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Case Report

Embolization of pulmonary and systemic mycotic pseudoaneurysms in a pediatric patient☆,☆☆

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ABSTRACT

Mycotic pseudoaneurysm is a rare complication of systemic infection in children. We report a case of a previously healthy 11-year-old female with methicillin-resistant staph aureus (MRSA) bacteremia who developed both pulmonary and systemic arterial pseudoaneurysms. These were detected on magnetic resonance (MR) and computed tomography (CT) imaging and treated with coil embolization.

Introduction

Arterial pseudoaneurysms (PSAs) are abnormal arterial dilations without integrity of all 3 layers of the arterial wall, typically secondary to trauma, iatrogenic injury, vasculitis, or infection. This is in contrast to true aneurysms, in which all 3 layers of the arterial wall remain intact. Mycotic pseudoaneurysms are an infectious type of PSA caused by arteritis and resulting in a saccular outpouching that contains perivascular tissue, hematoma, or fibro-inflammatory tissue. These have been described in the great vessels, pulmonary vasculature, visceral arteries and peripheral systemic arteries. PSAs are rare in children; though exact incidence is uncertain, 1 tertiary care children's hospital reported an incidence of less than 0.01% among hospitalized children [1]. Most of these are iatrogenic, with de novo mycotic PSAs rarely reported. To our knowledge, this is the first report of concomitant pulmonary and systemic arterial mycotic pseudoaneurysms in a pediatric patient.

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Case report

A previously healthy 11-year-old female with systemic methicillin-resistant staph aureus (MRSA) infection was transferred to our hospital for rehabilitation after an extended stay at an outside hospital. Six weeks prior to transfer, the patient developed right knee pain, back pain, and fevers following discovery of what was described as a purulent spider bite. Her course was further complicated by COVID-19 infection and dehydration at which point she presented to an emergency department with altered mental status and incontinence. At the time, she was noted to be febrile, tachypneic, tachycardic, and hypoxic and was admitted to the pediatric intensive care unit (PICU). Blood culture obtained on admission was positive for MRSA and she was started on intravenous antibiotic therapy. Persistent symptoms prompted magnetic resonance imaging (MRI) of the spine and computed tomography (CT) of her chest, abdomen and pelvis demonstrating multifocal fluid collections and inflammation involving the right psoas muscle, right thoracolumbar paraspinal soft tissues, cervical and thoracic prevertebral soft tissues, as well as multifocal septic arthritis. Bilateral pleural effusions, multifocal opacities, and multiple pulmonary nodules were also noted concerning for septic emboli. MRI of the brain demonstrated signs of meningitis and ventriculitis, confirmed on lumbar puncture with cerebrospinal fluid also positive for MRSA.

Throughout her stay at the outside hospital, she underwent multiarticular surgical washouts, as well as washout of her paraspinal abscesses. Bilateral chest tubes were later placed for empyema. She remained on antibiotics with clearing of her blood cultures 9 days after admission. She continued to improve clinically and was transferred to our facility for rehabilitation 10 days later.

Upon arrival, the patient was clinically well appearing and afebrile with normal vital signs. CT imaging of her chest, abdomen, and pelvis was obtained 8 days after transfer to monitor her known abscesses. Though most of her fluid collections had decreased, increased size of the right psoas collection prompted an MRI showing increased T1 signal intensity within this collection concerning for blood products (Fig. 1). CT angiography was performed demonstrating enhancing lesions in the left medial lower lobe, the right posterior mediastinum and the right psoas all consistent with pseudoaneurysms (Fig. 2). Retrospective review of the prior imaging demonstrated that these lesions had been present 2 weeks prior, likely coinciding with the active stages of her initial MRSA infection. Her hematocrit level had remained stable throughout her admission at our facility without need for blood transfusion.

Given the risk of life-threatening hemorrhage from PSA rupture, the interventional radiology (IR) service was consulted for embolization. Addressing the pulmonary lesion first, access was obtained to the right common femoral vein with a 5 French vascular sheath. The left pulmonary artery was selectively catheterized and diagnostic angiogram was performed, demonstrating a PSA arising from a medial branch of the posteromedial trunk of the left lower lobe artery measuring approximately 12 mm (Fig. 3A). The branch pulmonary artery was selectively catheterized using a 2.4 French microcatheter (Renegade, Boston Scientific, Marlborough, MA) and the PSA sac and feeding vessel were embolized using multiple detachable coils (Concerto, Medtronic, Minneapolis, MN). Postembolization angiography demonstrated no antegrade flow in this branch pulmonary artery, and angiography performed from the main pulmonary artery demonstrated no additional pulmonary arterial PSAs (Fig. 3B).

Access was then obtained to the left common femoral artery and diagnostic angiography was performed of the right L2-L3 lumbar artery demonstrating a PSA arising from a superior intramuscular branch, corresponding to the right psoas PSA seen on CT (Fig. 4). This branch was selectively catheterized using a 1.7 French microcatheter (Excelsior SL-10, Stryker, Fremont, CA) and coil embolized (Concerto, Medtronic, Minneapolis, MN).

The PSA in the posterior mediastinum was then identified on angiography of the right T9 intercostal artery with evidence of active hemorrhage. This was embolized in a similar fashion, and postembolization angiography demonstrated no antegrade flow in this branch. Completion fluoroscopic

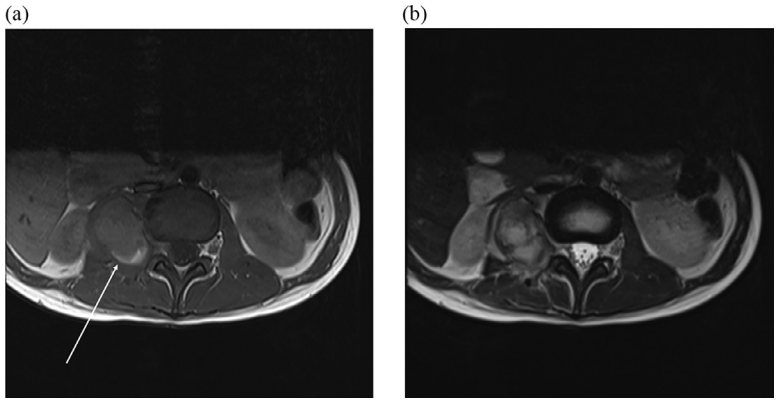

Fig. 1 – Axial precontrast T1-weighted (A) and T2-weighted (B) MR images demonstrate a complex right psoas collection with variable signal intensity including T1 hyperintensity (white arrow), consistent with blood products. MR, magnetic resonance.

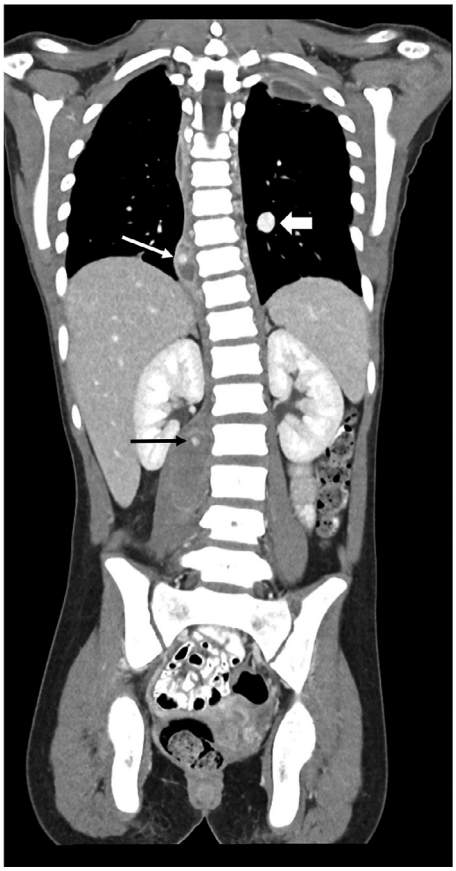

Fig. 2 – Coronal contrast-enhanced CT images of the chest, abdomen and pelvis demonstrates enhancing lesions compatible with pseudoaneurysms in the left medial lower lobe (thick white arrow), the right posterior mediastinum (thin white arrow) and the right psoas (black arrow). CT, computed tomography.

images demonstrated coils at the sites of all 3 treated pseudoaneurysms (Fig. 5).

The patient returned to the PICU after the procedure, where she remained clinically stable. She was transferred back to the rehabilitation medicine service the subsequent day. CT angiogram obtained 6 days postprocedure demonstrated stable position of embolization coils with no evidence of recurrent pulmonary, lumbar, or intercostal PSA, and marked decrease in the size of her right psoas collection. The remainder of her clinical course was uneventful and the patient was discharged on postprocedure day 7.

Follow-up CT angiogram obtained 17 days postprocedure demonstrated further decrease in the size of her multifocal fluid collections with no evidence of new or recurrent PSAs.

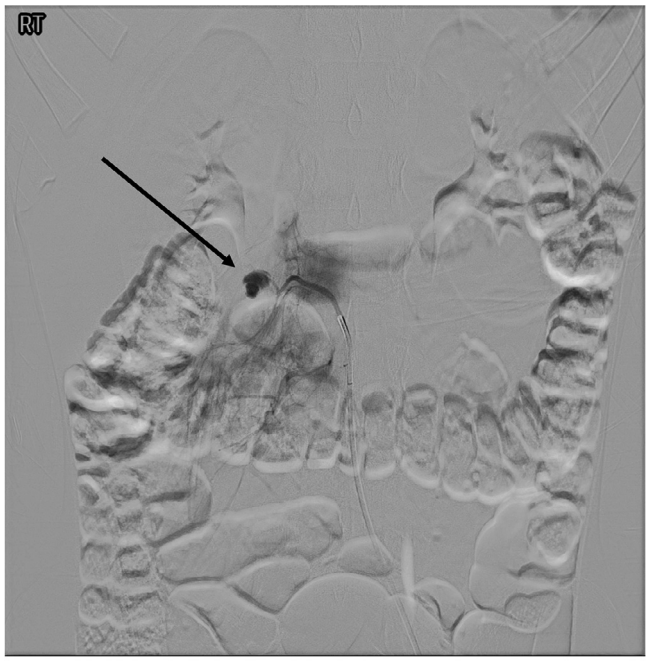

Fig. 4 – DSA demonstrates a pseudoaneurysm (black arrow) arising from a superior intramuscular branch of the right L2-L3 lumbar artery, corresponding to the pseudoaneurysm within the right psoas collection seen on CT and MR.

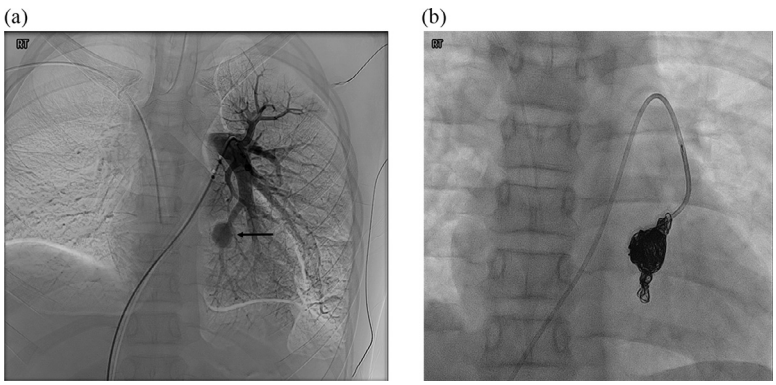

Fig. 3 – (A) DSA demonstrates a 12 mm pseudoaneurysm (black arrow) arising from a medial branch of the left lower lobe posteromedial pulmonary artery. (B) Postembolization DSA images demonstrate embolization coils in place without residual filling of the pseudoaneurysm sac. DSA, digital subtraction angiography.

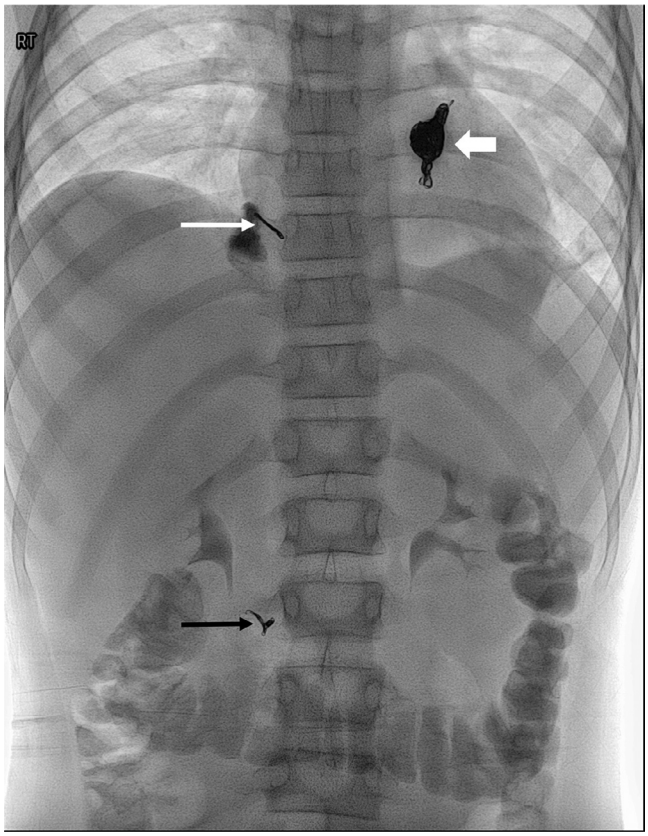

Fig. 5 – A postembolization fluoroscopic image demonstrates embolization coils at the sites of the treated pseudoaneurysms in the left medial lower lobe (thick white arrow), the right posterior mediastinum (thin white arrow) and the right psoas (black arrow).

Discussion

In this report, we describe the first known case of concomitant pulmonary and systemic arterial pseudoaneurysms presenting in a child with systemic MRSA infection. To our knowledge, mycotic PSAs have not previously been described in the lumbar or intercostal arteries in a pediatric patient.

Mycotic PSAs in children are uncommon, with most reported cases due to prior iatrogenic arterial injury, often in the setting of cardiac surgery. The rare formation of mycotic PSAs without prior iatrogenic trauma have been in the setting of necrotizing pneumonia, abscess formation or systemic bacterial infection, with most described as solitary and focal [2,3]. Of note, 1 case report describes multiple pulmonary pseudoaneurysms (PPSAs) developing in a patient with Coronavirus disease (COVID-19) infection which raises the possibility that concomitant MRSA and COVID-19 infection in our patient increased her susceptibility to vascular injury [4].

PSAs may present symptomatically due to bleeding or mass effect, or can be identified incidentally on imaging. One retrospective review in adults found that just 23% of patients with PPSAs presented with hemoptysis, and PPSAs were suspected in just 13% of all cases with almost half of the cases (46%) missed on initial imaging [5]. CT angiography is the imaging modality of choice to characterize these lesions given its superior spatial and temporal resolution. However, pseudoaneurysms can also be identified on venous phase imaging and diagnostic radiologists should be aware of this potential complication of systemic bacterial infection. PSAs may also mimic infectious fluid collections, which can be dangerous as drainage may result in rupture [6,7]. Therefore, both interventional and diagnostic radiologists should be aware of this condition prior to any percutaneous intervention.

Though PSA thrombosis or regression can occur, clinical predictors of regression have not been established, and spontaneous rupture remains potentially fatal. Reported mortality rates vary based on location, with rupture of pulmonary arterial pseudoaneurysms associated with up to 50% mortality [5]. Though similar figures are not available in the pediatric literature, urgent treatment should be strongly considered. Endovascular intervention is preferred due to lower morbidity and mortality when compared to surgical intervention [8]. Surgical intervention should be reserved for cases not amenable to percutaneous treatment.

Approaches to percutaneous treatment of a PSA should be tailored to its location and morphology. For peripheral PSAs, particularly postcatheterization femoral artery PSAs, direct thrombin injection has had reported success in both adult and pediatric populations [1,9]. Visceral PSAs and those not amenable to direct percutaneous injection can be treated with endovascular techniques, including coil embolization or stent placement [8]. When a single feeding vessel is identified, embolization of the feeding vessel alone may be utilized if no end-organ dysfunction is anticipated. In cases with multiple feeding vessels, the pseudoaneurysm must be embolized both proximal and distal to the aneurysm sac to prevent further flow. If the pseudoaneurysm sac is wide necked and not amenable to coil embolization, stent graft placement can be considered though this method is controversial in the setting of mycotic pseudoaneurysms given the risk of potential graft infection.

In our patient, all 3 pseudoaneurysm were successfully treated with coil embolization of the pseudoaneurysm sac and feeding vessel. There was no evidence of recurrence or need for additional intervention at 6-week follow-up.

Formation of mycotic pseudoaneurysms in children, while rare, can remain a serious complication of disseminated infection such as with MRSA. While many are solitary, they can be multiple and urgent treatment with coil embolization should be strongly considered.

Patient consent

Consent was obtained from the patient's parents for publication of this case report and any accompanying images.

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