ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

www.surgicalneurologyint.com

Surgical Neurology International

Editor-in-Chief: Nancy E. Epstein, MD, Clinical Professor of Neurological Surgery, School of Medicine, State U. of NY at Stony Brook.

SNI: Neuro-oncology

Editor
Mitsutoshi Nakada, MD
Kanazawa University, Ishikawa, Japan

SNI
Open Access

Case Report

Primary intracranial synovial sarcoma: A case report and review of literature

Tarang K. Vora[1], Rahul Lath[1], Meenakshi Swain[2], Amitava Ray[1]

Departments of [1]Neurosurgery and [2]Pathology, Apollo Health City, Filmnagar, Jubilee Hills, Hyderabad, Telangana, India.

E-mail: Tarang K. Vora - dr.tarangvora@gmail.com; Rahul Lath - rahullath@hotmail.com; Meenakshi Swain - meenakshi.swain@gmail.com; *Amitava Ray - amitray0407@gmail.com

***Corresponding author:**
Amitava Ray,
Department of Neurosurgery,
Apollo Health City, Filmnagar,
Jubilee Hills, Hyderabad,
Telangana, India.

amitray0407@gmail.com

Received : 22 July 2022
Accepted : 12 September 2022
Published : 30 September 2022

DOI
10.25259/SNI_665_2022

Quick Response Code:

ABSTRACT

Background: Primary intracranial synovial sarcomas (PrISS) are unusual dural based mesenchymal tumors seen most commonly in the supratentorial compartment. They can mimic a spontaneous intracranial hemorrhage or a high-grade glioma on imaging.

Case Description: A 31-year-old male presented with headache and right hemiparesis for 2 weeks. CT brain revealed a left frontal spontaneous intracerebral hemorrhage. PrISS revealed a heterogeneously ring enhancing solid cystic lesion with attachment to convexity dura. Intraoperatively, it mimicked a high-grade glioma. Histopathology report showed features of a synovial sarcoma, which was later confirmed with IHC. Classical SYT-SSX2 translocation was confirmed only on RTPCR after fluorescent *in situ* hybridization (FISH) was negative for same. Whole body positron emission tomography (PET-CT) did not show any extracranial tumor. Despite radiotherapy, there were recurrence and tumor progression at 6 months and the patient succumbed 11 months later.

Conclusion: PrISS is an unusual aggressive intracranial neoplasm that carries a worse prognosis when compared nonintracranial synovial sarcomas. Molecular cytogenetics (FISH and RTPCR) are essential for confirming the diagnosis, though FISH seems to have a lower sensitivity and can yield false negative results as was noted in this case.

Keywords: Fluorescent *in situ* hybridization, Primary intracranial synovial sarcoma, PrISS, RT-PCR, SYT-SSX2

INTRODUCTION

Primary intracranial synovial sarcoma (PrISS) is an unusual mesenchymal tumor within the intracranial space. Synovial sarcoma is an aggressive soft-tissue sarcoma that is generally seen in middle-aged patients, around the knee area, with a slight male predominance.[14] Unlike the systemic synovial sarcoma, PrISS carries a worse prognosis.[18] Like their systemic counterparts, PrISS is classified into biphasic and monophasic variants based on the presence of epithelial and/or spindle cell components. The monophasic type is the more common subtype in systemic synovial sarcomas, though tumor progression is often poorly differentiated in either variant. Over the years, molecular cytogenetics has proven to play an important role in confirming diagnosis in these tumors.

CASE REPORT

A 31-year-old male presented to us with severe persistent headache, right-sided weakness, and difficulty in speaking for 2 weeks at the height of the COVID pandemic. His admission GCS was E3V4M6 with Grade 4 power in the right upper and lower limbs. MRI brain showed the left frontal intra-axial heterogeneously enhancing tumor with an area of hemorrhage. Significant mass effect, perilesional edema, and mid line shift were also noticed [Figure 1]. With a working diagnosis of high-grade glioma, surgery was planned. During his preoperative surgical workup, he was found to be COVID-19-positive. However, as patient's clinical and neurological condition was deteriorating, it was deemed to be an emergency and gross total excision was performed. Intraoperatively, the tumor was friable with both solid cystic components and areas of hemorrhage with thrombosed veins in between. Clear plane between the brain and tumor was absent. A frozen section was not sent as the patient was COVID-positive and surgery was performed in specially designated operating room for COVID patients. Postoperatively, his recovery was smooth. His weakness and speech improved gradually.

Histopathological examination [Figure 2] revealed a spindle cell tumor with brisk mitosis and large areas of necrosis. Tumor cells were arranged in fascicles and had scant and ill-defined cytoplasm. High mitotic activity averaging 15–16/hpf was noted. IHC showed tumor cells staining for TLE-1 and focally for desmin. CD-99 was also diffuse and strongly positive. GFAP, STAT-6, SOX-10, EMA, S100, CD34, ATRX, CD31, NKX2.2, Caldesmon, and Bcl2 were negative in the tumor cells. IHC and histological findings were suggestive of primary monophasic intracranial synovial sarcoma. For confirmation, the block was sent for fluorescent *in situ* hybridization (FISH) testing of SYT-SSX2 translocation, but was consistently reported negative in two reputed laboratories. In view of the classical histological features, further testing with RT-PCR was done and was positive for both translocations SYT-SSX1 and SYT-SSX2, confirming the diagnosis of synovial sarcoma.

Whole body PET CT was done to exclude a metastasis confirming the diagnosis as a PrISS. Postoperative imaging revealed a small residual disease. He received radiotherapy for the same (60 Gray in 30 fractions). At 6 months of follow-up, he was noticed to have tumor progression in spite of radiotherapy. [Figure 1] Patient died at 11 months after first surgery.

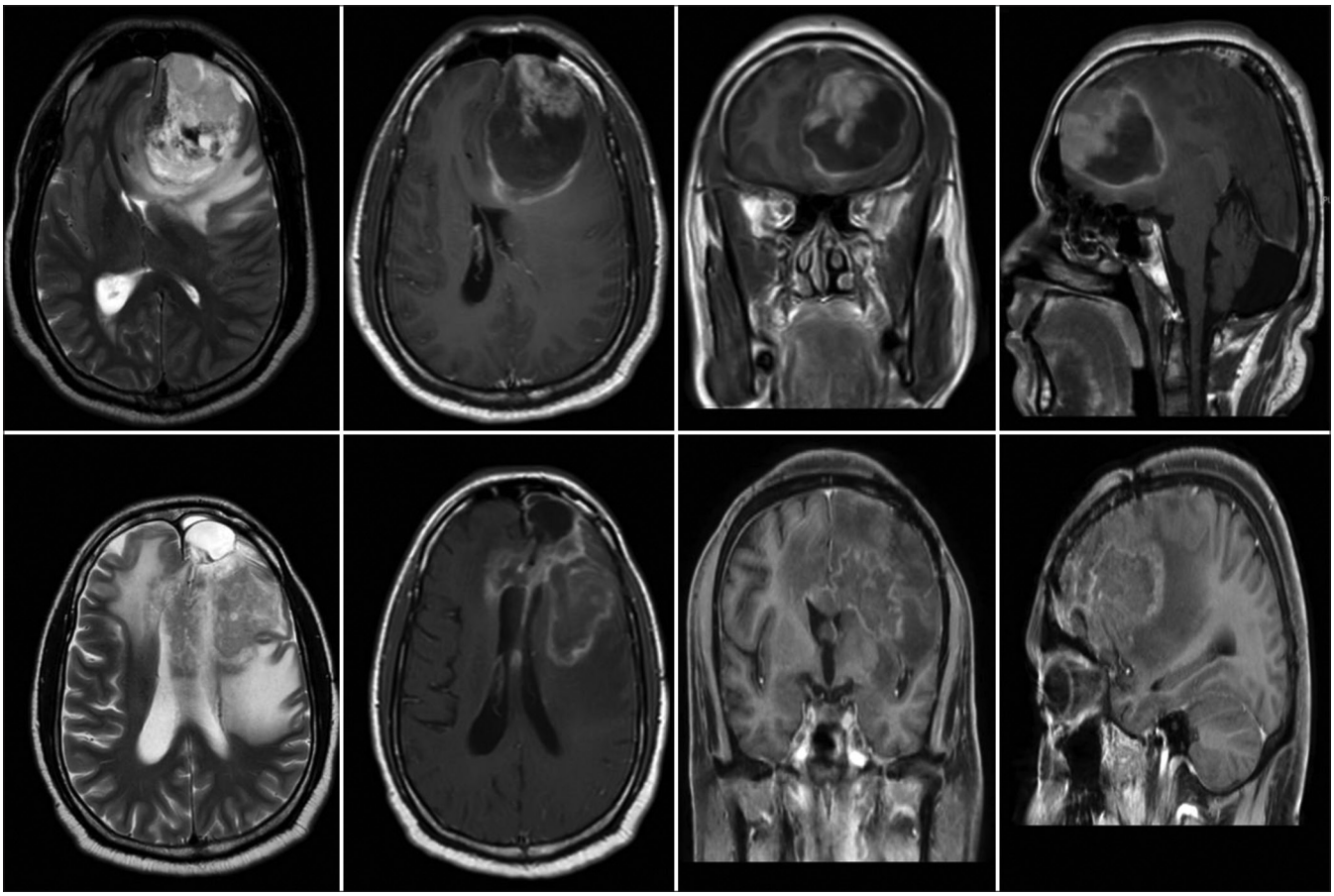

Figure 1: MRI imaging with gadolinium contrast depicting solid cystic tumor with dural attachment at convexity. (Top Row) Follow-up MRI at 6 months depicting tumor progression (Bottom Row).

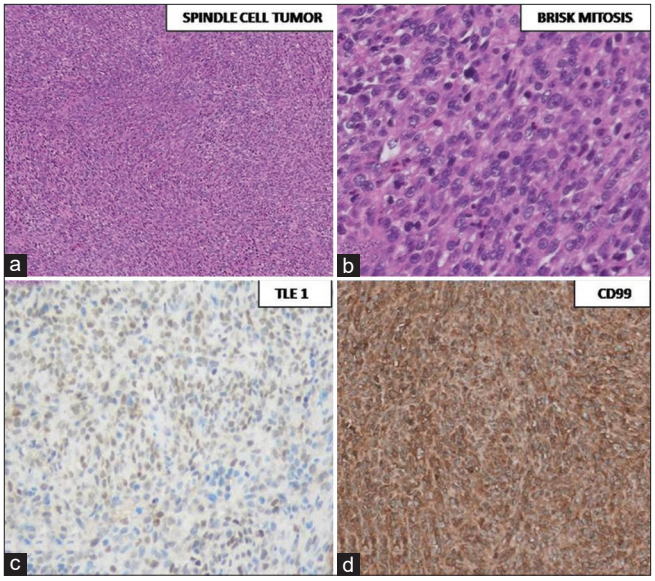

Figure 2: Hematoxylin and Eosin stain, (2a) 10× low magnification and (2b) 40× high magnification image. Immunohistochemistry with 20× magnification (2c) TLE1 and (2d) CD99.

DISCUSSION

Clinical symptoms and signs of PrISS depend on intracranial location of the tumor and may include dysphagia, pain, hoarseness, headache, or at times a palpable mass. The known sites of intracranial involvement are sellar region, skull base, cerebellum, and brain parenchyma. The preoperative diagnosis of PrISS is difficult and it may be thought to be an atypical meningioma, hemangiopericytoma, or a high-grade glioma. Synovial sarcoma may sometimes be confused with malignant meningioma because of their similar histological and immunohistochemical appearance (vimentinþ, EMAþ, and cytokeratinþ).[18] Most synovial sarcomas strongly coexpress CD99 and TLE-1, apattern is highly distinct because it is generally not encountered in anaplastic meningiomas. FISH and RTPCR methods are routinely used for detection of the characteristic chromosomal translocation SYT-SSX t (X; 18) (p11.2; q11.2) including two fusion types SYT-SSX1 (X11p.23) and SYT-SSX2 (X11p.21).[7]

Dural attachment and tumor origins

PrISS is an aggressive tumor associated with rapid neurological deterioration. Although "*synovial*" sarcoma has a predilection for particular areas, it is not actually associated with any synovial structure. Despite its name (a misnomer), it is no longer considered to be histologically derived from the synovium but rather from primitive mesenchymal cells.[10] MRI picture may often be similar to high-grade gliomas, except for the dural attachment which has been noticed in all reported cases till date. [Table 1] Dura is embryological mesenchymal in origin[1] and neoplastic transformation of mesenchymal tissue or embryonic mesenchymal cell rests may lead to PrISS.

Review of the literature [Table 1]

To the best of our knowledge, till date, 27 patients have been reported to have PrISS in English literature. [2,3,5,6,8,9,11-13,17,18] Average age of patients reported till date is 34.9 years. There was no sex predilection. The lesion locations mainly included the frontal convexity dura (n = 6), parietal convexity dura (n = 4), cerebellum (n = 3), anterior skull base (n = 3), sellar region (n = 3), petroclival region (n = 2), and temporal lobe dura (n = 2). Occipital lobe, lateral ventricle, third ventricle, and parafalcine locations were observed in one case each. [Table 1] Unlike its systemic counterpart where monophasic variant is more predominant, both subtypes have been reported equally for PrISS. Supratentorial location was predominant and dural attachment was noted in all cases reported. FISH has been predominantly used for cytogenetic confirmation of the chromosomal translocation. RTPCR is rarely used for confirmation of the translocation. To the best of our knowledge, this case is the first such report in PrISS where FISH was negative and RTPCR was positive.

Molecular cytogenetics: FISH versus RTPCR

Heuvel *et al*. compared the diagnostic accuracy of RT-PCR and FISH for synovial sarcomas. They verified SYT-SSX1/SSX2 gene fusions and FISH analysis for SYT gene breaks on 50 specimens of formalin-fixed and paraffin embedded synovial sarcomas.[16] RTPCR had a sensitivity of 94%; FISH had a sensitivity of 82%. A combined sensitivity of 100% was noted. If FISH is negative, RT-PCR has to be done to rule out diagnosis. Although the sensitivity of an RT-PCR test is greater than that of FISH, a FISH test is cheaper and capable of diagnosing gene fusion in majority of the cases, retaining it to be the first choice to detect the gene fusion.[16] However, if FISH test is negative, RT-PCR test is mandatory.

Intratumoral hemorrhage in PrISS

PrISS has been reported to be a mimicker of spontaneous intracranial hemorrhage.[2] Our case also presented with intracranial bleed with rapid neurological deterioration. Abnormal perilesional edema and contrast-enhancement on MRI helped are suspecting presence of intracranial tumor. Intratumoral hemorrhage in these patients is most likely to be due to abnormal neoplastic neovascularization in tumor progression. However, our patient was COVID-19-positive and a vasculitic thrombotic event secondary to the viral infection could have precipitated the hemorrhage in the neoplastic cells.[15]

Table 1: Literature review of primary intracranial synovial sarcoma.

Literature	Year	Age (year)	Sex	Molecular cytogenetics	Synovial sarcoma subtype	Location	Dural attachment	Outcome
Kleinschmidt *et al.*[8]	1998	19	F	Not done	Biphasic	Suprasellar region with third ventricular extension.	Yes	Patient died after 6 months of surgery
Scheithauer *et al.*[12]	2006	48	M	t(X;18) (p11; q11) (RTPCR +)	Biphasic	Sellar and parasellar region	Yes	Recurrence after 11 months of surgery
Katsaros *et al.*[6]	2008	15	F	Not done	Monophasic	Right petrous bone to the occipital bone at the level of the foramen magnum	Yes	Died 14 months after surgery
Horbinski *et al.*[5]	2008	81	M	t(X;18) (p11; q11) (FISH+)	Monophasic	Left parietal	Yes	No recurrence on at least 5-month follow-up
Lin *et al.*[9]	2012	21	M	t(X;18) (p11; q11) (FISH+)	Poorly differentiated	Right anterior skull base	Yes	No recurrence on at least 6-month follow-up
Xiao *et al.*[17]	2012	01	M	t(X;18) (p11; q11) (FISH+)	Monophasic	Right cerebellar	Yes	No recurrence on at least 6-month follow-up
Patel *et al.*[11]	2015	21	M	t(X;18) (p11; q11) (FISH+)	Not Availaible	Right Parietal	Yes	No recurrence on at least 24 months of follow-up
Sharma *et al.*[13]	2017	50	F	t(X;18) (p11; q11) (FISH+)	Monophasic	Right middle 1/3 parafalcine	Yes	NA
Akdeniz[3]	2019	60	M	Not Done	Poorly differentiated	Right temporo occipital	Yes	NA
Zhang *et al.*[18]	2019 (n=16)	Range (5 -65) Avg (23.8)	9M 7F	t(X;18) (p11 ;q11) (RTPCR+)	Seven Monophasic and nine Biphasic	Supratentorial (n=13); infratentorial (n=2); Both (n=1)	Yes	Died between 6 months and 24 months after surgery
Aggad *et al.*[2]	2021	48	M	t(X;18) (p11; q11) (FISH+)	Monophasic	Left Frontal	Yes	No recurrence at 6 months from second surgery.
Present case	2022	31	M	t(X;18)(p11; q11) (FISH -, RTPCR+)	Monophasic	Left Frontal	Yes	Progression at 6 months; died at 11 months

FISH: Fluorescent in situ hybridization

Treatment and outcome

The treatment for systemic synovial sarcoma is surgical resection with wide margins followed by radiotherapy. Wide margins are difficult to achieve in PrISS in comparison to systemic synovial sarcomas. Standard treatment for PrISS is not yet optimized though, adjuvant therapies including radiation have demonstrated benefits for local recurrence and prognosis.[4] Long-term outcomes in PrISS are unknown due to paucity of data. The overall survival for patients with systemic (not intracranial) localized synovial sarcoma was 51% at 10 years. In contrast, PrISS has an overall survival of 15.5 months only with surgery and radiation based on a series of 16 patients.[18] Our patient had a survival of only 11-month postdiagnosis in spite of radiotherapy.

CONCLUSION

PrISSs are unusual aggressive dural-based mesenchymal tumors with poor prognosis. They are seen most commonly

in supratentorial compartment in 3rd or 4th decade of life. Radiological appearance of a supratentorial solid cystic lesion with dural attachment and intratumoral hemorrhage should raise suspicion for PrISS. Molecular cytogenetics including FISH and RTPCR are required for confirming the diagnosis, though FISH seems to have lower sensitivity than RTPCR and can yield false negative results.

Declaration of patient consent

Patient's consent not required as patient's identity is not disclosed or compromised.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Adeeb N, Mortazavi MM, Tubbs RS, Cohen-Gadol AA. The cranial dura mater: A review of its history, embryology, and anatomy. Childs Nerv Syst 2012;28:827-37.
2. Aggad M, Gkasdaris G, Rousselot C, Destrieux C, François P, Velut S, *et al*. Intracranial primary synovial sarcoma mimicking a spontaneous cerebral hematoma-a case report and review of the literature. Neurochirurgie 2022;68:443-6.
3. Akdeniz N. Rare occurrence of synovial sarcoma originating from dura mater. Turk J Oncol 2019;34:52-5.
4. Flannery T, Kano H, Niranjan A, Monaco EA, Flickinger JC, Kofler J, *et al*. Gamma knife radiosurgery as a therapeutic strategy for intracranial sarcomatous metastases. Int J Radiat Oncol Biol Phys 2010;76:513-9.
5. Horbinski C, Cieply K, Bejjani GK, McFadden K. Primary intracranial dural-based synovial sarcoma with an unusual SYT fluorescence *in situ* hybridization pattern: Case report. J Neurosurg 2008;109:897-903.
6. Katsaros VK, Katsarou AA, Papadopoulou A, Floros D, Marangos N. Intracranial primary synovial sarcoma: Radiologic-pathologic correlation. Neuroradiol J 2008;21:362-7.
7. Kawai A, Woodruff J, Healey JH, Brennan MF, Antonescu CR, Ladanyi M. SYT-SSX gene fusion as a determinant of morphology and prognosis in synovial sarcoma. N Engl J Med 1998;338:153-60.
8. Kleinschmidt-Demasters BK, Mierau GW, Sze CI, Breeze RE, Greffe B, Lillehei KO, *et al*. Unusual dural and skull-based mesenchymal neoplasms: A report of four cases. Hum Pathol 1998;29:240-5.
9. Lin YJ, Yang Q, Tian X, Li B, Li Z. Unusual primary intracranial dural-based poorly differentiated synovial sarcoma with t(X; 18)(p11; q11). Neuropathology 2013;33:75-82.
10. Miettinen M, Virtanen I. Synovial sarcoma--a misnomer. Am J Pathol 1984;117:18-25.
11. Patel M, Li L, Nguyen HS, Doan N, Sinson G, Mueller W. Primary intracranial synovial sarcoma. Case Rep Neurol Med 2016;2016:e5608315.
12. Scheithauer BW, Silva AI, Kattner K, Seibly J, Oliveira AM, Kovacs K. Synovial sarcoma of the sellar region. Neuro Oncol 2007;9:454-9.
13. Sharma S, Sharma A, Lobo G, Nayak M, Pradhan D, Samriti, *et al*. Primary dura-based synovial sarcoma of the parafalcine region of brain. Pathol Res Pract 2017;213:868-71.
14. Stacchiotti S, van Tine BA. Synovial sarcoma: Current concepts and future perspectives. J Clin Oncol 2018;36:180-7.
15. Takeyama R, Fukuda K, Kouzaki Y, Koga T, Hayashi S, Ohtani H, *et al*. Intracerebral hemorrhage due to vasculitis following COVID-19 vaccination: A case report. Acta Neurochir (Wien) 2022;164:543-7.
16. Ten Heuvel SE, Hoekstra HJ, Suurmeijer AJ. Diagnostic accuracy of FISH and RT-PCR in 50 routinely processed synovial sarcomas. Appl Immunohistochem Mol Morphol 2008;16:246-50.
17. Xiao GY, Pan BC, Tian XY, Li Y, Li B, Li Z. Synovial sarcoma in cerebellum: A case report and literature review. Brain Tumor Pathol 2014;31:68-75.
18. Zhang G, Xiao B, Huang H, Zhang Y, Zhang X, Zhang J, *et al*. Intracranial synovial sarcoma: A clinical, radiological and pathological study of 16 cases. Eur J Surg Oncol 2019;45:2379-85.

How to cite this article: Vora TK, Lath R, Swain M, Ray A. Primary intracranial synovial sarcoma: A case report and review of literature. Surg Neurol Int 2022;13:447.