Int J Clin Exp Med 2019;12(6):7843-7851
www.ijcem.com /ISSN:1940-5901/IJCEM0085983

Case Report

Primary mediastinal synovial sarcoma: a case report and literature review

Xingxing Tao[1], Ting Liang[1,2], Heng Liu[1,2], Xianjun Li[1], Chao Jin[1], Yannan Cheng[1], Xiaoyu Wang[1], Huifang Zhao[1], Jian Yang[1,2]

[1]Department of Radiology, The First Affiliated Hospital of Xi'an Jiaotong University, Xi'an, Shaanxi, People's Republic of China; [2]Key Laboratory of Biomedical Information Engineering, Ministry of Education, Department of Biomedical Engineering, School of Life Science and Technology, Xi'an Jiaotong University, Xi'an, Shaanxi, People's Republic of China

Received September 26, 2018; Accepted April 8, 2019; Epub June 15, 2019; Published June 30, 2019

Abstract: Primary mediastinal synovial sarcoma (PMSS) is a rare malignant soft tissue tumor with a poor prognosis. Because of its rarity, the misdiagnosis rate remains high. To raise awareness of this disease, the current study presents a case of PMSS with atypical CT features. A 26-year-old male presented with a 3-day history of chest pain. Chest CT scans showed multi fusion masses with an ill-defined margin. After the mass was partially resected, pathological and immunochemistry examinations were performed. The patient was diagnosed with biphasic synovial sarcoma. Summary analysis was then conducted of clinical, histopathological, and CT details of cases reported in the literature (English only). Based on results, PMSS should be considered when a solitary mass in the mediastinum is observed in a man with chest pain. Moreover, PMSS is indicated when the mass measures greater than 4 cm and appears as a heterogenous mass with necrosis/cystic changes and heterogenous patterns. Prognosis of PMSS can be improved by early diagnosis.

Keywords: Primary synovial sarcoma, mediastinal, CT

Introduction

Synovial sarcoma is a rare malignancy, accounting for approximately 6-9% of all adult patients with soft tissue sarcomas [1]. It occurs most frequently in the extremities, especially in large joints [2, 3]. Other rare anatomic locations, such as the lungs, abdomen, head, neck, and heart, have been reported [4]. Definite diagnosis must be based on pathological and immunochemistry examinations. Primary mediastinal synovial sarcoma (PMSS), arising outside of usual anatomic locations, has been rarely reported in the literature. Because of its rarity, the misdiagnosis rate remains high. To raise awareness of this disease, the current study reports a case of PMSS presenting with multifusion masses. Summary analysis was conducted of clinical, histopathological, and CT details of cases reported (English only).

Case report

A 26-year-old smoking male presented with paroxysmal left superior chest pain for 3 days. Physical examination findings included decreased breath sounds on the left side of lungs with dullness on percussion. Chest X-rays showed a solitary left mediastinal mass with ipsilateral pleural effusion (**Figure 1**). Chest computed tomography (CT) scans (**Figure 2**) showed multiple irregular fusion masses, with an ill-defined margin and heterogeneous density in the left anterior and middle mediastinum (48HU). The left lung was oppressed. Pleural effusion was observed in the left hemithorax. Moderate tumor enhancement (60HU) with a disappearing gap between the mass and the pulmonary artery was also observed. There were no obvious abnormalities found in the head CT and upper abdomen CT.

Mass resection under thoracoscopy was performed, revealing a huge dumbbell-shaped hyper-vascular mass, mostly arising from the left anterior mediastinum. It violated the upper lobe of the left lung, localizing above the aorta and growing aggressively. It showed an ill-defined margin. The mass was only partially resected. It

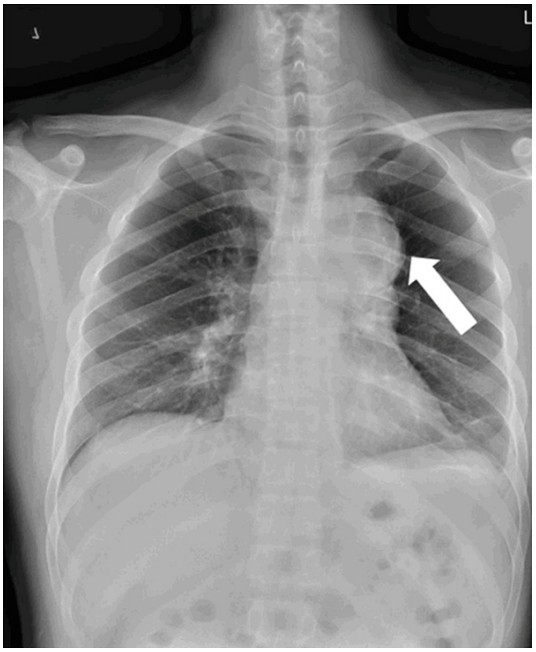

Figure 1. Chest X-ray shows solitary left mediastinal mass (white arrow) with ipsilateral pleural effusion.

was close to the aorta and left lung. Thus, there was a high risk of bleeding.

Pathological and immunochemistry examinations were performed after surgery. Epithelioid cells and spindle cells with hemorrhaging and necrosis were indicated (**Figure 3A**), consistent with biphasic synovial sarcoma. Combined with immunohistochemistry, staining was positive for cytokeratin (CK), CK7, EMA, and vimentin. Staining was negative for cluster of differentiation (CD) 34, NapsinA, TTF1, actin, des, and CR (**Figure 3B** and **3C**).

The patient recovered well after the partial tumor resection. Further chemotherapy was recommended. However, the patient and his family decided to transfer to another hospital for further treatment. Follow-up information was not obtained.

Summary analysis of clinical, histopathological, and CT details of cases reported in English

The literature search was conducted on April 1, 2017, for case reports of PMSS. PubMed, Web of Science, and Embase databases were searched. Certain keywords were used, including primary mediastinal synovial sarcoma, mediastinal synovial sarcoma, synovial sarcoma of mediastinum, synovial sarcoma, and mediastinum. There were no restrictions concerning the date of publication. However, the search was limited to papers written in English. Reports describing PMSS cases and containing data of computed tomography (CT) scans were included. For included case reports, first author, publication year, age, gender, symptoms, location of the tumor inside the mediastinum, tumor size, histologic subtype (monophasic, biphasic, poorly differentiate), and CT findings were summarized. Based on the description of CT scans from included case reports, primary analysis concerning CT characteristics (size, location, shape, margins, heterogeneity, enhancement pattern, calcification, necrosis/cystic change, lymphadenopathy, and pleural effusion) of PMSS was performed. A study flow chart of PMSS patients is shown in **Figure 4**. From the literature search, 29 papers about primary mediastinal synovial sarcoma, including 30 cases, were enrolled (**Table 1**). In addition to the above cases, the current study summarized and analyzed 31 PMSS cases.

The average age of patients was 39.9 years (range, 4-76 years; 20 men and 11 women). The spectrum of clinical presentations of PMSS was rather wide, including chest pain, shortness of breath, coughing, dyspnea, back pain, abdominal pain, fever, facial edema, weight loss, and weakness (**Table 2**). Based on present results, common symptoms of PMSS included chest pain, coughing, dyspnea, and shortness of breath.

According to histology subtype, twelve (38.7%) patients were biphasic, fourteen (45.1%) patients were monophasic, and one patient (3.2%) was poorly differentiated. Data of four (12.9%) patients was not available (**Figure 3D**).

The average diameter of tumors was 11.7 cm (range: 5.0-20.0 cm). Tumors of thirteen (41.9%) patients were found in the anterior mediastinum. Three (9.7%) patients were found with tumors in the middle mediastinum. Five (16.1%) patients were found with tumors in the posterior mediastinum. Two (6.5%) patients were found with tumors in the anterior to middle mediastinum. Four (12.9%) patients were found with tumors in the superior mediastinum. Tumor locations of four (12.9%) patients were not available.

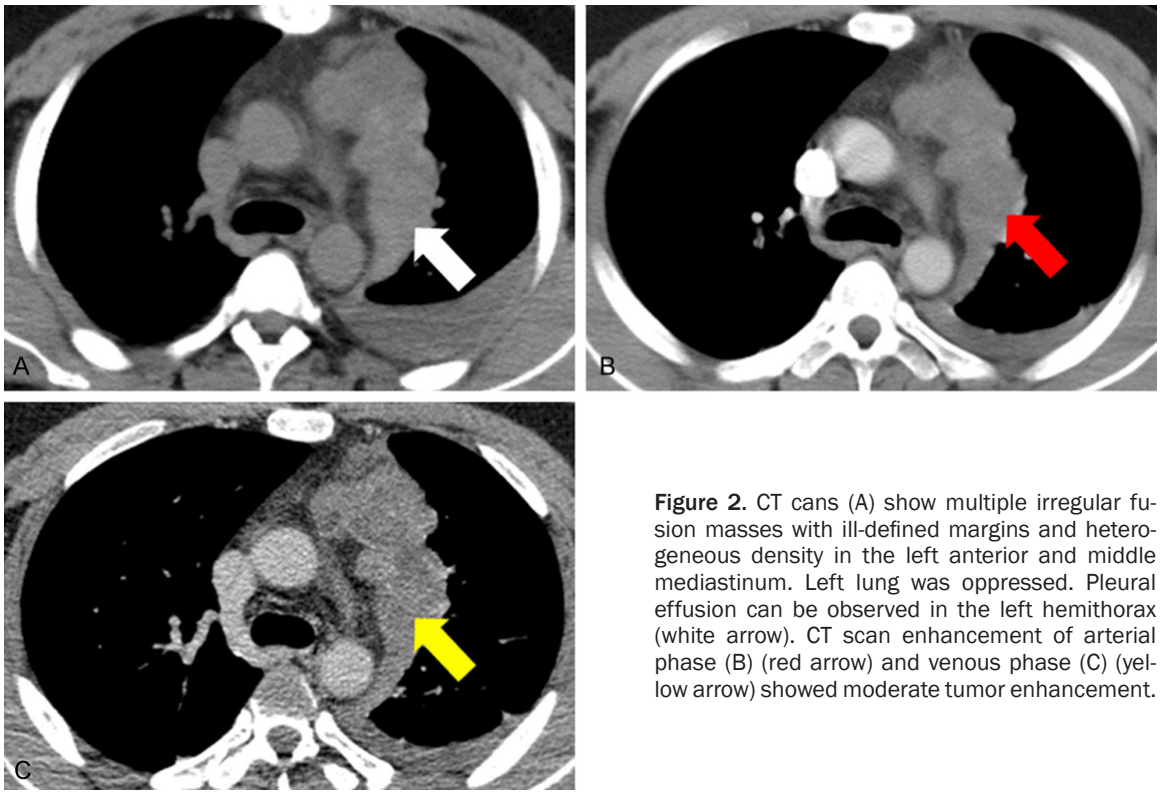

Figure 2. CT cans (A) show multiple irregular fusion masses with ill-defined margins and heterogeneous density in the left anterior and middle mediastinum. Left lung was oppressed. Pleural effusion can be observed in the left hemithorax (white arrow). CT scan enhancement of arterial phase (B) (red arrow) and venous phase (C) (yellow arrow) showed moderate tumor enhancement.

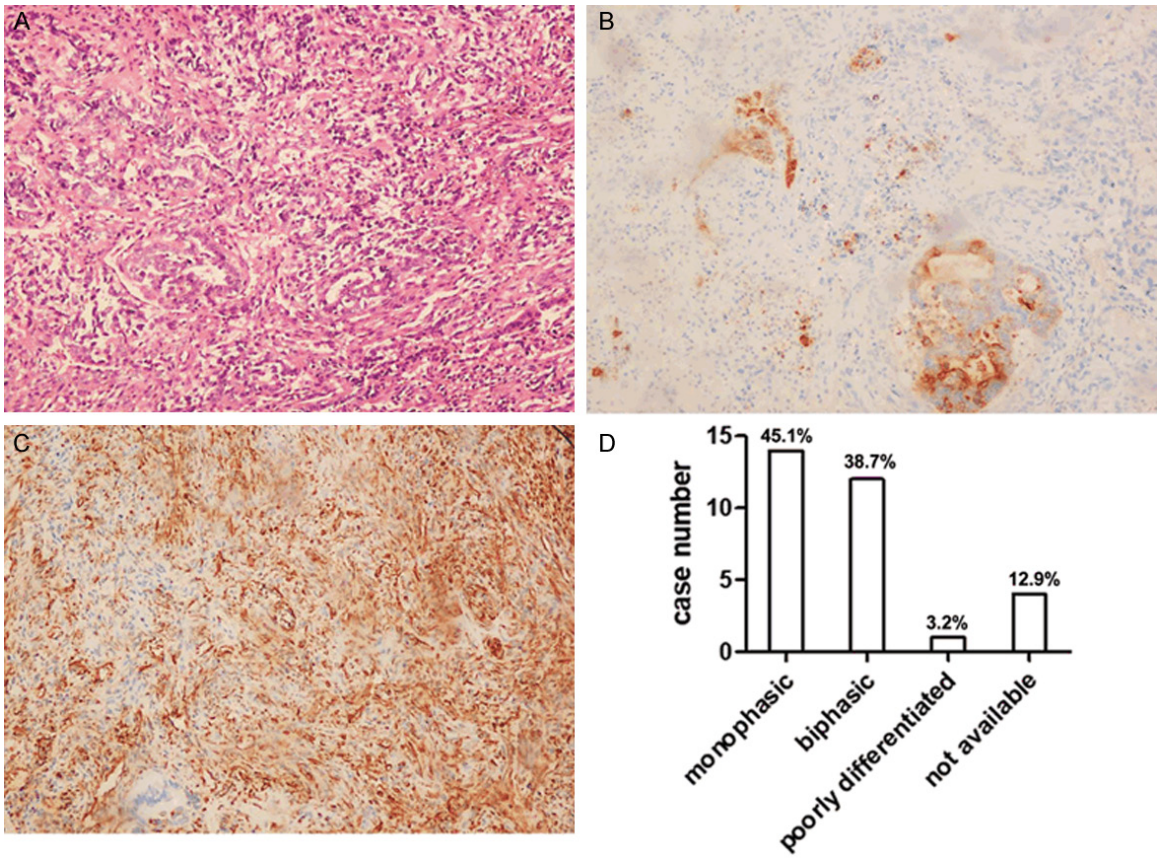

Figure 3. Pathology and immunohistochemistry images of the case. A. Shows (H&E (hematoxylin and eosin) staining) the clusters of epithelioid cells which are oval or cube and have clear boundaries, large nucleus, and rich cyto-

plasm tend to align like the shape of glandular tube. Spindle cells which have unclear boundaries, poor cytoplasm, and round deep dyed nucleus distribute widely (original magnification: ×100). B. Shows immunohistochemistry staining was positive for EMA in the area of epithelioid cells (original magnification: ×100). C. Shows immunohistochemistry staining was positive for vimentin in the area of spindle cells (original magnification: ×100). D. Shows the pathology subtype distribution of primary mediastinal synovial sarcoma.

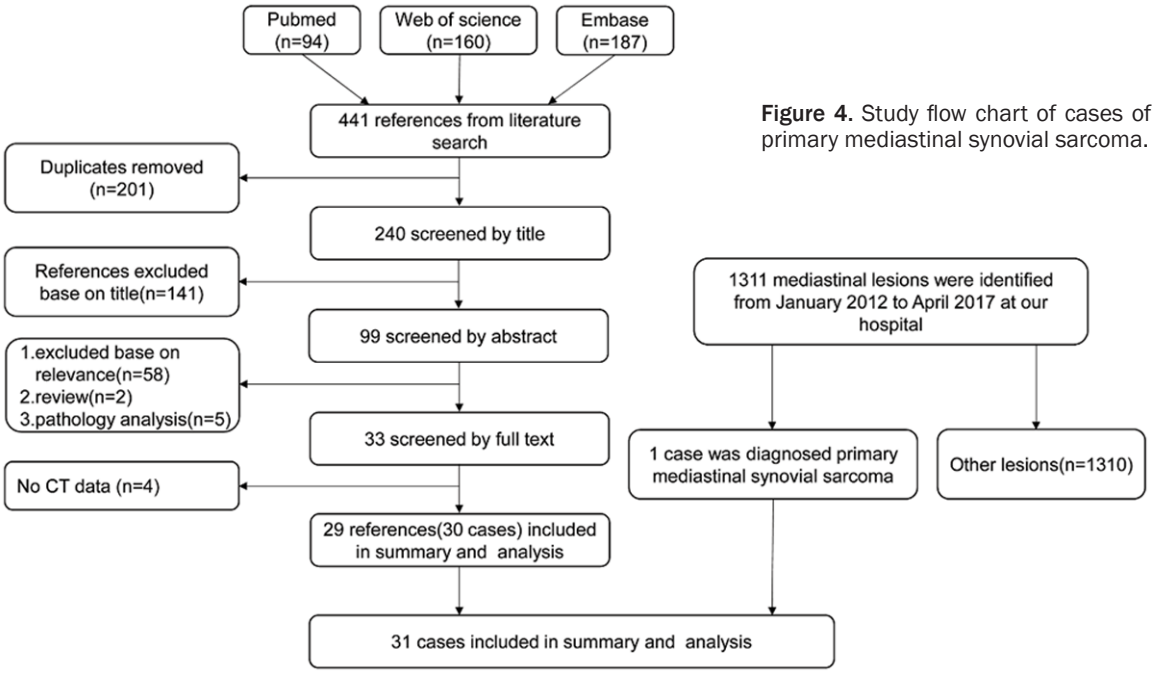

Figure 4. Study flow chart of cases of primary mediastinal synovial sarcoma.

All cases of PMSS in included studies presented with a solitary mass, according to CT scans. Tumor shapes were round, irregular, or lobulated. Tumor margins of only four (12.9%) cases were reported. All tumors were well-defined. Tumor heterogeneity of nineteen (61.3%) patients was reported. Tumor enhancement patterns of fourteen (45.2%) patients, showing heterogeneous enhancement, were reported. Tumor calcification of five (16.1%) patients was reported. Tumor necrosis/cystic changes were reported in thirteen (41.9%) patients. Lymphadenopathies in the mediastinum of three patients (9.7%) were reported. Pleural effusion was reported in ten (32.2%) patients.

Discussion

Synovial sarcomas originate from mesenchymal tissues, rather than synovial tissues [1-3, 5]. In the current study, PMSS occurred predominately in male adults, with a median age about 39.9 years. Common symptoms of PMSS included chest pain, coughing, dyspnea, and shortness of breath. The main cause of clinical manifestations of PMSS is compression of adjacent organs or tissues. This is related to the location of the tumor [6]. Due to the deep location of the mediastinum, tumors might go undetected and grow quite large.

Synovial sarcomas are divided into three subtypes, including the monophasic form, biphasic form, and poorly-differentiated form. Monophasic synovial sarcomas are entirely composed of an ovoid-spindle cell morphology, while biphasic subtypes are composed of both spindle cell elements and epithelial components. Poorly-differentiated synovial sarcomas are composed of uniform, densely packed, and small ovoid blue cells that resemble other small round blue cell tumors [1, 7]. Immunochemistry examinations play an important role in the diagnosis of primary mediastinal synovial sarcomas. Epithelial markers, including pan-keratin, CAM 5.2, and EMA, are most helpful. Positive spindled cells may be present as single cells, small clusters, or larger sheets. Vimentin, cytokeratin, and EMA positivity, in combination with CD34 negativity, are useful protein biomarkers for diagnosis of monophasic synovial sarcomas [8].

Table 1. Summary of Primary mediastinal synovial sarcoma cases in the literature

Athours (Years)	PN	Sex	Age (y)	Clinical presentations	CT presentations	Size (cm)	Mediastinal partition	Histology	Follow up period	Outcome
Ershadi et al. (2016) [12]	1	M	47	Chest pain, shortness of breath on exertion.	A heterogeneously mediastinal mass.	14	Anterior	B	-	Without evidence of residual or recurrent disease.
Ukekwe et al. (2016) [13]	1	F	22	Cough, chest pain.	A huge encapsulated and lobulated mediastinal mass extending superiorly and posteriorly and compressing on the left upper lung lobe.	20×15×15	Anterior	M	18 M	Death.
Madabhavi et al. (2016) [14]	1	M	35	Dyspnea, facial puffiness and hoarseness of voice.	A well-defined enhancing soft tissue density lesion with compression of trachea, superior vena cava right upper lobe bronchus and its branches.	10.3×9.3	Superior	M	1 Y	Without any progressive symptoms.
Bakula et al. (2015) [15]	1	M	76	Shaking, weakness, and productive cough.	A mediastinal mass was lateral to the superior vena cava and had a density almost equal to the thoracic aorta with contrast.	5.0×4.6×4.4	Anterior	B	10 M	A recurrent mass at the site of previous resection, with compression of the superior vena cava.
Gaetano et al. (2015) [16]	1	M	56	Dyspnea, back pain.	A round mediastinal lesion was adherent to the lateral pleural surface, to the posterior wall of trachea and to the lateral wall of esophagus.	13	Posterior	M	-	Disease-free.
Estival et al. (2015) [17]	1	M	38	Fever, productive cough.	A mediastinal mass involving the right hilum, as well as subcarinal enlarged lymph nodes.	11.2×11.2×10.5	Middle	M	7 M	Death.
Yan et al. (2014) [8]	1	M	11	A mass in the left side of the neck with mild dysphagia.	A large, patchily enhanced mediastinal mass extended into the left thyroid gland. Patchy areas of necrosis, low density liquidity and calcification were observed in the mass.	20×15×15	Anterior	M	-	-
Hoyos L et al. (2014) [18]	1	F	56	Sub-acute chest pain, along with dyspnea.	A lobulated soft tissue mass in close relation whit the aorta, superior vena cava, right upper lobe of the lung and superior pulmonary vein.	8×5	superior	M	-	No metastatic disease.
Kara et al. (2014) [19]	1	F	31	No symptom.	A heterogenous mass with tracheal displacement.	4.5×8.8	Anterior	-	4 M	With no signs of disease or recurrence.
Salah et al. (2013) [20]	1	F	35	Bilateral lower limb swelling and exertional shortness of breath.	A heterogeneously enhanced mediastinal soft tissue mass engulfing the major vessels.	-	Anterior	M	11 M	Progression of the size of the mass without distant metastasis.
Balieiro et al. (2013) [21]	1	M	30	Orthopnea, cough, hoarseness and thoracic pain.	The mass was heterogenous due to necrosis, and compressed and dislocated the heart to the right, and invaded the anterior chest wall with partial upper lobe atelectasia and a small pleural effusion.	20	Superior	B	5 Y	No sign of disease recurrence.
Nasser et al. (2013) [22]	1	M	31	Acute chest pain, dyspnea, profuse sweating and central cyanosis.	A heterogeneous mediastinal mass in close contact with ascending aorta, right atrium and superior vena cava.	11×9×11	Anterior	B	7 M	Remain well and asymptomatic.
Tezcan et al. (2012) [23]	1	F	38	Cough, dyspnea, and fatigue.	A soft tissue mass in the anterior and left side mediastinum.	13-14	Anterior	B	3 Y	Death.
Keeling et al. (2012) [24]	1	M	11	Shortness of breath, wheezing, and cough.	A large mediastinal mass partially compressed his trachea and was located above the aortic arch with loose attachments to the right innominate vein, and esophagus.	-	-	-	2 Y	A small fistula tract from the cervical anastomosis to the right chest remains.

Ravikumar et al. (2011) [25]	1	M	42	Chest pain, shortness of breath.	A heterogeneously enhancing mediastinal mass with areas of necrosis was adherent to the pericardium.	6×7	Anterior	B	8 M	With distant metastasis.
Arafah et al. (2011) [26]	1	M	30	Shortness of breath, cough, progressive weight loss.	A large heterogenous mass with multiple cystic degenerating areas with massive right-sided pleural effusion. There were multiple pulmonary and pleural soft tissue deposits and multiple enlarged right axillary and mediastinal lymph nodes.	10×9.5	Anterior	P	6 M	Alive.
Madhumayv et al. (2010) [27]	1	M	12	Chest pain.	A large, well-defined, patchily enhancing, heterogeneous mass with smooth margin. Patchy areas of necrosis and calcification were noted within the mass. Trachea and heart were deviated to the right.	14	Posterior	B	4 M	Disease-free.
Navaravong et al. (2010) [28]	1	F	43	Epigastric abdominal pain.	A hypodense mass with heterogeneous enhancement compressed the heart and distal esophagus.	14.1×8.2	Middle	M	10 Y+	Alive.
Henninger et al. (2009) [29]	1	F	56	Dyspnea during exercise, symptoms of chronic bronchitis.	Intrathoracic tumor was surrounded by pneumatocele with broadly based contact to the pericardium.	3.0×5.0	Anterior	M	16 M	Free of recurrence.
Korula et al. (2009) [30]	1	M	49	Dyspnea, chest pain.	A large heterogeneously enhancing mass with areas of necrosis and is related to the left ventricle with transdiaphragmatic extension.	13×11	-	B	-	-
Katakura et al. (2009) [31]	1	F	70	Cough and dyspnea on exertion.	A circumferential mediastinal tumor with marginal calcification was located at the right side of the pericardium.	13×7×6	-	M	79 D	Death.
Kaira et al. (2008) [32]	2	F/M	64/58	Back pain and dysphagia/ back pain.	A heterogeneously enhancing mass/ a heterogeneously enhancing mass with right pleural effusion.	-/-	Posterior/ Posterior	-/-	24 M/19 M	Death/death.
Hyun Ju et al. (2008) [33]	1	M	40	Cough, dyspnea, and chest pain.	A lobulated soft tissue mass.	12×10	Posterior	M	-	-
Vakili et al. (2007) [34]	1	M	16	Anorexia, nausea, constipation and an occasional cough.	A huge heterogeneous mass with calcified zones.	-	Anterior to middle	B	-	-
Reubendra et al. (2007) [35]	1	M	59	Abdominal pain.	A mass was closely related to the brachiocephalic vein and aortic arch.	12.4	-	B	-	-
Suster et al. (2005) [36]	1	F	4	Weight loss, weakness, fever.	A well-circumscribed mass with right pleural effusion showing low attenuation.	16×13×8	Anterior	M	-	-
Gotoh et al. (2004) [37]	1	M	50	Chest pain.	A heterogeneous mass with a cystic component compressed the superior vena cava with right pleural effusion.	10×8	Anterior	M	9 M	With recurrence and metastasis to right pleural cavity and mediastinal lymph nodes.
Cheng et al. (2003) [38]	1	F	60	No symptom.	A large paraspinal mass was next to the apical segment of the right lower lobe. The lesion had a lobular margin with some calcified foci in the peripheral area.	6.8×5.9×5	Middle	M	3 M	Without evidence of recurrence.
Hsieh et al. (2002) [39]	1	M	11	Facial edema and flushing.	A big mass with chest wall invasion and bilateral pleural effusion, and thrombi in the right jugular vein, superior vena cava and right atrium.	6	Superior	B	2 Y	Alive.

Notes: Age (years); Size (cm). Abbreviations: F, female; M, male; PN, patient number; "-", not available; B, biphasic; M, monophasic; P, poorly differentiated.

Table 2. Summary of clinical presentations of primary mediastinal synovial sarcomas

Clinical presentations	Number of patients	Percentage (%)
Chest pain	11	16.67
Cough	11	16.67
Dyspnea	9	13.63
Shortness of breath	6	9.09
Back pain	3	4.54
Abdominal pain	2	3.03
Weakness	2	3.03
Asymptomatic	2	3.03
Facial edema	2	3.03
Fever	2	3.03
Weight loss	2	3.03
Dysphagia	2	3.03
Orthopnea	1	1.51
Mass	1	1.51
Profuse sweating	1	1.51
Central cyanosis	1	1.51
Wheezing	1	1.51
Shaking	1	1.51
Lower limb swelling	1	1.51
Hoarseness of voice	1	1.51
Fatigue	1	1.51
Anorexia	1	1.51
Nausea	1	1.51
Constipation	1	1.51

All cases of PMSS in included studies presented a solitary mass, according to CT scans, as shown in **Table 1**. However, one case presented with multiple-fusion mediastinal masses, with an irregular shape and an ill-defined margin. Therefore, the mass was misdiagnosed as lymphoma before surgery. According to the present literature review, this is the first case of primary mediastinal synovial sarcoma presenting with multiple-fusion masses.

Due to the atypical imaging features and location of the current case, primary mediastinal lymphoma should be differentiated. Primary Hodgkin's lymphoma is the most common mediastinal lymphoma without predilection for either sex. The median age of patients with mediastinal involvement is 29 years [9]. Typical Hodgkin's lymphoma can show cervical or supraclavicular lymphadenopathy. Some patients may exhibit the symptom of mediastinal mass invasion. Imaging characteristics of mediastinal HD can manifest as surface lobulation, absence of vascular involvement, and high prevalence of associated mediastinal lymphadenopathy and pleural effusion, typically with homogenous soft-tissue attenuation [10]. Pathologically, Reed-Sternberg cells can be found in mass tissues [9].

Primary mediastinal synovial sarcomas have a poor prognosis. The median overall survival is 36 months, with a 5-year overall survival rate of 35.7%. These are far below the rates of extremity synovial sarcomas. In the recent analysis study of prognostic factors of primary mediastinal synovial sarcomas, complete resection of tumors was the only identified factor associated with improved survival [6]. Therefore, early diagnosis and surgery, with adequate resection margins, are very important [11].

The current study had some limitations, however. Since clinical data of the cases was collected retrospectively in the current study, MRI examinations were not performed before surgery. Only one case reported in English provided MRI data. Therefore, limited MRI data did not allow for analysis.

In conclusion, primary synovial sarcomas of the mediastinum can present in young adults as a multi-fusion masses in the mediastinal space, highlighted by atypical features. PMSS should be considered when a solitary mass is found in the mediastinum with chest pain. PMSS is also indicated when the mass measures greater than 4 cm and it appears as a heterogenous mass with necrosis/cystic changes and heterogenous patterns.

Acknowledgements

This work was supported by the National Key Research and Development Program of China (2016YFC0100300), National Natural Science Foundation of China (No. 81171317, 81471631, 81771810), the 2011 New Century Excellent Talent Support Plan of the Ministry of Education, China (NCET-11-0438), and the Clinical Research Award of the First Affiliated Hospital of Xi'an Jiaotong University (No. XJTU1AF-CRF-2015-004).

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Jian Yang, Department of Radiology, The First Affiliated Hospital of Xi'an Jiaotong University, No. 277 West Yanta Road, Xi'an 710061, Shaanxi, People's Republic of China. E-mail: yj1118@mail.xjtu.edu.cn

References

[1] Eilber FC and Dry SM. Diagnosis and management of synovial sarcoma. J Surg Oncol 2008; 97: 314-320.

[2] Bhattacharya D, Datta S, Das A, Halder KC and Chattopadhyay S. Primary pulmonary synovial sarcoma: a case report and review of literature. Int J Appl Basic Med Res 2016; 6: 63-65.

[3] O'Sullivan PJ, Harris AC and Munk PL. Radiological features of synovial cell sarcoma. Br J Radiol 2008; 81: 346-356.

[4] Aydogdu K, Sahin F, Findik G and Kaya S. Pulmonary synovial sarcoma. Asian Cardiovasc Thorac Ann 2014; 22: 92-94.

[5] Ukekwe FI, Ezemba N, Olusina DB, Igbokwe U and Ngene C. Giant primary synovial sarcoma of the anterior mediastinum: a case report and review of literature. Niger J Clin Pract 2016; 19: 293-297.

[6] Salah S and Salem A. Primary synovial sarcomas of the mediastinum: a systematic review and pooled analysis of the published literature. ISRN Oncol 2014; 2014: 412-527.

[7] Madabhavi I, Kataria P, Patel A, Revannasiddaiah S, Anand A, Panchal H, Parikh S, Sarkar M, Modi G, Kulkarni R and Shah S. Primary mediastinal synovial sarcoma presenting as superior vena cava syndrome: a rare case report and review of the literature. Case Rep Oncol Med 2015; 2015: 1-4.

[8] Zhou Y, Dong W, Zou F, Zhou DA and Ma JA. Primary giant mediastinal synovial sarcoma of the neck: a case report and review of the literature. Oncol Lett 2014; 7: 140-144.

[9] Strollo DC, Rosado-de-Christenson ML and Jett JR. Primary mediastinal tumors: part II. Tumors of the middle and posterior mediastinum. Chest 1997; 112: 1344-1357.

[10] Tomiyama N, Honda O, Tsubamoto M, Inoue A, Sumikawa H, Kuriyama K, Kusumoto M, Johkoh T and Nakamura H. Anterior mediastinal tumors: diagnostic accuracy of CT and MRI. Eur J Radiol 2009; 69: 280-288.

[11] Essary LR, Vargas SO and Fletcher CD. Primary pleuropulmonary synovial sarcoma reappraisal of a recently described anatomic subset. Cancer 2002; 94: 459-69.

[12] Ershadi R, Rahim M and Davari H. Primary mediastinal synovial sarcoma: a rare case report. Int J Surg Case Rep 2016; 27: 169-171.

[13] Ukekwe FI, Ezemba N, Olusina DB, Igbokwe U and Ngene C. Giant primary synovial sarcoma of the anterior mediastinum: a case report and review of literature. Niger J Clin Pract 2016; 19: 293-297.

[14] Madabhavi I, Patel A, Anand A, Panchal H and Parikh S. Primary mediastinal synovial sarcoma with subsequent development of primary adenoid cystic carcinoma of lung presenting as superior vena cava syndrome. Clin Respir J 2016; 12: 306-311.

[15] Bakula A, Gan MF, Levinson M, Buckley T, Volpe J and Lowe R. Synovial sarcoma-AV malformation collision in the anterior mediastinum. Conn Med 2015; 79: 87-91.

[16] Rea G, Francesco S, Valente T, Antinolfi G, Grezia GD, Gianluca G. Primary mediastinal giant synovial sarcoma: a rare case report. Egyptian Journal of Radiology & Nuclear Medicine 2015; 46: 9-12.

[17] Estival A, Hardy M, Musulen E, Etxaniz O and Balana C. A 38 year-old man with mediastinal synovial sarcoma: case report and review of literature. J Clin Stud Med Case Rep 2015; 2: 021

[18] Hoyos L, Valdivia D, Macias L, Varela A, Gomez D and Campo JL. Multimodality therapy of primary mediastinal synovial sarcoma: case report. Chest 2014; 146.

[19] Kara HV, Javidfar J, D'Amico TA. Surgical excision for mediastinal synovial sarcoma with limited response to chemoradiotherapy. Ann Thorac Surg 2014; 98: 69-70.

[20] Salah S, Al-Ibraheem A, Daboor A and Al-Hussaini M. Synovial sarcoma presenting with huge mediastinal mass: a case report and review of literature. BMC Res Notes 2013; 6: 240.

[21] Balieiro MA, Lopes AJ, Costa BP, Veras GP, Perelson PS, Nunes RA and Saito EH. The surprising outcome of a giant primary mediastinal synovial sarcoma treated with neoadjuvant chemotherapy. J Thorac Dis 2013; 5: 94-96.

[22] Nasser F, Cavalcante RN, Galastri FL and Affonso BB. Use of transoesophageal echocardiography in endovascular stenting for superior vena cava syndrome. BMJ Case Rep 2013; 2013.

[23] Tezcan Y, Koc M, Kocak H and Kaya Y. Primary intrathoracic biphasic synovial sarcoma. Arch Iran Med 2012; 15: 331-332.

[24] Keeling L, Gordon C, Sawaya D, Giles H and Nowicki M. Synovial sarcoma leading to a paraesophageal abscess in a child. Am J Case Rep 2012; 13: 128-132.

[25] Ravikumar G, Mullick S, Ananthamurthy A and Correa M. Primary synovial sarcoma of the mediastinum: a case report. Case Rep Surg 2011; 2011: 602853.

[26] Arafah M and Zaidi SN. Poorly differentiated monophasic synovial sarcoma of the mediasti-

num. Indian J Pathol Microbiol 2011; 54: 384-387.
[27] Pal M, Ghosh BN, Roy C and Manna AK. Posterior mediastinal biphasic synovial sarcoma in a 12 year-old boy: a case report and review of literature. J Cancer Res Ther 2010; 6: 564.
[28] Navaravong L, Miller BR, Rice KL and Deschamps C. An unusual cause of dyspepsia. Am J Med 2010; 123: 510-513.
[29] Henninger B, Freund M, Zelger B, Putzer D, Bonatti H, Müller L, Fiegl M and Geltner C. Primary mediastinal synovial sarcoma: a case report and review of the literature. Cases J 2009; 2: 6948.
[30] Korula A, Shah A, Philip MA, Kuruvila K, Pradhip J, Pai MC and Chacko RT. Primary mediastinal synovial sarcoma with transdiaphragmatic extension presenting as a pericardial effusion. Singapore Med J 2009; 50: e26-28.
[31] Tatebe S, Oka K, Kuraoka S and Yatabe Y. Benign metastasizing leiomyoma of the lung: potential role of low-grade malignancy. Thorac Cardiovasc Surg 2009; 57: 180-183.
[32] Kaira K, Ishizuka T, Sunaga N, Hashimoto K, Yanagitani N, Nonaka T, Ebara T, Hisada T and Mori M. Primary mediastinal synovial sarcoma: a report of 2 cases. J Comput Assist Tomogr 2008; 32: 238-241.
[33] Hyun-Ju L, Jin-Haeng C, Joon-Sung J, Jae-Ho L, Tae-Jeong K, Sang-Hoon J, Soo-Mee B and Jae-Sung K. Primary mediastinal synovial sarcoma. J Lung Cancer 2008; 7: 29-33.
[34] Vakili R, Hiradfar M, Zabolinejad N and Badiei Z. Tumor induced hypercalcemia in a patient with mediastinal synovial sarcoma. J Pediatr Endocrinol Metab 2007; 20: 841-845.
[35] Jeganathan R, Davis R, Wilson L, McGuigan J and Sidhu P. Primary mediastinal synovial sarcoma. Ulster Med J 2007; 76: 109-111.
[36] Suster S and Moran CA. Primary synovial sarcomas of the mediastinum: a clinicopathologic, immunohistochemical, and ultrastructural study of 15 cases. Am J Surg Pathol 2005; 29: 569-578.
[37] Gotoh M, Furukawa S, Motoishi M, Fujimoto T, Okazaki T, Matsukura T, Hanawa T, Yamashita N, Matsui T, Kuwabara M and Matsubara Y. Synovial sarcoma of the mediastinum: report of a case. Surg Today 2004; 34: 521-524.
[38] Cheng LS, Tse GM, Li WW, Lee TW and Yim AP. Mediastinal synovial sarcoma: a case report and literature review. Can Respir J 2003; 10: 393-395.
[39] Hsieh PP, Ho WL, Peng HC and Lee T. Synovial sarcoma of the mediastinum. Zhonghua Yi Xue Za Zhi (Taipei) 2002; 65: 83-85.