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Balloon occlusion technique with ethylene vinyl alcohol for the treatment of a pediatric pulmonary artery mycotic aneurysm

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ABSTRACT

Mycotic aneurysms, which may occur anywhere in the body, may be prone to spontaneous rupture. Antibiotic therapy combined with surgical debridement without or with revascularization has been described as potential treatment options. This report describes a combined balloon occlusion technique with the injection of ethylene-vinyl alcohol copolymer for the treatment of a mycotic aneurysm of the pulmonary artery secondary to infective endocarditis. Similar techniques have been described in the cerebral circulation and may obviate concerns for coil erosion, non-target embolization, or superinfection.

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Introduction

A mycotic aneurysm is an aneurysm resulting from a bacterial infection of the arterial wall. It is a common complication because of hematogenous spread of a bacterial infection and often occurs in the setting of endocarditis [1]. A mycotic aneurysm can occur anywhere in the body; however, the most common locations include the thoracic and abdominal aorta as well as abdominal visceral, intracranial, lower extremity, and pulmonary arteries [1]. Degeneration of the vessel wall secondary to infection results in an unstable aneurysm prone to rupture [1]. Standard treatment of a mycotic aneurysm is antibiotic therapy combined with surgical debridement without or with revascularization [2]. This report describes a pediatric patient with congenital heart disease that developed a mycotic aneurysm of the pulmonary artery secondary to infective endocarditis who was successfully treated with embolization using the balloon occlusion technique with the injection of ethylene-vinyl alcohol copolymer (EVOH) (Onyx, Ev3, Irvine, CA). Institutional review board approval was obtained before preparation of this report.

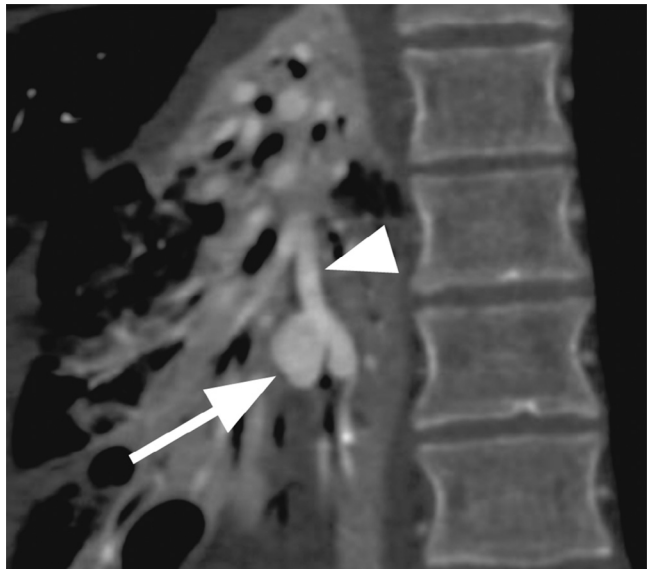

Fig. 1 – Computed tomography image shows a 19-mm aneurysm (arrow) arising from the medial basal segmental branch of the right pulmonary artery (arrowhead).

Case report

A 13-year-old girl with history of DiGeorge syndrome, prior neonatal truncus arteriosus repair, and severe left pulmonary artery hypoplasia presented with methicillin-sensitive staphylococcal bacteremia secondary to infective endocarditis complicated by septic pulmonary emboli, bilateral pyelonephritis, and septic shock. Because of worsening respiratory failure and pulmonary hemorrhage, the patient was placed on venovenous extracorporeal membrane oxygenation (V-V ECMO). Six days after placement on V-V ECMO, acute hemorrhage was noted around and in the right chest tube and also in the endotracheal tube. Computed tomography angiography showed a patent conduit between the right ventricle and the pulmonary artery, an acute right hemothorax, and a 19-mm bilobed presumed mycotic aneurysm involving the medial basal segment of the right lower lobe pulmonary artery (Fig. 1). In addition, extravasation was noted from an intercostal artery at the site of the right chest tube.

The patient was placed under general anesthesia with additional support from a perfusionist team to manage her ECMO circuit. Left common femoral vein access was obtained antegrade using a micropuncture set, and a 9-French, 70 cm Flexor sheath (Cook Medical; Bloomington, IN) was placed into the inferior vena cava. A 7-French APC catheter (Cook Medical) was used to select the main pulmonary artery. Digital subtraction arteriography revealed a patent pulmonary artery conduit (Fig. 2) and confirmed the presence of a 19-mm bilobed mycotic aneurysm arising from the medial basal segment of the right lower lobe pulmonary artery (Fig. 3). The guiding sheath was advanced further into the right pulmonary artery, and a 5-French, 100 cm vertebral tip catheter (AngioDynamics; Latham, NY) and angled tip Glidewire (Terumo; Tokyo, Japan) were used to cannulate the branch vessel feeding the mycotic aneurysm. Given the patient's history of endocarditis and acute hemorrhage in the endotracheal tube, the thought was this most likely represented a friable mycotic aneurysm, which would be prone to rupture with any significant manipulation. Based on this, a decision was made to occlude the mycotic aneurysm using the balloon occlusion technique with the injection of EVOH (Onyx). A 150-cm, Scepter C Occlusion Balloon

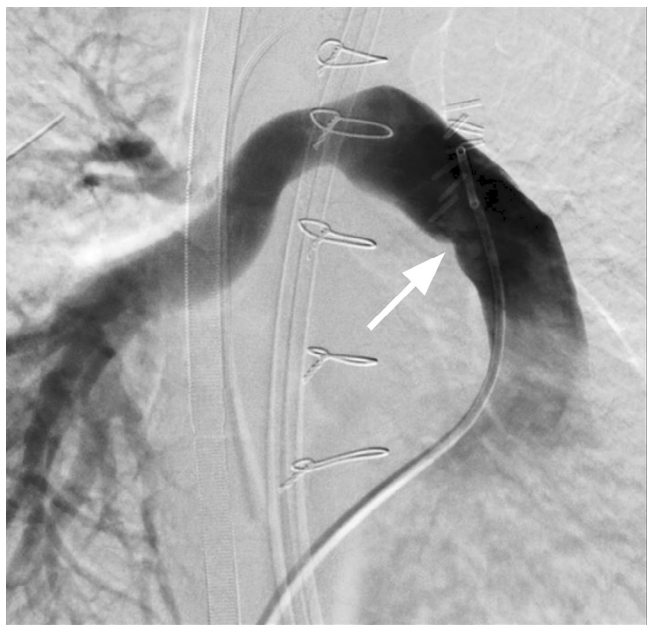

Fig. 2 – Digital subtraction pulmonary arteriogram showing the anastomosis (arrow) of the revised right ventricular to pulmonary artery conduit for truncus arteriosus.

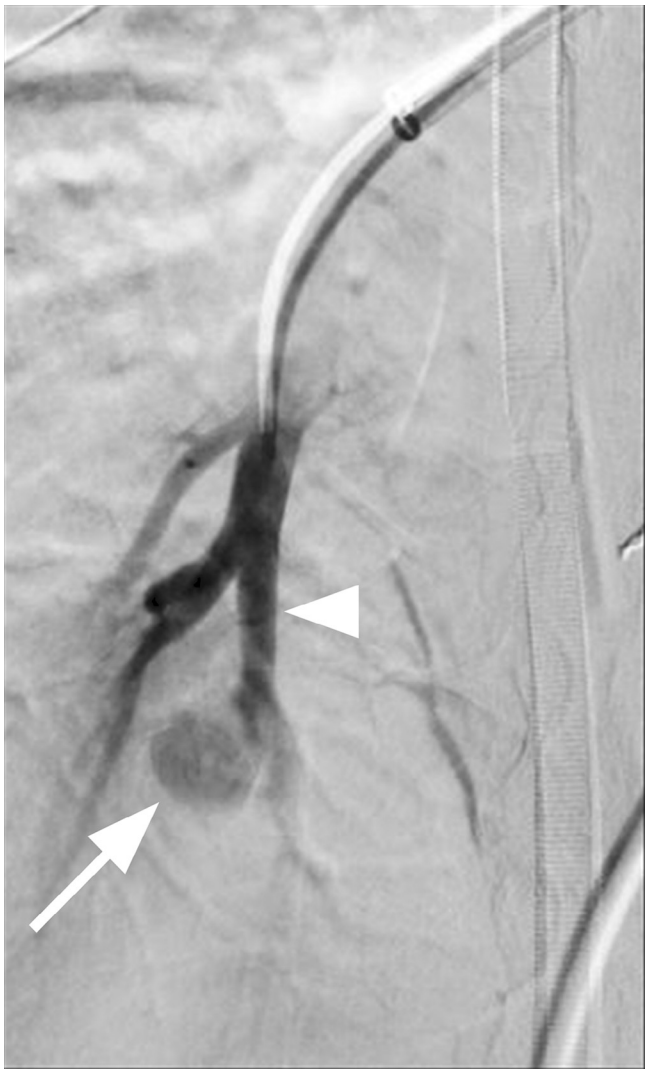

Fig. 3 – Selective digital subtraction pulmonary arteriogram demonstrating a presumed mycotic bilobed aneurysm (arrow) from the medial basal segmental branch of the right pulmonary artery (arrowhead).

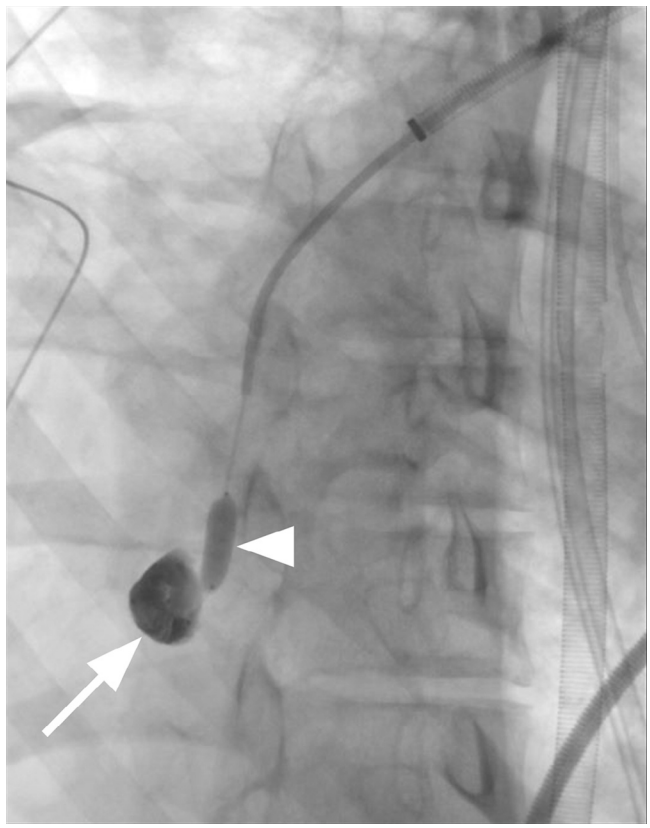

Fig. 4 – A Scepter C occlusion balloon microcatheter (MicroVention) is seen inflated within the medial basal segmental pulmonary artery branch (arrowhead) with subsequent injection of ethylene-vinyl alcohol copolymer (Onyx 34) into the aneurysm (arrow).

Catheter (Microvention; Tustin, CA) was advanced coaxially and placed at the neck of the mycotic aneurysm over a Synchro 0.014-inch wire (Stryker Neurovascular; Kalamazoo, MI). The occlusion balloon was gently inflated to 5 mm in the parent vessel using a Cadence Precision injector syringe (ev3, Covidien; Plymouth, MN). The dead space of the catheter was then primed with dimethyl sulfoxide, and EVOH (Onyx 34; ev3, Covidien) was then slowly injected into the mycotic aneurysm, filling it completely (Fig. 4). The balloon was deflated and repeat pulmonary arteriography showed occlusion of the mycotic aneurysm and preserved flow to normal lung parenchyma (Fig. 5). Right femoral arterial access was then obtained, and a thoracic aortogram revealed extravasation from a right intercostal artery. The artery was selected and successfully treated with coils and Gelfoam. Total procedure time was 132 minutes. The patient returned to the pediatric intensive care unit in stable condition. Hemorrhage into the right chest tube and endotracheal tube resolved completely 24 hours after the procedures. Unfortunately, care was withdrawn because of neurologic deterioration 3 days after the procedure. The family declined an autopsy.

Discussion

Mycotic aneurysms carry a high mortality rate because of their propensity for rupture [1,2]. Given the inherent fragility of the vessels involved in mycotic aneurysms, embolization must be performed with caution. Embolization coils and Amplatzer vascular plugs (St. Jude Medical; Saint Paul, MN) may cause trauma to vessels during delivery and have the potential to erode through the weakened vessel walls. Stent-graft placement in the setting of a mycotic aneurysm is risky because the graft may become infected [1,2]. In this case, a short trunk of the parent vessel made coil embolization more likely to result in non-target embolization; also, the rigidity of a coil may make it more susceptible to future erosion. Liquid embolics have the benefit of being able to be delivered in a controlled fashion with little manipulation of the aneurysmal sac when compared with occlusion with coils or vascular plugs. Glue embolics (n-BCA, TRUFILL; Codman Neuro, DePuy Synthes; West Chester, PA) have

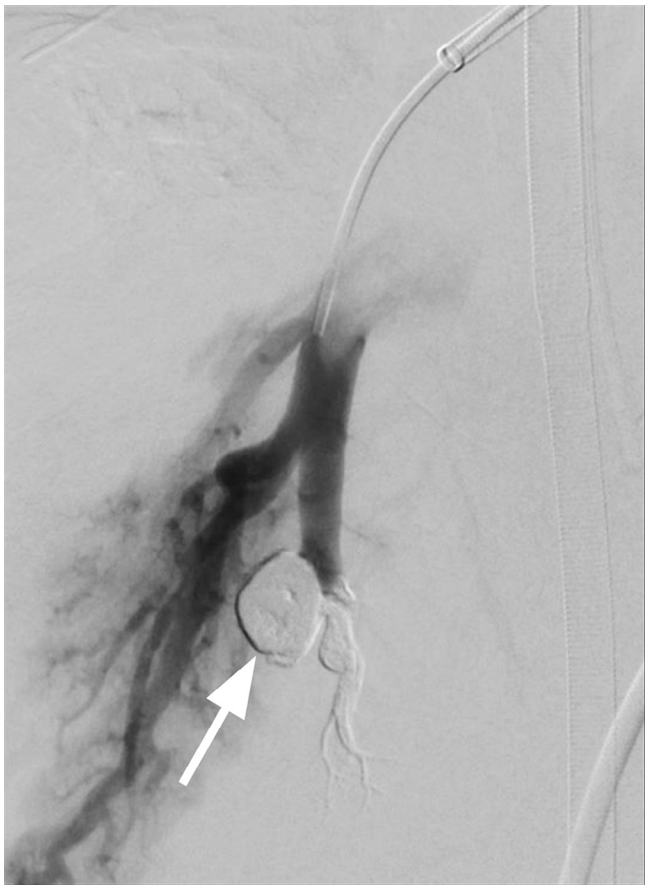

Fig. 5 – Post-embolization digital subtraction pulmonary arteriography demonstrating complete embolization of the aneurysm (arrow) with a small amount of non-target embolization within a sub-segmental right lower lobe pulmonary arterial branch.

been described for the treatment of cerebral mycotic aneurysms and pseudoaneurysms [3,4]. Onyx embolization of infectious intracranial aneurysms has also previously been reported to be safe and effective with a low risk of superinfection and complications including reperfusion [5]. Nonetheless, the patient should receive intravenous antibiotics before and after the procedure.

Although the presence of a mycotic aneurysm inherently carries a poor prognosis, the injection of EVOH using the balloon occlusion technique may potentially offer a safer method of treatment given that there is less manipulation of the aneurysm sac. Further, in the case of intraoperative aneurysm rupture, inflation of the balloon may potentially limit acute life-threatening hemorrhage.

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