Right atrial tumor embolism from thoracic chondrosarcoma: A case report

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Abstract. Chondrosarcoma accounts for ~15% of all primary malignant bone tumors. Chondrosarcoma of the spine is rare, while intra-atrial tumor embolisms as a result of chondrosarcoma are extremely rare. In the present study, the case of a 70-year-old male with thoracic chondrosarcoma, who presented with a fever and exertional dyspnea, is reported. Following anti-infection treatment with cefoperazone sodium and sulbactam sodium, the patient developed shock and a mass was identified in the right atrium by echocardiogram. The patient subsequently developed acute circular breathing failure and succumbed to the disease. To the best of our knowledge, this is the first case of thoracic chondrosarcoma with a tumor embolism in the right atrium to be reported in the literature.

Introduction

Chondrosarcomas are the second most common type of bone malignancy, worldwide (1). Spine chondrosarcoma account for <10% of all chondrosarcomas (2,3) and the majority are located in the thoracic spine (1,3,4). Diagnosis is based on computed tomography and magnetic resonance imaging, however, pathological diagnosis based on needle biopsies or lesion resection is the gold standard criteria for diagnosis (5). Surgical resection is the most effective treatment strategy (2,3,6), as these tumors are relatively resistant to chemotherapy and radiotherapy (7-9). However, chondrosarcoma of the spine is associated with a poor prognosis; previous studies determined a 5-year survival rate of 64%. In addition, patients have a median survival time of 6 years following surgery and surgical margins are an important prognostic factor (6,10).

Malignancy is one of the primary risk factors for tumor embolism. Embolism refers to the lodging of an embolus, which may be a blood clot, fat globule, gas bubble or foreign material in the bloodstream. Thromboembolisms are the most common type of tumor embolism, commonly occurring in the pulmonary artery. Tumor embolization is a rare but unique complication of malignancy. Patients with cancer have an increased risk of developing embolism due to tumor- and treatment-mediated hypercoagulability (11-13). In an analysis oncology outpatient cohort at Dana-Farber Cancer Institute (Boston, MA, USA), CNS, pancreatic, upper gastrointestinal and lung/pleural malignancies were associated with a significantly higher risk of pulmonary embolism than other malignancies, whereas hematological and breast malignancies had a significantly lower risk of pulmonary embolism (14).

To the best of our knowledge, a right atrial embolism from thoracic chondrosarcoma has not been reported previously. In the present study, the case of an adult male with thoracic chondrosarcoma who succumbed as a result of a right atrial embolism is reported. Written informed consent was obtained from the patient's family.

Case report

A 70-year-old male, who was previously diagnosed with thoracic chondrosarcoma in 2008, presented to Guang'anmen Hospital (Beijing, China) on May 7, 2012 with a fever and exertional dyspnea that had persisted for two weeks. The patient had previously received multimodality therapy for the treatment of local recurrence, osseous metastasis and pulmonary metastasis, which included surgical treatment of recurrent lesions, the placement of an artificial vertebral body, radiotherapy, biological therapy with interleukin-2, administration of bisphosphonates for the treatment of bone metastasis and traditional Chinese medicine (TCM) therapy, as follows. The patient underwent T5 vertebral resection, replacement and posterior fixation for treatment of a thoracic neoplasm at Peking University People's Hospital (Beijing, China) on December 9, 2008. A postoperative pathological diagnosis was chondrosarcoma was determined. The patient subsequently underwent thoracic mass fixation and artificial vertebral body implantation due to local recurrence on June 29, 2011. Chest computed tomography on August 30, 2011 suggested T5-7 vertebral bodies, bone metastases in the adjacent ribs and a mass surrounding the vertebral bodies. Therefore, the patient underwent T5 extrapyramidal radiotherapy (6 MV X-rays at 95% planning target volume administered in 20 fractions of 40 Gy (2 Gy/fraction)] at Peking University Third Hospital (Beijing, China) between September 5, 2011 and October 7, 2011. Later,

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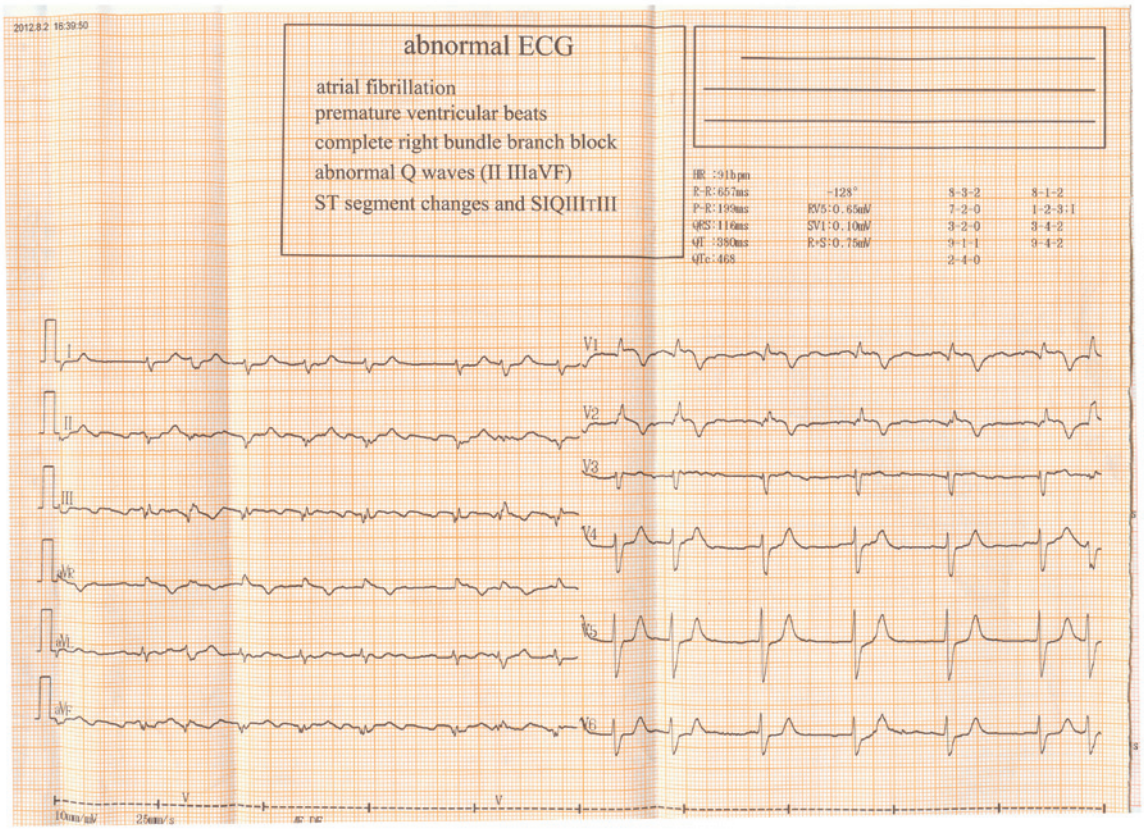

Figure 1. Electrocardiogram results revealing atrial fibrillation, premature ventricular beats, complete right bundle branch block, abnormal Q waves (II, III, aVF), ST segment changes and $S_IQ_{III}T_{III}$.

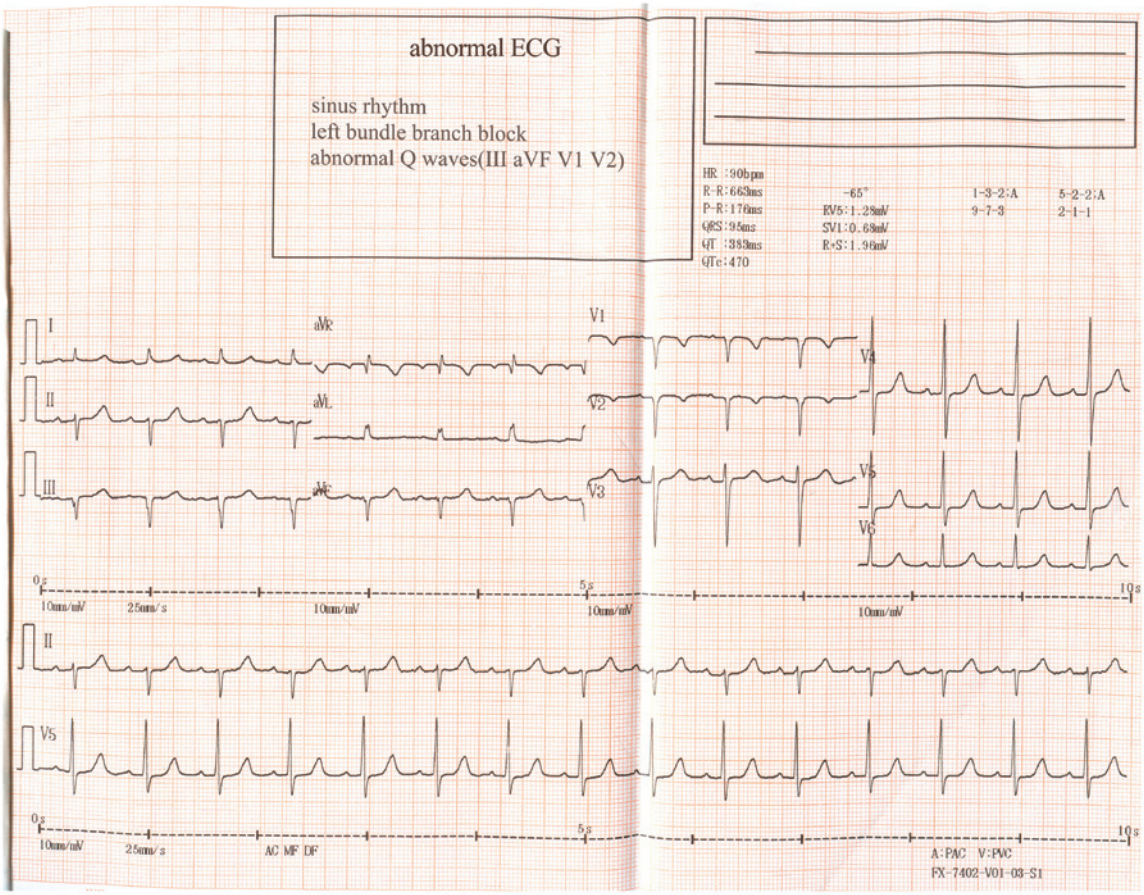

Figure 2. Electrocardiogram performed on admission revealing a sinus rhythm, left bundle branch block and abnormal Q waves (III, aVF, V1, V2).

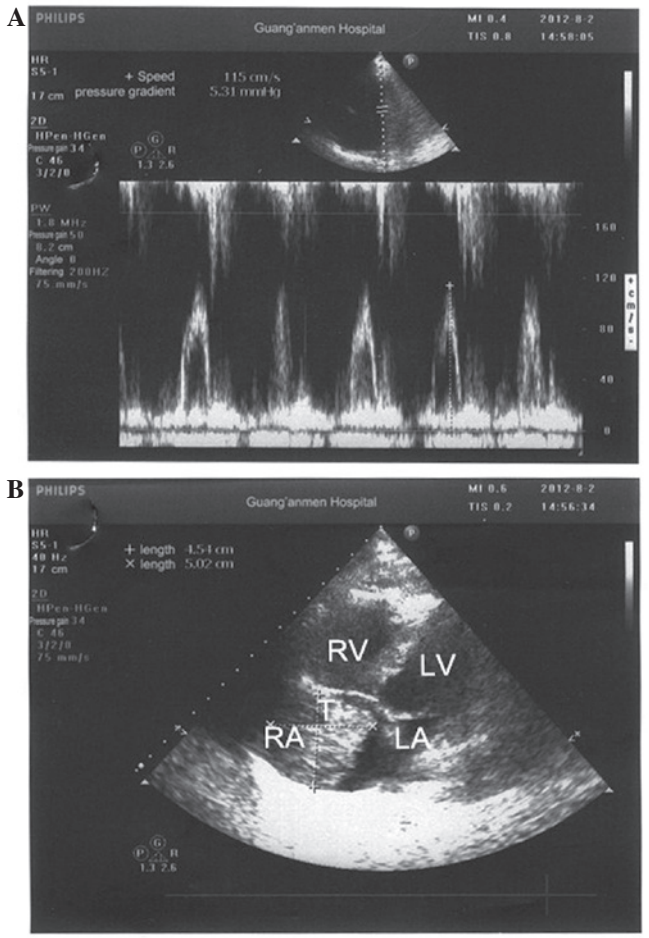

Figure 3. (A) Continuous wave Doppler ultrasonography revealing severe tricuspid regurgitation and severe pulmonary arterial hypertension. (B) Echocardiography scans revealing a 5.0x4.5-cm mass in the RA. RV, right ventrical; LV, left ventricle; RA, right atrium; LA, left atrium; T, tumor.

the patient received interleukin-II therapy ($1x10^6$ IU three times a week). Chest computed tomography performed at Peking University Third Hospital on January 13, 2012, suggested bilateral pulmonary nodules. Thus, the patient received additional interleukin-II therapy ($1x10^6$ IU five times a week). In April 2012, chest computed tomography suggested progress of the bilateral pulmonary nodules, a mass surrounding vertebral bodies and bone metastases. Consequently, the patient received TCM therapy [20 ml cinobufotalin injection plus 250 ml 0.9% normal saline (NS) intravenously (i.v.) drip daily for 13 days, followed by 20 ml compound Kushen injection plus 250 ml 0.9% NS i.v. drip daily for 13 days] in Guang'anmen Hospital between May 23 and June 5, 2012. On presentation to Guang'anmen Hospital, the patient reported mild shortness of breath and a fever. Initial blood tests, performed on June 7, 2012, revealed leukocytosis with neutrophilia [white blood cell, $9.15x10^9$/l (normal range, $4\text{-}10x10^9$/l); neutrophil count, 77.1% (normal range, 51-75%); lymphocyte count, 15.3% (normal range, 20-40%)]. In addition, *Klebsiella pneumoniae* was identified in bacterial culture of the sputum. The patient was diagnosed with a lung infection and subsequently received anti-infection treatment (cefoperazone sodium and sulbactam sodium, 3 g every 12 h for 12 days) between June 7 and 31, 2012. Following three days of treatment, the fever had gone and the blood tests results were within the normal ranges. However, three weeks later, the patient's breathing suddenly deteriorated and shock developed. The blood pressure decreased to 75/35 mmHg (normal range, 120/80-140/90 mmHg), and a cardiovascular examination revealed tachycardia and systolic blowing murmurs. In addition, diastolic rumbling noises were heard in the auscultatory mitral area. Electrocardiogram (ECG) revealed atrial fibrillation, ST segment changes and an $S_IQ_{III}T_{III}$ right bundle branch block (lead I, apparent S waves; lead III, obvious Q and T wave inversion; Fig. 1), which had not been identified on the ECG performed previously following admission (Fig. 2).

Analysis of the arterial blood gas revealed that the partial pressure of O_2 was 53 mmHg at room air temperature (normal range, 80-100 mmHg) and that the partial pressure of CO_2 was 35.3 mmHg (normal range, 35-45 mmHg). Echocardiography revealed a 5.0x4.5-cm mass in the right atrium (Fig. 3), severe tricuspid regurgitation and severe pulmonary arterial hypertension. Subsequently, anti-shock therapy, including high-flow (8 l/min) oxygen therapy, intravenous fluids and dopamine, were administered. However, the patient's condition continued to deteriorate and the patient succumbed as a result of the atrial embolism.

Discussion

Chondrosarcoma accounts for ~15% of all primary malignant bone tumors (15). Chondrosarcoma of the spine is rare, and the majority of such cases occur in the vertebral body or attachments (6,10,16). Chondrosarcoma of the spine is most frequently identified in the cervical, thoracic and lumbar vertebrae, with occurrence in the thoracic vertebrae being the most common (5); this preponderance may be due to the greater number of thoracic vertebrae (6). Chondrosarcoma is classified into five types, namely, central, peripheral, mesenchymal, differentiated and clear cell chondrosarcoma. The two most common types of chondrosarcoma are central (arising within a bone) and peripheral (arising from the surface of a bone) (17). In contrast to osteosarcoma, chondrosarcoma usually occurs in adulthood (18).

Malignancy is one of the main risk factors for a tumor embolism. A number of previous studies have reported the occurrence of tumor embolisms in patients with chondrosarcoma (19-21). A literature search of PubMed for studies published between 1977 and 2013 was conducted using the following keywords: ('tumour embolism' [All Fields] OR 'neoplastic cells, circulating' [MeSH Terms] OR ('neoplastic' [All Fields] AND 'cells' [All Fields] AND 'circulating' [All Fields]) OR 'circulating neoplastic cells' [All Fields] OR ('tumor' [All Fields] AND 'embolism' [All Fields]) OR ('tumor embolism' [All Fields]) AND ('chondrosarcoma' [MeSH Terms]) OR 'chondrosarcoma' [All Fields]). The search identified 32 studies. Of these, 20 studies were associated with the subject of 'tumor embolism with chondrosarcoma' (19,21-39), 14 of which were reported with pulmonary tumor embolism and 3 of which exhibited left atrial embolism. However, no previous studies reporting a large tumor embolism to the right atrium were found.

Intra-atrial tumor embolism is an extremely rare manifestation of chondrosarcoma. Three pathways of cardiac involvement exist: Hematogenous spread, direct invasion from

neighboring chest tumors or via the pericardial space, and retrograde lymphatic spread (40-43). In the present case, we hypothesize that circulating tumor cells migrated to the heart hematogenously, via the superior vena cava, and that subsequently, the tumor emboli reduced the blood flow volume of the heart. The tumor emboli may have attached to the endocardium, causing an intracardiac obstructive mass. A high proportion of patients with tumor embolisms exhibit widespread metastatic disease at the time of presentation. This is consistent for the patient in this case, who exhibited pulmonary metastasis and bone metastases at presentation.

The clinical presentation of embolisms may include non-specific symptoms, such as chest pain, weight loss and dyspnea, or more characteristic symptoms, such as congestive cardiac failure secondary to intracardiac obstructions and embolic events, as observed in the present case. Tumor site, size and tendency to cause an embolism determine the clinical findings. Embolic events must be considered in patients who develop unexplained heart failure or dyspnea. In such patients, echocardiography presents a useful diagnostic step for the detection of cardiac metastasis (44), as it provides information regarding the mobility of the tumor thrombus and the association between the valve and cardiac muscle with respect to the thrombus (45).

Surgery is the main method of treatment for spinal chondrosarcoma (46,47), as the disease is not sensitive to chemotherapy (48). Furthermore, radiation therapy has been found to have no significant effect on the post-operative outcome of patients with chondrosarcoma (10). In the current study, the patient developed shock following the identification of a mass in the right atrium by echocardiography. Surgical embolectomy was not suitable as the patient was in a state of shock with unstable vital signs. In addition, chemotherapy and radiation therapy were not suitable due to the insensitivity of chondrosarcoma to such treatments. Thus, a high level of awareness is required to establish the diagnosis of an intra-atrial tumor embolism. Embolisms as a result of this disease may also lead to arrhythmias and heart failure. As symptoms may mimic other cardiac conditions, the possibility of an intra-atrial tumor embolism must be considered in order to provide timely treatment.

In conclusion, chondrosarcoma is a tumor that rarely extends to involve the right atrium. To the best of our knowledge, based on the literature search conducted, this is the first case of thoracic chondrosarcoma with a right atrial tumor embolism to be reported in the literature. The patient exhibited poor prognosis due to a number of complications, including pulmonary embolism. The findings of this study may increase awareness with regard to this rare tumor, leading to improved clinical treatment of chondrosarcoma.

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