Radiology Case Reports 18 (2023) 4195–4201

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journal homepage: www.elsevier.com/locate/radcr

Case Report

Synovial sarcoma in the prevertebral space can mimic malignant neurogenic neoplasm: Case report and literature review ☆,☆☆

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ARTICLE INFO

Article history:
Received 18 March 2023
Revised 21 August 2023
Accepted 24 August 2023

Keywords:
Synovial sarcoma
The retropharyngeal space
Imaging
Oncology

ABSTRACT

Synovial sarcoma, a rare malignant neoplasm with a poor prognosis, accounts for approximately 5%-10% of all primary soft-tissue malignancies worldwide. Typically affecting adolescents and young adults, it primarily manifests near the joints of the lower extremities. This study aimed to demonstrate that this tumor can also affect the prevertebral space. A 32-year-old male patient presented at our outpatient clinic with a 2-month history of upper limb numbness and a 1-month complaint of palpable neck mass. Imaging studies revealed a bulky, lobulated, and heterogeneous mass exhibiting heterogeneous enhancement. Furthermore, the mass caused expansion of the neuroforamen in the neck, initially suggesting a diagnosis of malignant schwannoma. However, a histopathologic examination suggested synovial sarcoma. The article provided a comprehensive review of the clinical, pathological, and radiological features of this condition. Additionally, it explored current treatment options and prognoses by referencing relevant literature.

Introduction

Synovial sarcoma is a rare soft-tissue malignancy with uncertain differentiation that infrequently affects the head and neck regions, resulting in limited case reports of synovial sarcoma in the prevertebral space of the neck. Regarding this significant soft-tissue malignancy, radiology plays a critical role in diagnosis, differentiation, and staging. Given its propensity for late local recurrence and metastasis, the

☆ Acknowledgments: The study was supported by Young and Middle-aged Health Talents Training Project of Fujian Province (2020GGB059) and Incubation Project in Zhongshan Hospital (Xiamen), Fudan University (2019ZSXMYS08).
☆☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.
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https://doi.org/10.1016/j.radcr.2023.08.106

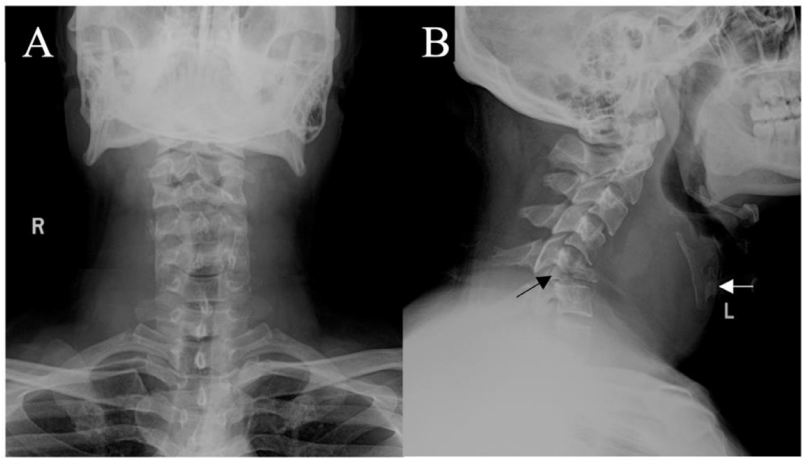

Fig. 1 – Anteroposterior (A) and lateral (B) radiographs of a 32-year-old male patient diagnosed with synovial sarcoma in the retropharyngeal space. (A) showed a large mass in the neck. (B) showed a large mass in the prevertebral space with the fifth cervical spine pathological fracture (black arrow). Thyrohyoid bone and trachea moved forward under compression (white arrow).

optimal approach involves radical excision with clear margins and a follow-up period exceeding 10 years. The article aimed to provide a comprehensive overview of the clinical, pathological, and radiological characteristics of synovial sarcoma and its current treatment options and prognoses.

Case report

A previously untreated 32-year-old man presented at our outpatient clinic with a 2-month history of upper limb numbness and a one-month complaint of a palpable neck mass. The cervical spine radiograph indicated a substantial prevertebral mass and a pathological fracture of the fifth vertebral body. The mass caused compression and displacement of the thyrohyoid bone and trachea (Figs. 1A and B). The cervical spine computerized tomography (CT) scan showed a bulky, lobulated, and heterogeneous mass in the neck, extending from the retropharyngeal space to the spine. This mass invaded the neural canal and intervertebral foramen, exerting compression on the cord/nerve root. The mass measured approximately 11.0 × 5.8 × 8.1 cm (Fig. 2), causing osteolytic destruction of the fourth to sixth cervical vertebral bodies. Furthermore, the mass exhibited iso-to-low attenuation to adjacent musculature, exhibiting mild heterogeneous enhancement following intravenous administration. CT angiography revealed prominent tumor vascular structures resembling "caput medusae" in the maximum density projection (MIP) (Fig. 2). Magnetic resonance imaging (MRI) revealed a complex multilobulated mass extending from the C2–C3 to the T1–T2 level, causing adjacent bone erosion. T1-weighted images showed a predominantly iso-to-low-intensity mass, exhibiting heterogeneous enhancement following gadolinium contrast agent administration. T2-weighted images demonstrated predominantly high intensity, focal necrosis, neovascularization, and perilesional edema (Fig. 3). Due to lesion size, excision was an infeasible option. Therefore, an ultrasound-guided core biopsy was performed, and subsequent histopathological analysis revealed the presence of synovial sarcoma with a t(X;18) (p11; q11) translocation involving SYT-SSX1. The patient declined radiotherapy (RT) due to potential side effects but received adjuvant chemotherapy with Epirubicin and Ifosfamide. After 6 months of adjuvant chemotherapy, the lesion size decreased, and therapeutic responses in the form of hemorrhage, triple sign, and tumor calcification were observed (Fig. 4). During the initial examination, erosion of the lesion into the intervertebral foramen and thickening of the nerve root led to a misdiagnosis of malignant schwannoma, highlighting the common error caused by relying on first impressions.

Discussion

Synovial sarcoma constitutes approximately 5%-10% of all primary soft-tissue malignancies worldwide [1,2]. The 2020 WHO classification for soft tumors classified it as a tumor of uncertain differentiation [1], originating from pluripotential mesenchymal cells with dual epithelial and mesenchymal differentiation. Synovial sarcoma is histologically classified into 3 main subtypes: biphasic, monophasic, and poorly differentiated. The formation of SS18-SSX fusion oncogenes, resulting from the chromosomal anomaly T(x;18)(P11.2;q11.2), is observed in over 90% of synovial sarcoma cases and is considered the underlying cause of the disease [2].

Synovial sarcoma most commonly affects adolescents and young adults, with a median age of diagnosis at 37.5 years [2]. The average age at diagnosis in the head and neck region is 33.5 years [3]. It primarily occurs in the limbs, with 46.1%-71% of cases occurring in the lower extremities, primarily in the knee [2,4]. Contrarily, the head and neck region accounts for only 3%-10% of cases, most commonly affecting the pharynx, with the hypopharynx being the most frequently involved site [5,6]. There is no significant difference in the gender

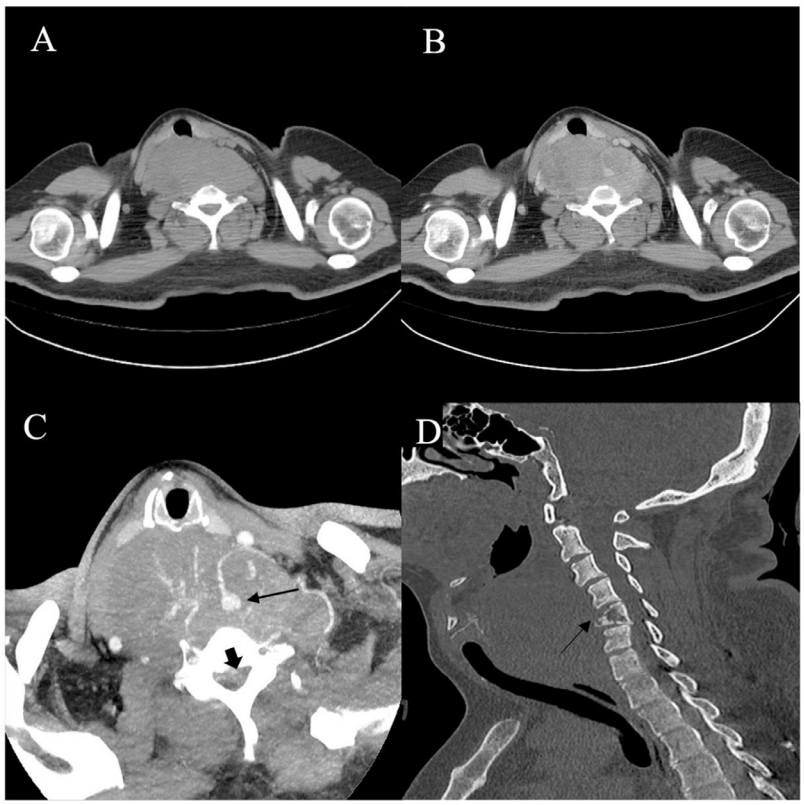

Fig. 2 – Axial (A), axial contrast-enhanced CT image (B), MIP of CTA (C), and Sagittal reconstruction of the cervical spine of a synovial sarcoma in the retropharyngeal space of a 32-year-old male patient. A bulky, lobulated, heterogeneously enhancing mass measuring 11.0 x 5.8 x 8.1 cm was observed. Mild enhancement was noted following intravenous administration. Prominent tumor vascular structures resembling "caput medusae" were visible centrally within the lesion (black arrow in C), and the tumor eroded into the spinal canal (thick arrow in C). The fifth vertebral body showed osteolytic destruction with compression fracture (black arrow in D, bone window).

distribution, although males are more commonly affected in the head and neck region [7–9].

Synovial sarcoma patients typically present with a palpable mass and swelling, sometimes accompanied by pain or tenderness. The nerve involvement may cause sensory or motor dysfunction, but acute inflammation is rare [2,10]. In the head and neck region, the most common clinical presentation of synovial sarcoma is a painless mass, occasionally associated with hoarseness, dysphagia, odynophagia, and bleeding [11].

Synovial sarcoma usually manifests as a roughly ovoid or multilobulate mass with well-defined borders, often compressing adjacent structures but rarely infiltrating surrounding muscles and fascia. While it primarily occurs in the juxtaarticular soft tissues, its occurrence in the head and neck region shares similar imaging characteristics. The primary lesion size could range from 1.5-18 cm [10] since the different locations cause the different ends of the lesion. For example, some superficial lesions can be resected at smaller sizes, while most tend to exceed 5 cm in size [12,13]. Some reports have indicated an association between larger tumors (> 5 cm) and poorer prognosis [7–9,14]. Synovial sarcoma grows slowly, and symptoms may persist longer before an accurate diagnosis, often mistaken for a benign process, leading to delayed diagnosis [4,10]. Given its potential for aggressive behavior, radiologic and pathologic examinations are crucial in staging and assessing the lesion to determine the optimal treatment approach.

Radiographic imaging of synovial sarcoma typically reveals a noninvasive oval or lobulated mass in the deep soft tissue near the joint, with approximately 30% of cases exhibiting punctate eccentric or peripheral calcification, associated with a better prognosis [4,10,15]. Additionally, 10%-20% of cases show bone erosion or periosteal reaction [4,10]. CT scans are more sensitive in detecting subtle calcifications and bone erosion than X-ray imaging [16,17]. The most common CT features of synovial sarcoma include large heterogeneous masses with attenuation similar to or lower than muscle. Following contrast administration, the tumor usually exhibits pronounced heterogeneous enhancement due to necrosis and hypervascularity [16].

MRI is the preferred modality for diagnosing and staging synovial sarcomas and other soft-tissue tumors owing to its superior soft contrast resolution and signal characteristics [17–19]. Typical MRI findings include a large, heterogeneous mass with well-defined margins (53%-91%) and variable T1-weighted and T2-weighted signal intensity, appearing hypo-, iso-, or hyperintense compared to muscle due to different stages of hemorrhage within the lesion [16,19,20]. Therefore, a combination of cystic and solid elements with

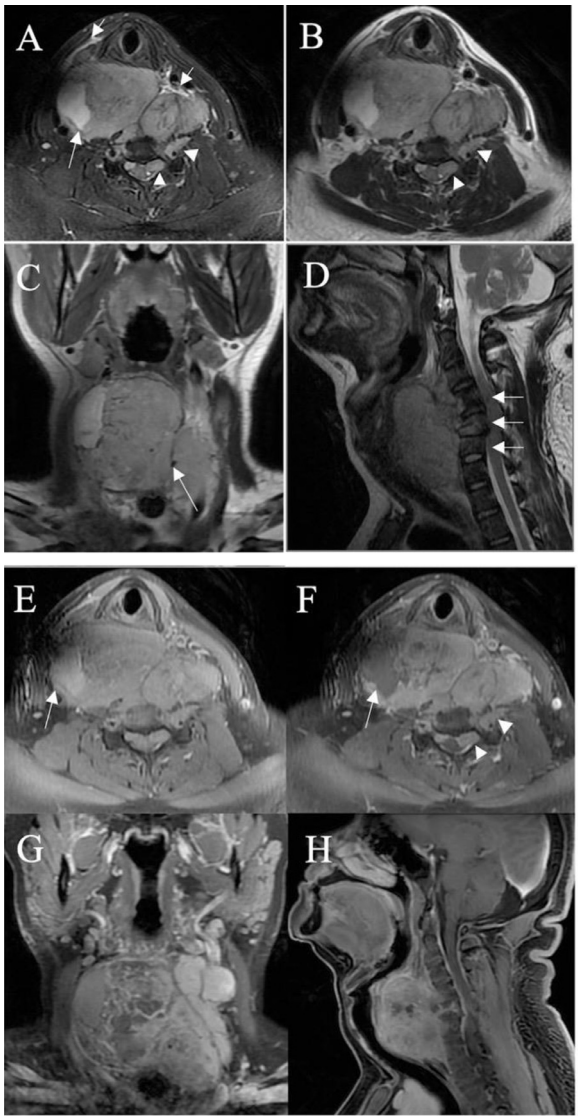

Fig. 3 – Axial fat-suppressed T2W image: (A) 3.0T TE 85, TR 4300; (B) axial T2W image; (C) coronal T2W image; (D) sagittal T2W image; (E) axial fat-suppressed T1W; (F) axial fat-suppressed T1W image postgadolinium; (G) Coronal T1W image postgadolinium; and (H) sagittal T1W image postgadolinium, of synovial sarcoma in the retropharyngeal space in a 32-year-old male patient. A large, irregularly-shaped mass measuring 11.0 × 5.8 × 8.1 cm was observed, displaying heterogeneous enhancement following intravenous administration. The mass exhibited focal hemorrhagic necrosis (indicated by a long white arrow in images A, B, E, and F), invasion of the intervertebral foramen and spinal canal (indicated by a white arrowhead in images A, B, and F), prominent tumor vascular structures with a flow void effect (indicated by a white arrow in image C), erosion of the fourth to sixth cervical vertebrae (with a slight increase in T2WI signal in image D), and peritumoral edema (indicated by a short white arrow in image A).

hemorrhage and fibrous tissue, known as the "triple sign," could be observed in up to 35% of cases on T2-weighted imaging [19,21]. Additional imaging features may include a "bowl of grapes" appearance (10%-13%), internal septa (67%-87%), cysts (29%-42%), perilesional edema (45%-75%), and neurovascular encasement (17%-24%) within the lesion [4,16,22]. While these imaging features lack specificity, they can predict the metastatic potential, prognosis, and differentiation of low- and high-grade tumors [16,20]. For example, the presence of perilesional edema, a "bowl of grapes," and hemorrhage is associated with metastasis and poor prognosis [16,17], while the absence of calcification favors a high-grade tumor diagnosis and is indicative of a poor prognosis [20].

Synovial sarcoma of the head and neck shares similar imaging features with its counterparts in the extremities. However, it can be misdiagnosed as a benign lesion, including neurofibroma, when it shows smooth margins, cystic features, and noninvasion [17,23]. When synovial sarcoma arises in the head and neck region, differential diagnoses encompass neurogenic tumors (including Schwannoma, neurofibroma, and Malignant Peripheral Nerve Sheath Tumor) [23–26] and other sarcomas (including rhabdomyosarcoma, fibrosarcoma, and liposarcoma) [27,28]. Table 1 summarizes the clinical and imaging characteristics specific to synovial sarcoma in the head and neck region, while Table 2 summarizes the imaging characteristics for the differential diagnosis of synovial sarcoma in this region, see in the supplement.

Treatment strategies for synovial sarcoma typically involve surgical resection, RT, chemotherapy, and targeted therapy. However, there is currently no consensus on treatment principles for synovial sarcoma, and treatment follows the principles of soft-tissue sarcomas (STS). Achieving clear surgical margins, associated with a better prognosis, can be particularly challenging in the head and neck region [29]. Recent research has shown that a resection margin of < 1 mm, compared to a contaminated margin, may show a trend toward improved 5-year local recurrence-free survival (LRFS) or overall survival (OS), aligning with the Union Internationale Contre le Cancer (UICC) classification [30] and reducing the need for resection of vital structures.

RT is commonly applied in cases of large tumors (> 5 cm), close soft tissue margins (< 1 cm), or contaminated margins [31]. RT can be used as a primary treatment, preoperatively or postoperatively, with different radiation doses yielding different benefits and side effects [31]. Preoperative RT, for instance, may reduce the risk of tumor dissemination during surgery and decrease the likelihood of recurrence, while postoperative RT can improve local control in cases with unclear margins [30,31]. However, it is worth noting that preoperative RT may negatively impact wound healing, whereas postoperative RT may lead to fibrosis and joint stiffness [31]. Although some studies have shown that RT independently improves LRFS and OS [2,30], others have found no OS benefits [9]. Therefore, the potential benefits and adverse effects of postoperative RT should be carefully considered before its implementation.

Chemotherapy can be a preoperative or postoperative treatment for resectable high-grade, advanced, unresectable, or metastatic diseases, as with other soft tissue sarcomas

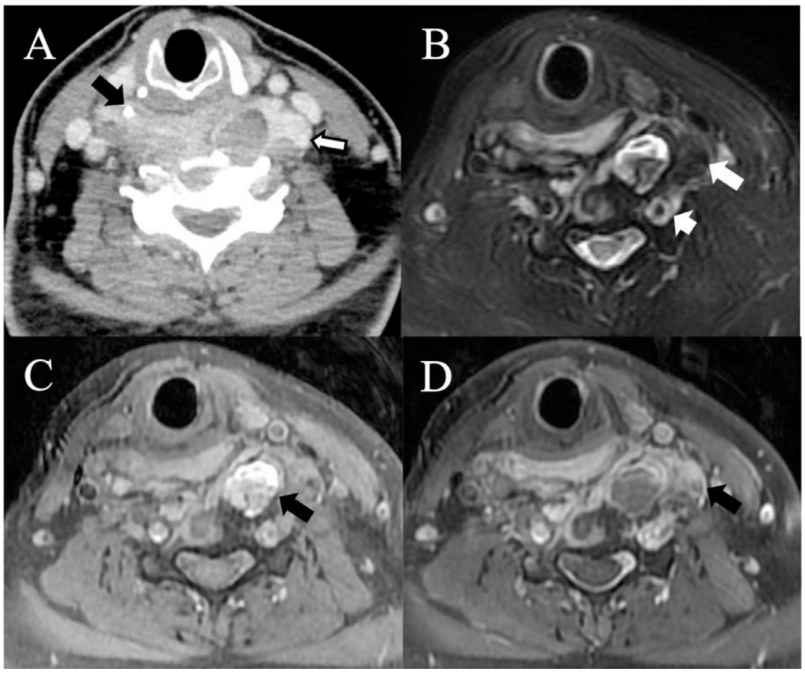

Fig. 4 – (A) Axial contrast-enhanced CT image; (B) Axial fat-suppressed T2W image; (C) Axial fat-suppressed T1W; and (D) Axial fat-suppressed T1W image post-gadolinium after 6 months of adjuvant chemotherapy of synovial sarcoma in the retropharyngeal space in a 32-year-old male patient. The lesion was significantly reduced, with new calcification (A, black arrow) and focal bleeding appearing at the liquid-liquid level (C, black arrow). The white arrow and short white arrow in B showed iso- and high-signal tumor parenchyma with a low bleeding signal, making a "triple sign."

(STS) [31]. Synovial sarcoma exhibits greater chemosensitivity than other STS types; however, the effectiveness of chemotherapy in synovial sarcoma remains controversial. Notably, pediatric patients have shown a high response rate to chemotherapy for synovial sarcoma, whereas its impact on adult patients remains unknown. Some retrospective analyses have yielded inconclusive findings, with no significant prognostic or OS benefits observed in patients receiving chemotherapy than those who did not [2,7,11], even in the head and neck region [11]. In our case, the tumor size significantly shrank and showed new calcification and hemorrhage as a response to chemotherapy (Fig. 4); however, the lesion remained too large for resection.

Targeted therapy has become a promising treatment for advanced or metastatic synovial sarcoma. Pazopanib, a multitarget tyrosine kinase inhibitor, has demonstrated efficacy in prolonging progression-free survival in a phase III study (EORTC 62072), showing single-agent activity in patients with advanced STS subtypes except for liposarcomas [31]. Preclinical trials exploring cell-based therapies targeting cancer-immune interactions or reversing oncogene expression have yielded promising results [32,33]. However, further research is needed to transition these therapies from preclinical to clinical stages.

Conclusion

Despite current treatment strategies, synovial sarcoma carries a generally poor prognosis, with 5- and 10-year survival rates ranging from 32% to 74.2% and 26% to 61.2%, respectively [2,7,9,11]. The risk of late-stage local recurrence and metastasis, particularly in the lungs [13], necessitates a follow-up period exceeding 10 years [34]. The prognosis of synovial sarcoma is influenced by several factors, including age, gender, histologic subtype, tumor size, tumor location, bone or neurovascular invasion, local recurrence, and RT [2,7–9,11,14]. Several studies have identified older age at diagnosis, larger tumor size (> 5 cm), male gender, bone or neurovascular invasion, and central location as independent factors for poor prognosis [2,7,11–13]. Conversely, RT has improved survival outcomes [7], and the biphasic subtype has the best survival [7].

Authors' contributions

Yi Guo wrote the original manuscript; Chong Lin collected the case and performed the pictures and tables; Xiao-xia Li review & editing the original manuscript; all authors are considered to have contributed equally to the article. Jian-jun Zhou and Jian Wang performed the validation and final approval of the version to be submitted as a corresponding author.

Patient consent

Written informed consent for the publication of this case report was obtained from the patient.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.radcr.2023.08.106.

REFERENCES

[1] WHO. WHO classification of tumours: soft tissue and bone tumours. 2020. ISBN: 9780511545375.
[2] Aytekin MN, Öztürk R, Amer K, Yapar A. Epidemiology, incidence, and survival of synovial sarcoma subtypes: SEER database analysis. J Orthop Surg (Hong Kong) 2020;28(2):2309499020936009. doi:10.1177/2309499020936009.
[3] Stanbouly D, Litman E, Lee KC, Philipone E. Synovial sarcoma of the head & neck: a review of reported cases in the literature. J Stomatol Oral Maxillofac Surg 2021;122(5):505–10. doi:10.1016/j.jormas.2020.12.001.
[4] Murphey MD, Gibson MS, Jennings BT, Crespo-Rodríguez AM, Fanburg-Smith J, Gajewski DA. From the archives of the AFIP: imaging of synovial sarcoma with radiologic-pathologic correlation. Radiographics 2006;26(5):1543–65. doi:10.1148/rg.265065084.
[5] Sturgis EM, Potter BO. Sarcomas of the head and neck region. Curr Opin Oncol 2003;15(3):239–52. doi:10.1097/00001622-200305000-00011.
[6] Fang ZW, Chen J, Teng S, Chen Y, Xue RF. Analysis of soft tissue sarcomas in 1118 cases. Chin Med J (Engl) 2009;122(1):51–3. doi:10.3760/cma.j.issn.0366-6999.2009.01.010.
[7] Xiong L, Chen Z, Zhou Y, Li H, Xiao T. The survival and prognosis analysis of synovial sarcoma subtypes: a Surveillance, Epidemiology, and End Results population-based analysis. Int Orthop 2020;44(12):2779–86. doi:10.1007/s00264-020-04708-5.
[8] Wushou A, Miao XC. Tumor size predicts prognosis of head and neck synovial cell sarcoma. Oncol Lett 2015;9(1):381–6. doi:10.3892/ol.2014.2634.
[9] Mallen-St Clair J, Arshi A, Abemayor E, St John M. Factors associated with survival in patients with synovial cell sarcoma of the head and neck: an analysis of 167 cases using the SEER (surveillance, epidemiology, and end results) database. JAMA Otolaryngol - Head Neck Surg 2016;142:576–83. doi:10.1001/jamaoto.2016.0384.
[10] Cadman NL, Soule EH, Kelly PJ. Synovial sarcoma; an analysis of 34 tumors. Cancer 1965;18:613–27. doi:10.1002/1097-0142(196505)18:5⟨613::aid-cncr2820180510⟩3.0.co;2-v.
[11] Gopalakrishnan V, Amini B, Wagner MJ, Nowell EN, Lazar AJ, Lin PP, et al. Synovial sarcoma of the head and neck: a single institution review. Sarcoma. 2017;2016752. doi:10.1155/2017/2016752. 2017.
[12] Outani H, Nakamura T, Murata H, Stevenson J, Parry M, Gregory J, et al. Localized synovial sarcoma: a single institutional study of 191 patients with a minimum follow-up of 5 years for survivors. J Surg Oncol 2019;119(7):850–5. doi:10.1002/jso.25417.
[13] Bakri A, Shinagare AB, Krajewski KM, Howard SA, Jagannathan JP, Hornick JL, et al. Synovial sarcoma: imaging features of common and uncommon primary sites, metastatic patterns, and treatment response. AJR Am J Roentgenol 2012;199(2):W208–15. doi:10.2214/AJR.11.8039.
[14] Crowson MG, Lalich I, Keeney MG, Garcia JJ, Price DL. Clinicopathologic factors and adjuvant treatment effects on survival in adult head and neck synovial cell sarcoma. Head Neck 2015;37(3):375–80. doi:10.1002/hed.23605.
[15] Jaly AA, Thway K, Touska P, Wale A, Miah A, Kerawala C, et al. Imaging soft-tissue sarcomas of the head and neck: a tertiary soft-tissue sarcoma unit experience. Anticancer Res 2019;39:6223–30. doi:10.21873/anticanres.13831.
[16] Baheti AD, Tirumani SH, Sewatkar R, et al. Imaging features of primary and metastatic extremity synovial sarcoma: a single institute experience of 78 patients. Br J Radiol 2015;88(1046):20140608. doi:10.1259/bjr.20140608.
[17] O'Sullivan PJ, Harris AC, Munk PL. Radiological features of synovial cell sarcoma. Br J Radiol 2008;81(964):346–56. doi:10.1259/bjr/28335824.
[18] Kransdorf MJ, Murphey MD. Radiologic evaluation of soft-tissue masses: a current perspective. AJR Am J Roentgenol 2000;175(3):575–87. doi:10.2214/ajr.175.3.1750575.
[19] Jones BC, Sundaram M, Kransdorf MJ. Synovial sarcoma: MR imaging findings in 34 patients. AJR Am J Roentgenol 1993;161(4):827–30. doi:10.2214/ajr.161.4.8396848.
[20] Tateishi U, Hasegawa T, Beppu Y, Satake M, Moriyama N. Synovial sarcoma of the soft tissues: prognostic significance of imaging features. J Comput Assist Tomogr 2004;28(1):140–8. doi:10.1097/00004728-200401000-00024.
[21] Georgiev AA, Tashkova D, Chervenkov L, Anastasova V, Kitova T. Primary synovial sarcoma of the shoulder: case report of the "triple sign" on proton density magnetic resonance imaging. Radiol Case Rep 2022;18(3):943–7. doi:10.1016/j.radcr.2022.11.077.
[22] Ashikyan O, Bradshaw SB, Dettori NJ, Hwang H, Chhabra A. Conventional and advanced MR imaging insights of synovial sarcoma. Clin Imaging 2021;76:149–55. doi:10.1016/j.clinimag.2021.02.010.
[23] Hirsch RJ, Yousem DM, Loevner LA, et al. Synovial sarcomas of the head and neck: MR findings. AJR Am J Roentgenol 1997;169(4):1185–8. doi:10.2214/ajr.169.4.9308488.
[24] Bansal A, Goyal S, Goyal A, Jana M. WHO classification of soft tissue tumours 2020: an update and simplified approach for radiologists. Eur J Radiol 2021;143:109937. doi:10.1016/j.ejrad.2021.109937.
[25] Koeller KK, Shih RY. Intradural extramedullary spinal neoplasms: radiologic-pathologic correlation. Radiographics 2019;39(2):468–90. doi:10.1148/rg.2019180200.
[26] Ren X, Wang J, Hu M, Jiang H, Yang J, Jiang Z. Clinical, radiological, and pathological features of 26 intracranial and intraspinal malignant peripheral nerve sheath tumors. J Neurosurg 2013;119(3):695–708. doi:10.3171/2013.5.JNS122119.
[27] Zhu J, Zhang J, Tang G, et al. Computed tomography and magnetic resonance imaging observations of rhabdomyosarcoma in the head and neck. Oncol Lett 2014;8(1):155–60. doi:10.3892/ol.2014.2094.
[28] Scelsi CL, Wang A, Garvin CM, Bajaj M, Forseen SE, Gilbert BC. Head and neck sarcomas: a review of clinical and imaging findings based on the 2013 World Health Organization Classification. AJR Am J Roentgenol 2019;212(3):644–54. doi:10.2214/AJR.18.19894.
[29] Harb WJ, Luna MA, Patel SR, Ballo MT, Roberts DB, Sturgis EM. Survival in patients with synovial sarcoma of the head and neck: association with tumor location, size, and extension. Head Neck 2007;29(8):731–40. doi:10.1002/hed.20564.
[30] Bilgeri A, Klein A, Lindner LH, Nachbichler S, Knösel T. Birkenmaier C,et al. The effect of resection margin on local recurrence and survival in high grade soft tissue sarcoma of the extremities: how far is far enough? Cancers (Basel) 2020;12(9):2560. doi:10.3390/cancers12092560.
[31] von Mehren M, Randall RL, Benjamin RS, Boles S, Bui MM, Conrad EU III, et al. Soft Tissue Sarcoma, Version 2.2016 Clinical Practice Guidelines in Oncology NCCN Categories of Evidence and Consensus. JNCCN-Journal Natl Compr Cancer. Netw 2016;14(6):758–86. doi:10.6004/jnccn.2016.0078.

[32] Jerby-Arnon L, Neftel C, Shore ME, Weisman HR, Mathewson ND, McBride MJ, et al. Opposing immune and genetic mechanisms shape oncogenic programs in synovial sarcoma. Nat Med 2021;27(2):289–300. doi:10.1038/s41591-020-01212-6.
[33] Brien GL, Remillard D, Shi J, Hemming ML, Chabon J, Wynne K, et al. Targeted degradation of BRD9 reverses oncogenic gene expression in synovial sarcoma. Elife 2018;7:e41305. doi:10.7554/eLife.41305.
[34] de Haas RJ, Bonenkamp JJ, Flucke UE, de Rooy JW. Synovial sarcoma of the abdominal wall: imaging findings and review of the literature. J Radiol Case Rep 2015;9(2):24–30. doi:10.3941/jrcr.v9i2.1992.