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Brief Report

Chondrosarcoma presenting with pulmonary embolism in a 9-year-old girl: a case report

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Abstract Chondrosarcoma is a malignant bone tumour common in adults, third to myeloma and osteosarcoma, but is exceptionally rare in children. Here we discuss a 9-year-old girl presenting with occlusive right pulmonary artery neoplastic embolus, resulting from a primary right proximal humerus chondrosarcoma. To the best of our knowledge, this the first pediatric and only second overall case reported in the United States of a neoplastic pulmonary embolus resulting from a primary chondrosarcoma.

Keywords: Chondrosarcoma; tumour embolus; pulmonary embolus

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Case report

A 9-year-old African American girl presented with a 3-week history of productive cough, weakness, and fatigue. She was observed twice in the outpatient setting and received antibiotics on the first visit, but returned with the same symptoms and hypoxaemia (saturation 80% in room air) on follow-up. Physical examination revealed diminished breath sounds at the right lung base, without wheezes, crackles, or increased work of breathing. Cardiac examination revealed a hyperdynamic precordium, grade III/VI holosystolic murmur at left lower sternal border, and liver edge 2 cm below costal margin.

Chest roentgenogram revealed a moderate-sized pleural effusion. Electrocardiogram revealed non-specific ST and T-wave changes throughout. Echocardiogram showed normal intracardiac anatomy, severe right ventricular hypertension (~100 mmHg + right atrial pressure by tricuspid regurgitation jet), no inferior vena caval collapsibility, and flow reversal in the hepatic veins. There was moderate tricuspid regurgitation, moderately depressed right ventricular systolic function, and an occlusive mass in the right pulmonary artery (Fig 1). Computed tomography of the chest revealed mediastinal fullness, marked lymphadenopathy, right pulmonary artery mass, and flow voids in all the right lobar and left lower lobar arteries (Fig 2).

Lower extremity Doppler was negative for venous thrombosis. Computed tomography of the abdomen/pelvis were negative and hypercoagulable work-up was negative. On serial echocardiograms, there was persistent right ventricular hypertension without change in the pulmonary artery echodensity despite heparinisation. Thus, the patient was taken for embolectomy. Following confirmation of preoperative findings with transoesophageal echocardiogram, the operation was performed through a median sternotomy via aorto–right atrial cardiopulmonary bypass at 34°C after full systemic heparinisation had been confirmed. A generous pulmonary arteriotomy was performed through the pulmonary artery, and the central and branch pulmonary arteries were inspected. These were full of friable, gelatinous material that did not resemble blood clot. All of the tissue that could be seen was

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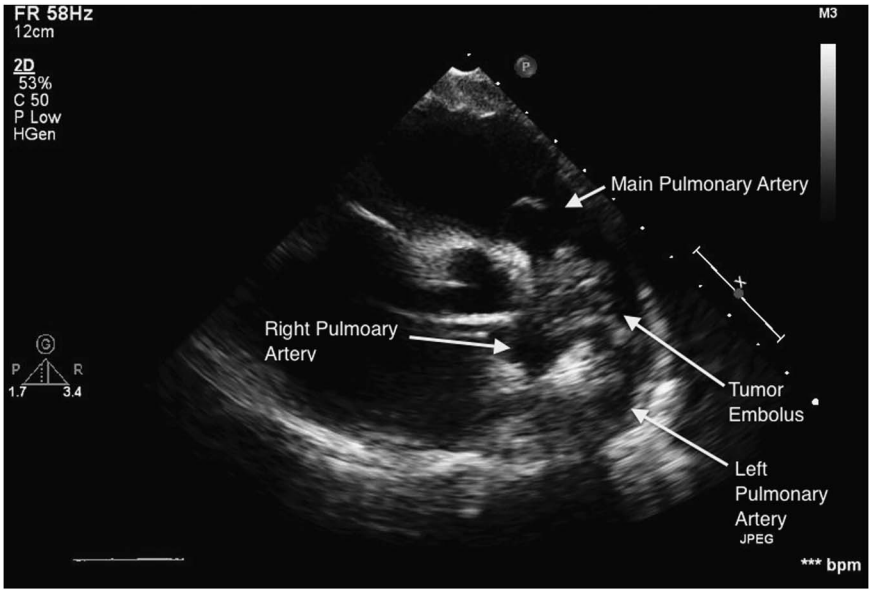

Figure 1.
Transthoracic echocardiogram in parasternal short-axis view showing the tumour embolus occluding the right pulmonary artery and partially occluding the left pulmonary artery.

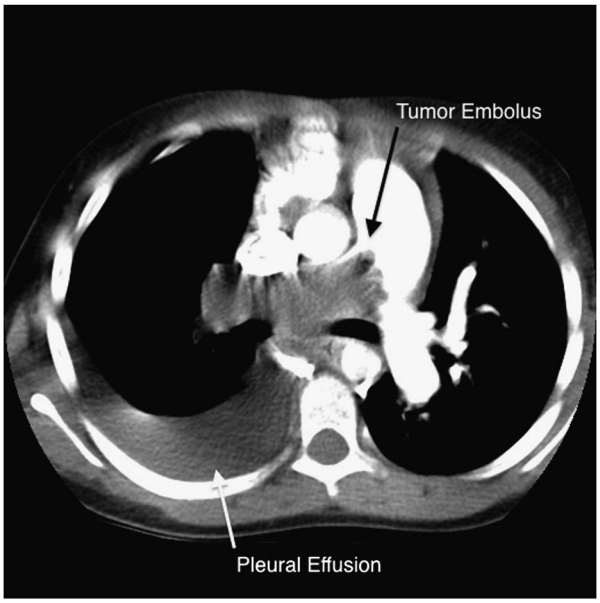

Figure 2.
There is extensive tumour burden completely occluding the right pulmonary artery along with a large right-sided pleural effusion shown on initial computed tomography angiogram.

removed piecemeal, first with forceps, then with sucker and irrigation all the way back through the secondary pulmonary branches. Fogarty embolectomy was then performed on all the branches until each pass was clean. The arteriotomy was closed primarily and the patient rewarmed and weaned from cardiopulmonary bypass without incident. The immediate postoperative transoesophageal echocardiogram showed marked improvement – under general anaesthesia and paralysis – in right ventricular size, pressure, and function; however, the patient's right ventricular pressure was suprasystemic again following extubation, requiring nitric oxide and sildenafil. These increased pressures were most likely secondary to residual distal tumour burden that could not be surgically removed. Upon pathologic analysis of the embolus, the diagnosis at the time was an unspecified sarcoma that had not yet been more definitively characterised. The patient required stabilisation before further investigation owing to her clinical status. In addition, the patient had no extremity complaints at the time of presentation to specifically guide testing for a primary lesion.

Following clinical stabilisation (recovery after embolectomy), an extensive search for primary tumour was conducted. Positron emission tomography-computed tomography, magnetic resonance imaging, and bone scan unveiled a right proximal humerus mass suspicious for osteosarcoma; however, pathology on initial embolectomy specimen and open-biopsy specimens of the proximal humerus (soft tissue and bone) revealed high-grade chondrosarcoma. Shortly thereafter, the patient was initiated on the following chemotherapy regimen. She received 1 cycle of ifosfamide 2800 mg/m^2 per dose × 3 days and etoposide 100 mg/m^2 per dose × 3 days. This cycle was followed by a cycle of doxorubicin 37.5 mg/m^2 per dose on days 1 and 2 with dexrazoxane, cisplatin 60 mg/m^2 per dose on days 1 and 2, and methotrexate 12 gm/m^2 on day 21. After the second cycle, there was significant

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improvement in the right ventricular pressure to half systemic on echocardiogram. We postulate that the reduction in right ventricular pressure was secondary to neovascularisation/collateralisation ± reduction in tumour burden in the distal pulmonary vascular bed. She then received a second cycle of doxorubicin, cisplatin, and methotrexate. The patient did not have significant changes in tumour burden by multi-modality radiologic reassessment. She received another cycle of ifosfamide and etoposide. Owing to the extent of metastatic disease – not amenable to further surgical resection because of the location beyond the hilum – persistent half systemic right ventricular hypertension on outpatient echocardiogram evaluation, and known relative chemotherapy insensitivity of chondrosarcoma, she had a biopsy of her humeral lesion to assess response to therapy before potentially disfiguring local control. There was 60% tumour necrosis – indicating tumour responsiveness to therapy; therefore, she received another cycle of ifosfamide and etoposide, followed by adjuvant chemotherapy.

Discussion

Chondrosarcoma is the third most common primary bone tumour in adults after myeloma and osteosarcoma.[1] They most commonly occur in the femur, humerus, pelvis, scapula, or ribs.[2] The most common age range for chondrosarcoma is 30–60 years old, with the incidence during the first and second decade of life being very low.[2]

Of all chondrosarcomas, 75% to 85% are conventional primary tumours[1] and 90% of these are grade I to II tumours (low to intermediate),[3] and intravascular invasion is a well-known feature of chondrosarcoma.[2] In the scant published cases of children and young adults with primary chondrosarcoma, the tumours have been found to be highly aggressive.[4]

In patients with tumour emboli, treatment should include embolectomy and wide *en bloc* excision of the primary tumour. Prognosis is directly related to primary tumour removal. Chondrosarcomas are known as being somewhat resistant to systemic chemotherapy and radiation.[1]

Pulmonary embolism is a rare phenomenon in children. The annual incidence of pulmonary embolism in childhood is 0.86 per 10,000 hospital admission[5] and 0.14–0.9 per 100,000 children.[6,7] The increasing incidence of pulmonary embolism is likely secondary to increased successful treatment of serious underlying medical conditions that were previously fatal, such as congenital cardiac defects, prematurity, and malignancies.[8] Other underlying risk factors for pulmonary embolism include immobility, recent surgery, central venous lines, vascular malformations, nephrotic syndrome, long-term total parenteral nutrition administration, systemic lupus erythematosus, ventriculoatrtial shunts, congenital and/or thrombotic tendencies, and acute deep venous thrombi.[9] There is a bimodal peak in incidence occurring in infants below 1 year of age and teenagers, with an equal gender ratio.[9] In a retrospective cohort study at The Hospital for Sick Children in Toronto, 56 children with pulmonary embolism were evaluated for their risk factors and associated underlying medical conditions. A central venous catheter was the most consistent factor contributing to thrombotic events in childhood, present in 32.8–63.6% of children with thrombosis.[5,7]

To the best of our knowledge, neoplastic tumour embolism of chondrosarcoma in a child has never been reported in the medical literature. Adult autopsy studies estimate that the incidence of pulmonary tumour embolism is between 3% and 26% among patients with solid tumours, most commonly associated with breast, stomach, and lung carcinomas, but rarely chondrosarcoma.[10]

Conclusion

Chondrosarcoma is extremely rare in children. In addition, chondrosarcoma with pulmonary tumour embolism has been reported only once in the United States, and never before in a child. It is important to treat pulmonary embolism as thrombus until proven otherwise, with anticoagulation plus or minus thrombolysis. If treatment failure occurs, other causes of embolisation must be ruled out. This may require tissue diagnosis.

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Conflicts of Interest

None.

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