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Case Report

Massive Hemoptysis from a Pulmonary Artery Pseudoaneurysm during Cardiac Surgery

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Abstract

Massive hemoptysis is a life-threatening condition usually related to a pathology of the bronchial arteries. Pulmonary artery pseudoaneurysms represent a relatively rare cause of severe airway bleeding, but are associated with a mortality rate of over 50%. A case of massive intraoperative hemoptysis treated with temporary occlusion of the right pulmonary artery and delayed endovascular occlusion of the feeding segmental artery is described.

KEYWORDS: Hemoptysis, pseudoaneurysm, pulmonary artery catheterization, computed tomography

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INTRODUCTION

Massive hemoptysis is a life-threatening condition usually related to a pathology of the bronchial arteries [1]. Pulmonary artery pseudoaneurysms represent a relatively rare cause of severe airway bleeding, but are associated with a mortality rate of over 50% [2]. We report a case of massive intraoperative hemoptysis treated by temporary occlusion of the right pulmonary artery and delayed endovascular occlusion of the feeding segmental artery.

CASE PRESENTATION

We describe the case of an 80-year-old woman who presented with massive hemoptysis during an open heart procedure. The patient survived and gave her consent for the publication of the present case report.

The patient underwent mitral repair at our institution. One hour after the procedure, she had asystolia and was reanimated. Echocardiography performed during cardiopulmonary resuscitation (CPR) showed severe biventricular dysfunction and demonstrated the presence of a right atrial thrombus. The patient underwent emergency surgical re-exploration. Cardiopulmonary bypass (CPB) with bi-caval cannulation was instituted, and the right atrium was explored without cross-clamping the aorta. A 2×1×0.5 cm thrombus was found in the superior vena cava, adherent to the central venous catheter, and was removed. A 2 cm longitudinal incision was then made on the main pulmonary artery, and the right atrium and ventricle were flushed with a heparin solution. A small sucker was advanced in the left pulmonary artery and retrieved a second small clot. It was then advanced in the right pulmonary artery (RPA), finding no additional thrombotic material. A 6-French Fogarty catheter (Edwards Lifesciences, Irvine, CA) was advanced in the left and RPA branches, but no other thrombi were retrieved. The left and right ventricular function recovered, the right atrium and pulmonary artery were sutured, and the patient was weaned from CPB. However, as soon as the pump flow was reduced, significant hypovolemia developed and massive hemoptysis was observed. Notably, the surface of both lungs appeared normal. CPB was started again and bronchoscopy was performed, but the exploration stopped at the carena due to excessive bleeding. A left-sided Robertshaw endotracheal tube (Covidien Spa, Segrate) was positioned, and the source of bleeding was identified in the right lung. The tracheal lumen was occluded, the patient was weaned from CPB during single lung ventilation, and protamine was administered. However, severe bleeding with hemodynamic instability continued despite the normalization of the coagulation. The RPA was then occluded by snaring it with an umbilical tape to interrupt the hemorrhage and obtain a stable hemodynamic condition. The lobar branches of the RPA were selectively isolated and snared, and after re-opening the main RPA, they were released one after the other to identify the pulmonary lobe where the bleeding had occurred. However, after 20 min of complete occlusion of the RPA, the bleeding had stopped. A new bron-

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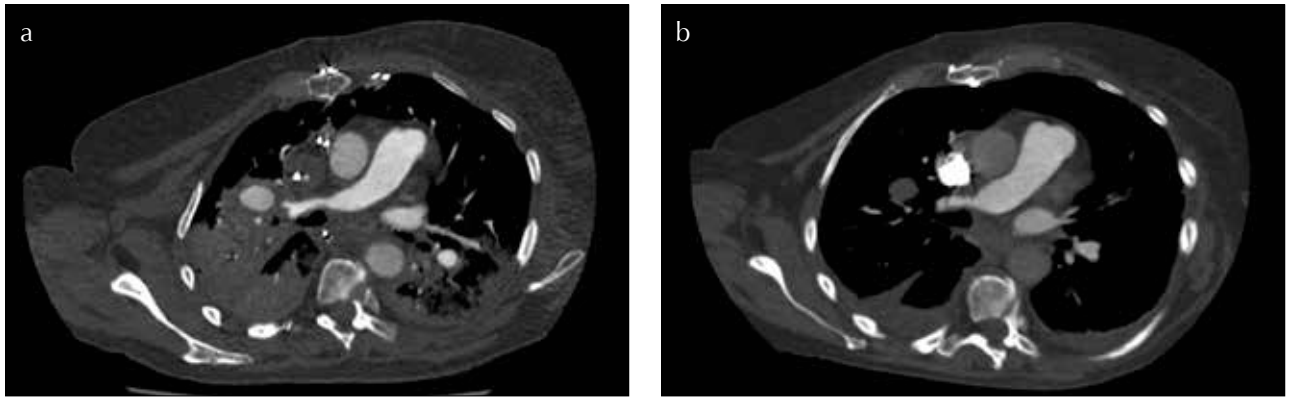

Figure 1. a, b. Contrast-enhanced computed tomography scan of the chest, double oblique axial view demonstrating the presence of a large pseudoaneurysm originating from the right upper anterior segmental artery. The right lung is almost completely collapsed. (a) After the embolization of the feeding artery, the pseudoaneurysm is excluded from the circulation (b)

Figure 2. a, b. Selective injection in the left upper lobar pulmonary artery. (a) An Amplatzer vascular plug II has been released in the right upper anterior segmental artery. The pseudoaneurysm is excluded from the circulation (b)

choscopy demonstrated a clot in the right upper lobar bronchus. The chest was closed, and the patient was transferred again to the intensive care unit. On postoperative day 2, a control computed tomography (CT) scan was performed. CT revealed the presence of a pseudoaneurysm in the right upper lobe (Figure 1). The right upper lobe anterior segmental artery was therefore occluded with an 8-mm Amplatzer Vascular Plug II (St Jude Medical, Saint Paul, MN) without complications (Figure 2, Supplemental Video 1). The subsequent course was uneventful, and the patient was extubated on postoperative day 6 and was discharged to a rehabilitation facility on postoperative day 11. Before discharge, the control CT scan revealed the exclusion of the pseudoaneurysm (Figure 1). At the 1-year follow-up, the patient was alive and well. The mitral valve was normofunctioning, and the pulmonary artery pressure was in the normal range.

DISCUSSION

Pulmonary artery pseudoaneurysms are a rare cause of hemoptysis associated with high mortality rates. In a series of patients with massive hemoptysis, Krokidis et al. [1] reported that the source of bleeding was of pulmonary origin in only 6 out of 72 cases. Similar findings were reported by Remy et al. [3] and Sbano et al.[4]. Pseudoaneurysms can be congenital or acquired, and if acquired, they can be due to cardiovascular disease, infection, neoplasm, or trauma [5]. Acquired pulmonary artery pseudoaneurysms, however, are more often iatrogenic and may occur during right cardiac catheterization, chest tube insertion, and lung biopsies. A 0.2% incidence of pulmonary artery rupture due to pulmonary artery catheters has been reported, with a mortality rate as high as 50% [5,6]. In our patient, no pulmonary artery catheters were used, and bleeding occurred following a complex chain of events including asystolia and CPR, right atrial thrombosis, pulmonary embolism, emergency surgical re-exploration, and embolectomy. Although a Fogarty catheter was advanced in the RPA, it is unlikely that it reached the right upper lobe anterior segmental artery causing direct damage to the arterial wall because the maneuver was performed under digital control and the catheter always remained in the intrapericardial branches of the RPA. Other mechanisms of vascular damage, such as an “ex-vacuo”

lesion caused by the sucker or external trauma to the lung during surgery or CPR, are also possible. Whatever the mechanism(s) of formation, the pulmonary pseudoaneurysm provoked a catastrophic hemorrhage with rapid deterioration of the hemodynamics, and a fatal outcome was prevented only by temporarily occluding the RPA. This drastic measure, originally undertaken to gain some time to restrict the source of bleeding to one pulmonary lobe or segment, resolved the hemorrhage and allowed us to avoid pulmonary resection, stabilize the patient's condition, and perform all subsequent diagnostic and therapeutic maneuvers in a secure setting. Luckily, the patient did not develop pulmonary artery thrombosis or pulmonary hypertension, and it is possible that the collateral blood flow from the bronchial arteries was sufficient to flush the PA tree, but not to sustain further bleeding, and we were able to spare the right lung.

The emergency therapeutic options for massive hemoptysis due to pulmonary artery pseudoaneurysms include open surgical techniques (lobectomy and segmentectomy) and percutaneous techniques [1,2]. The pseudoaneurysm may be embolized with coils or microcoils [3], or it can be occluded with a stent graft [7]. In our patient, an Amplatzer Vascular Plug II was used because the feeding segmental artery was too small for a covered stent, and the neck of the pseudoaneurysm was large, increasing the risk of coil migration. The procedure was straightforward and effective and led to the complete exclusion of the pseudoaneurysm from the pulmonary circulation (Supplemental video 1, Figure 1).

Massive hemoptysis occurring during cardiopulmonary bypass may pose some special problems related to the peculiar physiologic condition and altered coagulation. In our patient, a stable hemodynamic condition was obtained only after snaring the RPA, and this drastic maneuver was lifesaving and allowed for subsequent diagnosis and treatment. A multidisciplinary environment, with the possibility to perform advanced intraoperative airway exploration and management, prompt diagnostic assessment, and surgical and interventional treatment, was the key for success in the management of this catastrophic complication.

Informed Consent: The patient gave her informed consent for the publication of the present case report.

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Supplemental Video 1. The feeding artery is identified and a delivery catheter is advanced at the origin of the right upper anterior segmental artery. Through the sheet, an Amplatzer vascular plug II is advanced in the artery and released. The final angiography demonstrates the complete exclusion of the pseudoaneurysm from the circulation

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