of the orbit. Oral Maxillofac Surg. 2012;17(3):225–227.
47. Galie M, Tieghi R, Cavazzini L, Clauser L. Solitary fibrous tumor of the orbit: a case report. Int J Oral Maxillofac Surg. 2005;34(3):331–333.
48. Luo SH, Kao SC, Pan CS. Solitary fibrous tumor of the orbit. J Formos Med Assoc. 2003;102(10):726–728.
49. Bandyopadhyay R, Ghosh AK, Roy R, et al. Solitary fibrous tumour of the orbit: an unusual presentation. J Ind Med Assoc. 2011;109(9):676–677.
50. Kitamura Y, Akiyama T, Hirose S, Yoshida K. Optic nerve sheath solitary fibrous tumor. Acta Neurochirurg. 2012; 154(4):633–635.
51. Savino G, Aliberti S, Colucci D, et al. Atypical presentation of a case of solitary fibrous tumor of the orbit. Orbit. 2009; 28(2–3):176–178.
52. Cerda-Nicolas M, Lopez-Gines C, Gil-Benso R. Solitary fibrous tumor of the orbit: morphological, cytogenetic and molecular features. Neuropathology. 2006;26(6):557–563.
53. Meyer D, Riley F. Solitary fibrous tumor of the orbit: A clinicopathologic entity that warrants both a heightened awareness and an atraumatic surgical removal technique. Orbit. 2006;25(1):45–50.
54. Manousaridis K, Stropahl G, Guthoff RF. Recurrent malignant solitary fibrous tumor of the orbit [in German]. Ophthalmologe. 2011;108(3):260-264
55. Wang X1, Qian J, Bi Y, Ping B, Zhang R. Malignant transformation of orbital solitary fibrous tumor. Int Ophthalmol. 2013;33(3):299-303
56. Das JK, Sharma AS, Deka ACh, Das D. Solitary fibrous tumor of the orbit presenting in pregnancy. ak Indian J Ophthalmol. 2009 May-Jun;57(3):238-40. doi: 10.4103/0301-4738.49405.
57. Baldi GG, Stacchiotti S, Mauro V, et al. Solitary fibrous tumor of all sites: outcome of late recurrences in 14 patients. Clin Sarcoma Res. 2013 Apr 3;3:4.
58. Yang BT1, Wang YZ, Dong JY, at al. MRI study of solitary fibrous tumor in the orbit. AJR Am J Roentgenol. 2012 Oct;199(4):W506-11.
59. Tenekeci G , Sari A, Vayisoglu Y, Serin O. Giant Solitary Fibrous Tumor of Orbit. J Craniofac Surg. 2015 Jul;26(5): e390-2. doi: 10.1097/SCS.0000000000001868.
60. Petrovic A1, Obéric A, Moulin A, Hamedani M. Ocular adnexal (orbital) solitary fibrous tumor: nuclear STAT6 expression and literature review. Graefes Arch Clin Exp Ophthalmol. 2015;253(9):1609-1617
61. Goldberg RA, Rootman DB, Nassiri N, et al. Orbital Tumors Excision without Bony Marginotomy under Local and General Anesthesia J Ophthalmol. 2014;2014:424852. doi: 10.1155/2014/424852. Epub 2014 Apr 14.
62. Liu Y, Li K, Shi H, Tao X Solitary fibrous tumours in the extracranial head and neck region: correlation of CT and MR features with pathologic findings. Radiol Med. 2014 Dec;119(12):910-9.
63. Mulay K, Honavar SG. Orbital solitary fibrous tumor with multinucleate giant cells: case report of an unusual finding in an uncommon tumor. Indian J Pathol Microbiol. 2013 Jul-Sep;56(3):282-4.
64. Blandamura S, Alaggio R, Bettini G, et al. Four cases of solitary fibrous tumour of the eye and orbit: one with sarcomatous transformation after radiotherapy and one in a 5-year-old child's eyelid. J Clin Pathol. 2014 Mar; 67(3):263-7.
65. Polomsky M , Sines DT, Dutton JJ Solitary fibrous tumor of the orbit with multiple cavities Ophthal Plast Reconstr Surg. 2013 Sep-Oct;29(5):e117-9. doi: 10.1097/IOP.0b013e318279fdd6.
66. Graue GF, Schubert HD, Kazim M. Correlation between clinical features, imaging and pathologic findings in recurrent solitary fibrous tumor of the orbit. Orbit. 2013 Dec;32(6):375-80.

67. Cummings TJ, Burchette JL, McLendon RE. CD34 and dural fibroblasts: the relationship to solitary fibrous tumor and meningioma. Acta Neuropathol. 2001 Oct;102(4):349-54.
68. Yang BT, Wang YZ, Dong JY, et al. MRI study of solitary fibrous tumor in the orbit. AJR Am J Roentgenol. 2012 Oct;199(4):W506-11.
69. van Houdt WJ, Westerveld CM, Vrijenhoek JE, et al. Prognosis of solitary fibrous tumors: a multicenter study. Ann Surg Oncol. 2013 Dec;20(13):4090-5.
70. Sonabend AM, Zacharia BE, Goldstein H, et al. The role for adjuvant radiotherapy in the treatment of hemangiopericytoma: a Surveillance, Epidemiology, and End Results analysis: Clinical article. J Neurosurg. 2014; 120(2):300-308
71. Wushou A, Miao XC and Shao ZM. Treatment outcome and prognostic factors of head and neck hemangiopericytoma: A meta-analysis. Head Neck. 2015; 37:1685-90.
72. Milano MT, Singh D P, Zhang H. Thoracic malignant solitary fibrous tumors: a population-based study of survival. J Thorac Dis. 2011;3(2):99–104.
73. Bisceglia M, Galliani C, Giannatempo G, et al. Anat Pathol. Solitary fibrous tumor of the central nervous system: a 15-year literature survey of 220 cases (August 1996-July 2011). 2011;18(5):356-92.
74. Melone AG, D'Elia A, Santoro F, et al. Intracranial hemangiopericytoma – our experience in 30 years: a series of 43 cases and review of the literature. World Neurosurg. 2014; 81(3-4):556-562.
75. Stacchiotti S, Tortoreto M, Bozzi F, et al. Dacarbazine in solitary fibrous tumor: a case series analysis and preclinical evidence vis-a-vis temozolomide and antiangiogenics. Clin Cancer Res Off J Am Assoc Cancer Res. 2013;19(18):5192–5201.
76. Park MS, Patel SR, Ludwig JA, et al. Activity of temozolomide and bevacizumab in the treatment of locally advanced, recurrent, and metastatic hemangiopericytoma and malignant solitary fibrous tumor. Cancer. 2011; 117(21):4939–4947
77. Lackner H, Urban C, Dornbusch HJ, et al. Interferon alfa-2a in recurrent metastatic hemangiopericytoma. Med Pediatr Oncol. 2003;40(3):192–194.
78. Macfarlane RG, Galloway M, Plowman PN, Thomas DG. A highly vascular intracranial solitary fibrous tumor treated with radiotherapy and toremifene: case report. Neurosurgery. 2005 ;56(6):E1378; discussion E1378.
79. Tacchiotti S, Tortoreto M, Baldi GG, et al. Preclinical and clinical evidence of activity of pazopanib in solitary fibrous tumour. Eur J Cancer. 2014;50(17):3021–3028.
80. Tacchiotti S, Negri T, Libertini M, et al. Sunitinib malate in solitary fibrous tumor (SFT) Ann Oncol Off J Eur Soc Med Oncol Esmo. 2012;23(12):3171–3179.