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Clinical, Radiologic, and Pathologic Findings in Eight Cases of Primary Pulmonary Synovial Sarcoma with Rare *SS18/SSX* Translocation Fusion Type 4

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ABSTRACT

Pulmonary synovial sarcoma is a rare tumor with characteristic SS18/SSX translocation. Fusion products comprising this translocation are predominantly types 1 or 2 with only rare cases of fusion types 3 or 4. We evaluated eight cases of primary synovial sarcoma with SS18/SSX fusion type 4 to better define this rarely studied cohort of patients. We found patients with tumours showing SS18/SSX fusion type 4 are younger than those with fusion type 1 or 2 and showed cases of overall survival of nearly 10 years. Radiologically, in contrast to soft tissue synovial sarcoma, calcification, high vascularity, bone or chest wall invasion was not seen. Histology unusual in pulmonary synovial sarcoma was found in 63% of fusion type 4 cases compared with 21% in reported cases of fusion type 1 and 2. Although fusion type 4 is a rare finding in an already rare tumour, and while additional cases are needed, SS18/SSX fusion type 4 may impart unique clinical and histologic characteristics.

Keywords

Fusion type 4, Radiology, *SSX/SS18*, Synovial sarcoma.

Introduction

Soft tissue synovial sarcoma is a clinical, pathologic, and cytogenetically distinct neoplasm that conventionally affects deep soft tissues of the extremities in adolescents and young adults [1]. Synovial sarcoma is also recognized as a primary pulmonary neoplasm [2]. Primary pulmonary synovial sarcoma is an aggressive tumor sharing common histological features with soft tissue synovial sarcoma, but different radiologic features [3]. Molecular testing for the pathognomonic *SS18/SSX* chromosomal translocation has enabled diagnostic confirmation in over 90% of cases and typically reveals *SS18/SSX* fusion types 1 and 2, with only rare cases comprising fusion types 3 or 4 [4]. We evaluated the clinical, radiological, and pathological findings in eight cases of primary pulmonary synovial sarcoma with *SS18/SSX* fusion type 4 to better characterize this rarely reported cohort of patients. Clinical and follow-up data were obtained from patient records. Radiology, including chest X-ray, CT scan and MRI, was available in one case. Hematoxylin and eosin-stained sections were available for each case. Histological features were categorized based on frequency and/or diagnostic utility. Immunohistochemistry was performed on paraffin embedded sections using commercially available antibodies. Molecular analysis was performed on RNA extracted from paraffin embedded samples. *SS18/SSX* RNA fusion transcripts from t(x;18) (p11; q11) translocation and subtypes were detected using real-time reverse transcriptase-polymerase chain reaction. We found patients with tumours showing *SS18/SSX* fusion type 4 to be younger than those reported with fusion type 1 or 2 and showed cases of overall survival of nearly 10 years. Radiologically, features were similar to fusion types 1 and 2, and in contrast to soft tissue synovial sarcoma, calcification, high vascularity, bone or chest wall invasion was not seen. Histology unusual in pulmonary synovial sarcoma was found in 63% of fusion type 4 cases compared with 21% in reported cases of fusion type 1 and 2.

Methods

Of 61 known cases of primary pulmonary synovial sarcoma from our research archives, eight with fusion type 4 *SS18/SSX* translocation were reviewed. Clinical and follow-up data were obtained from patient records. Hematoxylin and eosin-stained sections were available for each case (range, 1 to 15 slides; mean,

5). Tumors were subtyped as monophasic or biphasic according to World Health Organization criteria. Grading by tumor cell differentiation, mitotic rate, and necrosis was performed following the French Federation of Cancer Centers (FNCLCC) scheme. Histological features were categorized as major, minor or unusual based on frequency and/or diagnostic utility. Diagnostic immunohistochemistry was performed on paraffin embedded sections using commercially available antibodies. Molecular analysis was performed on RNA extracted from paraffin embedded samples. *SS18/SSX* RNA fusion transcripts from t(x;18) (p11; q11) translocation and subtypes were detected using real-time reverse transcriptase-polymerase chain reaction.

Results

Patients were 4 males and 4 females ranging in age from 10 to 50 years (m= 36). The most common presenting symptom was chest pain. Tumor sites were lung (6) and pleura (2). Four patients were dead of disease after a mean of just under 2 years (23 months). Two patients had no evidence of disease after a mean of nearly 10 years (m=118 months). In two cases, follow up was unknown. Procedures were pneumonectomy (3) and wedge resection of mass (3); (for two patients surgery details were unknown), and two patients had ancillary treatment with chemotherapy and radiation. One patient had metastatic disease to mediastinum at presentation, and one patient had local recurrence of disease at 24 months. Radiologic imaging (chest radiograph, CT and MRI scan) was available in only one case and showed a large homogenous mass with peripheral rim of enhancement without calcification, high vascularity, bone or chest wall invasion (Figure 1). Grossly, tumors were fleshy tan white well circumscribed lesions with focal necrosis and hemorrhage, ranging in size from 0.6 to16 cm (m=8cm). Histology showed all tumors comprised of interlacing fascicles of dense tumor cells and hyalinized stroma (Figure 2). Seven of eight (88%) also had hemangiopericytoma-like vasculature. Five were monophasic and three were biphasic. Seven were grade 2 and one was grade 3. Tumors (63%) showed unusual histology common to other neoplasms including papillary formations (3), Verocay bodies (Figure 3) and adenomatoid areas (2). As expected, all tumors stained focally with at least one epithelial marker, and all were negative with CD34. *SS18/SSX* translocation, fusion type 4 was seen in all tumors.

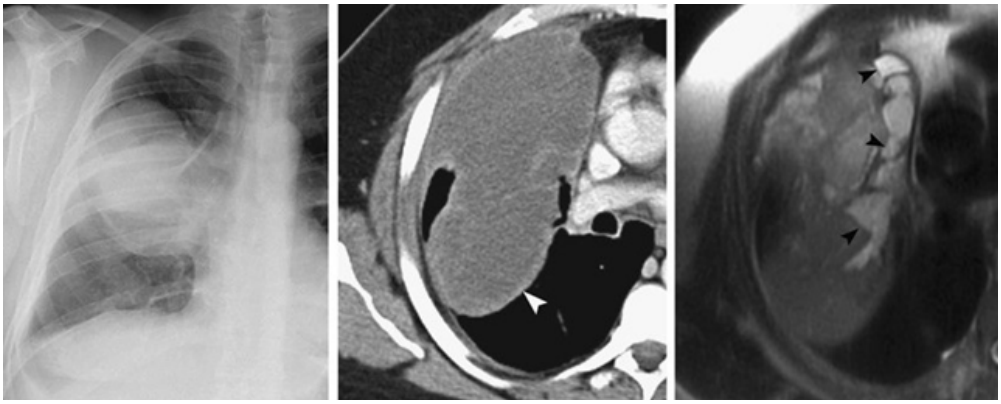

Figure 1: Synovial sarcoma in a young female with dyspnea and pleuritic chest pain. PA chest radiograph (left) coned to the right lung demonstrates a right hilar mass with smooth borders. Contrast-enhanced CT scan (center) demonstrates a large low attenuation mass with rim enhancement (arrowhead). Axial T2-weighted (2110/57.6) magnetic resonance image (right) shows greater contrast among internal components, with well-demarcated spaces (arrowheads) suggesting cyst formation. Calcification, high vascularity, bone or chest wall invasion is not seen.

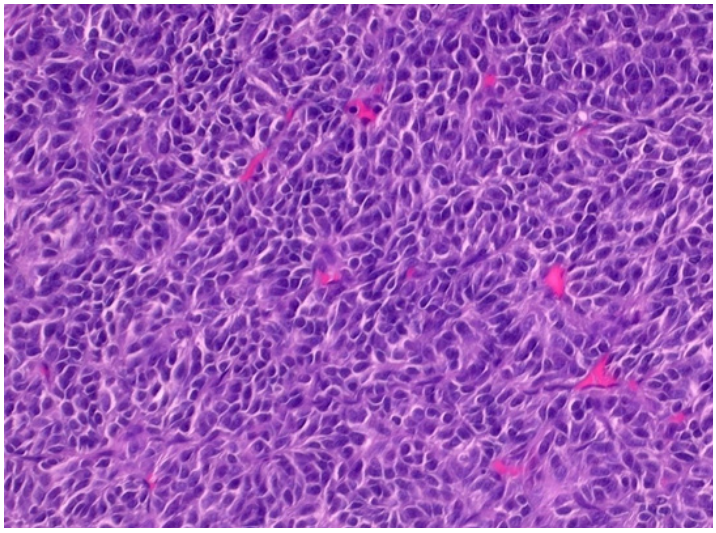

Figure 2: Pulmonary synovial sarcoma with usual histologic appearance. H & E stain, medium power.

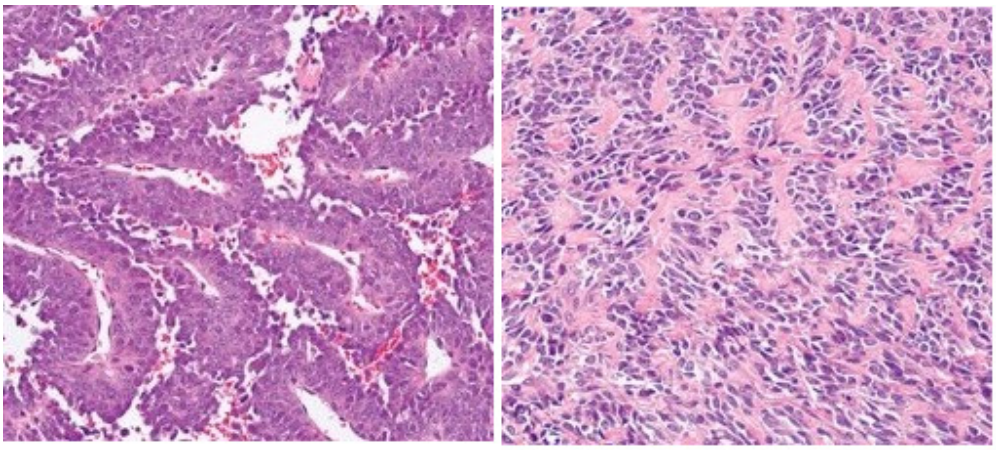

Figure 3: Pulmonary synovial sarcoma with fusion type 4 showing unusual histology in 63% of cases vs. 21% of cases with fusion type 1 or 2. Papillae (left) and Verocay bodies (right), H & E stain, medium power.

Discussion

Similar to soft tissue synovial sarcoma, molecular testing for the pathognomonic *SS18/SSX* chromosomal translocation in pulmonary synovial sarcoma has enabled diagnostic confirmation in over 90% of cases. Fusion products of *SS18/SSX* typically reveal fusion types 1 and 2, with only rare cases comprising fusion types 3 or 4 [4]. We evaluated the clinical, radiological, and pathological findings in 8 cases of primary pulmonary synovial sarcoma with *SS18/SSX* fusion type 4 to better characterize this rarely reported cohort of patients.

In previous studies primary pulmonary synovial sarcoma has been shown to be more aggressive than primary soft tissue tumours with a slightly greater than 50% five-year overall survival [5,6]. In recent reports, *SS18/SSX* fusion types 1 and 2 together have shown an average overall survival of just under two years [7]. Our cases showed two examples of overall survival of nearly 10 years. Fusion type 4 patients were also younger than previously published fusion types 1 and 2 patients [5,6]. The fusion type 4, like many fusion products generated from chromosomal translocations, may have meaningful clinical and biologic correlates [8-10].

Previous studies have shown that, radiologically, compared with soft tissue synovial sarcoma, primary pulmonary synovial sarcoma shows less vascularity in general, no cortical bone destruction, no tumour calcification or HPC-like vasculature and no invasion into chest wall or intermuscular growth [3,11]. These radiologic features are often considered characteristic and very specific for soft tissue synovial sarcoma [12]. Additionally, in contrast to soft tissue synovial sarcoma, lymphadenopathy suggestive of metastasis is typically not seen. Although limited to only one case with imaging available, our findings were concordant with previous findings.

Histologically, as reported previously, primary pulmonary synovial sarcoma demonstrates features similar to soft tissue synovial sarcoma. Histology unusual to synovial sarcoma was seen here in five cases (63%) which is a higher prevalence of unusual histology than reported for fusion types 1 or 2, which is on the order of approximately 20% [7]. These features are common to other neoplasms and included papillary structures, gland-like formations and Verocay bodies. Attention to the typical characteristic histology of synovial sarcoma and prudent use of immunohistochemistry will avoid histologic misdiagnosis of carcinoma, mesothelioma or malignant peripheral nerve sheath tumour.

We found patients with tumours showing *SS18/SSX* fusion type 4 are younger than those with fusion type 1 or 2 and showed cases of overall survival of nearly 10 years compared with a mean overall survival of just under 2 years for fusion types 1 and 2. Radiologically, fusion type 4 cases did not differ from findings in other fusion types and, in contrast to soft tissue synovial sarcoma, calcification, high vascularity, bone or chest wall invasion was not seen. Histology unusual in pulmonary synovial sarcoma was found in higher prevalence in fusion type 4 cases compared with fusion types 1 and 2. Although fusion type 4 is a rare finding in an already rare tumour, and additional case numbers are needed, pulmonary synovial sarcoma with *SS18/SSX* fusion type 4 may impart unique clinical and histologic characteristics.

References

1. Weiss SW, Goldblum JR, editors. Enzinger and Weiss's Soft Tissue Tumors, Fourth Edition. Mosby: St. Louis. 2001; 1502-1504.
2. Travis WD, Brambilla E, Muller-Hermelink HK, et al. World Health Organization Classification of Tumors. Pathology and Genetics of Tumors of the Lung, Pleura, Thymus, and Heart. IARC Press: Lyon, France. 2004; 344.
3. Hartel PH Parker JE. Radiologic Findings in Primary Thoracic Synovial Sarcoma Differ from Soft Tissue Synovial Sarcoma. 2021; 1: 1017.
4. Fletcher CD, Unni KK, Mertens FE, et al. World Health Organization Classification of Tumors. Pathology and Genetics of Tumors of Soft Tissue and Bone. IARC Press: Lyon, France. 2002; 427.
5. Zeren H, Moran CA, Suster S, et al. Primary pulmonary sarcomas with features of monophasic synovial sarcoma: a

clinicopathological, immunohistochemical, and ultrastructural study of 25 cases. Hum Pathol. 1995; 26: 474-480.

6. Begueret H, Galateau-Salle F, Guillou L, et al. Primary intrathoracic synovial sarcoma: a clinicopathologic study of 40 t(x;18)-positive cases from the French Sarcoma Group and the Mesopath Group. Am J Surg Pathol. 2005; 29: 339-346.
7. Hartel PH, Fanburg-Smith JC, Frazier AA, et al. Primary pulmonary and mediastinal synovial sarcoma: A clinicopathologic study of 60 cases and comparison with five prior series. Mod Pathol. 2007; 20: 760-9.
8. De Alava E, Kawai A, Healey JH, et al. EWS-FLI1 fusion transcript structure is an independent determinant of prognosis in Ewing's sarcoma. J Clin Oncol. 1998; 16: 1248-1255.
9. Kelly KM, Womer RB, Sorensen PH, et al. Common and variant gene fusions predict distinct clinical phenotypes in rhabdomyosarcoma. J Clin Oncol. 1997; 15: 1831-1836.
10. Frazier AA, Franks TJ, Pugatch RD, et al. From the archives of the AFIP: Pleuropulmonary synovial sarcoma. Radiographics. 2006; 26: 923-40.
11. Melo JV. The diversity of BCR-ABL fusion proteins and their relationship to leukemia phenotype. Blood. 1996; 88: 2375-2384.
12. Murphey MD, Gibson MS, Jennings BT, et al. From the archives of the AFIP: Imaging of synovial sarcoma with radiologic-pathologic correlation. Radiographics. 2006; 26: 1543-65.