

Case Report

Trisegmentectomy for traumatic left superior pulmonary vein pseudoaneurysm

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ABSTRACT

Traumatic pulmonary vein pseudoaneurysms are an extremely rare and dangerous phenomenon. These pseudoaneurysms are caused by both penetrating and blunt thoracic trauma, with late sequelae of pseudoaneurysm rupture and high output cardiac failure secondary to arteriovenous fistula. We present a unique case of pulmonary vein pseudoaneurysm due to penetrating chest trauma managed by segmentectomy using thoracic principles of lung preservation.

Introduction

Traumatic pulmonary vein pseudoaneurysms are rare with few cases reported in the literature. Patients sustaining significant injury to the pulmonary vasculature expire soon after injury or require emergent intervention to control hemorrhage. In survivors without immediate intervention, a pseudoaneurysm of the arterial or venous wall may develop at the site of vascular trauma. Fortunately, the pressure within the pulmonary circulation is sufficiently low to facilitate thrombosis of the pseudoaneurysm [1]. This is particularly true for pulmonary vein pseudoaneurysms. Despite this, operative intervention is usually warranted given the risk of rupture and life threatening hemorrhage. Surgical options include aneurysectomy, vessel ligation, and lobectomy or pneumonectomy for hilar control. In select cases, intraluminal coil embolization may be utilized [2–4]. We present the case of a 44 year old male who sustained a traumatic pulmonary vein pseudoaneurysm with associated hemothorax after left chest stab wound. Management consisted of a left upper lobe trisegmentectomy as a unique application of thoracic principles of sublobar parenchymal resection.

Case report

A 44 year old male with history of tobacco use presented to the trauma bay with a knife stab wound to left second intercostal space in the midclavicular line. On arrival, the patient's heart rate was 80, blood pressure 96/61, and oxygen saturation 100% on non-rebreather. The patient had bilateral breath sounds, diminished throughout, with mild dyspnea. A left sided hemothorax was managed by 32 French tube thoracostomy, with initial sanguineous output of 200 mL. Computed tomography (CT) angiography of the chest, abdomen and pelvis was obtained which identified a 0.9 cm pseudoaneurysm of the left superior pulmonary vein at the deepest portion of the stab tract. (Figs. 1 and 2) There were no additional injuries.

He was admitted to the trauma surgical intensive care unit for hemodynamic and respiratory monitoring. Chest tube output over the next seven hours totaled 550 mL. Repeat chest X-ray showed a persistent, albeit improved, left hemothorax. Interventional radiology was consulted for coil embolization of the left superior pulmonary vein pseudoaneurysm, but the patient was not a

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Fig. 1. Coronal image from CT angiogram showing left superior pulmonary vein pseudoaneurysm (arrow).

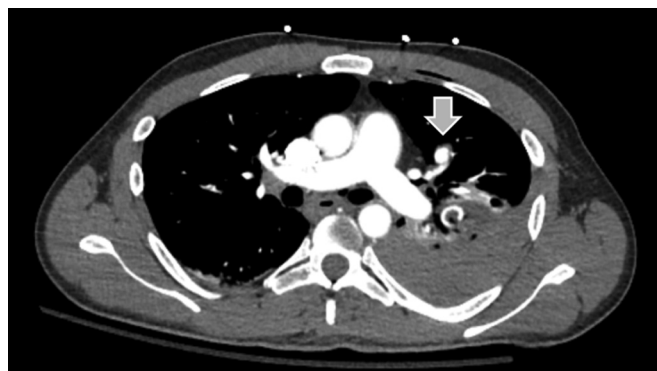


Fig. 2. Axial image from CT angiogram showing left superior pulmonary vein pseudoaneurysm (arrow).

candidate due to the location of the pseudoaneurysm and its associated large feeding vessel. The decision was made to proceed to the operating room for evacuation of retained left hemothorax, control of hemorrhage, and definitive management of a traumatic left superior pulmonary vein pseudoaneurysm.

Promptly, the patient underwent flexible bronchoscopy with bronchoalveolar lavage and left video-assisted thoracoscopic evacuation of hematoma during which ongoing bleeding from the left upper lobe parenchyma was identified. A planned conversion to left muscle sparing thoracotomy allowed for an anatomic left upper lobe trisegmentectomy including apical, posterior and anterior segments. (Fig. 3) A pleural flap was used to buttress the bronchial stump and parenchymal staple line. The case was uncomplicated, with approximately 500 mL of hematoma evacuated from the left hemithorax.

Postoperative chest X-ray showed decreased opacification of the left hemithorax. The patient's postoperative course was

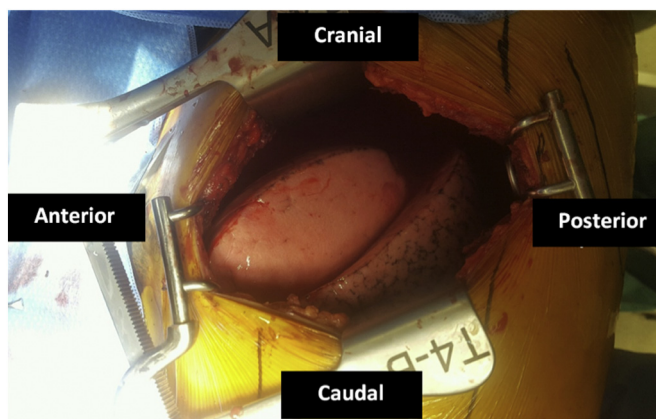


Fig. 3. Anatomic left upper lobe trisegmentectomy.



Fig. 4. Coronal image from postoperative CT scan with absence of left superior pulmonary vein pseudoaneurysm and improvement of left hemithorax.

uneventful. The chest tube was removed on postoperative day 2. The patient was discharged home on postoperative day 8 in stable condition, with discharge delayed by days due to social work and rehabilitation issues. A CT chest was obtained at the time of discharge for patient complaints of worsening pain. Imaging showed no acute abnormalities and interval improvement of left hemithorax (Fig. 4). At one month follow up, the patient was progressing appropriately in his recovery despite continued tobacco use. Surgical pathology was consistent with stab injury causing parenchymal and vascular disruption with pulmonary vein pseudoaneurysm.

Discussion

Pulmonary vein pseudoaneurysms are rare with few cases reported in the literature. This is thought to be due the immediate mortality from catastrophic hemorrhage or the natural physiology of the pulmonary circulation [4]. The low pressure system allows for hemostasis and fibrosis while compression of the pseudoaneurysm by surrounding pulmonary parenchyma may contribute to thrombus formation [4,5]. Most cases of pulmonary vein pseudoaneurysm are due to penetrating trauma, however cases of vascular erosion secondary to malignancy have been reported [3,6]. Rupture with ensuing hemorrhage is the most feared complication of any pulmonary pseudoaneurysm as it may quickly lead to airway compromise and fatality. The risk of rupture and bleeding are unknown in cases of pulmonary vein pseudoaneurysm due to the paucity of cases in the literature [3]. Late sequelae of arteriovenous fistula formation can lead to hypoxia and eventual heart failure, which can also be both morbid and lethal. In hemodynamically stable patients without evidence of ongoing bleeding, pulmonary vein pseudoaneurysms may be observed and allowed to thrombose. However, some surgeons feel the risk of rupture is unnecessarily high and recommend intervention in all cases [3].

Surgical management of pulmonary vein pseudoaneurysms traditionally follows established principles for treatment of pulmonary artery pseudoaneurysms due to the rarity of this pathology. Surgical intervention was previously the mainstay treatment with options including aneurysectomy, vessel ligation, and resection of the involved parenchyma with either lobectomy or pneumonectomy [4].

In the modern era, angioembolization is becoming more commonplace. Endovascular coil embolization and percutaneous coil embolization have been employed with success in cases of pulmonary artery and vein pseudoaneurysms [2,3,7,8]. Interventional radiology guidelines for management typically follow those established for pulmonary artery venous malformations (PAVM) which uses the “3 mm guideline” as the threshold for embolization. Treatment is recommended for PAVM with feeding vessel diameter greater than 3 mm [9]. Advancements in technology have improved the ability to access and treat sub-3 mm vessels in cases of symptomatic PAVM, although this is center dependent [9].

While angioembolization is the preferred initial approach for pulmonary artery pseudoaneurysms, access to the pulmonary venous system for endovascular intervention may prove challenging, requiring these patients to undergo definitive surgical intervention. Endovascular access to the pulmonary veins may be achieved through a transfemoral approach with retrograde advancement through the aortic and mitral valves or through an interatrial transeptal puncture as in the Brockenbrough technique [1,10]. In each case, the procedure is technically challenging with risk of injury to surrounding structures and vessels. Peripheral lesions may be amenable to image-guided percutaneous transparenchymal coil embolization [3]. In our case, the central location of the pulmonary venous pseudoaneurysm was considered too high risk for percutaneous intervention. Endovascular intervention may have been possible, but would have traversed a technically challenging path.

This case is unique because of the application of thoracic principles of conservative segmentectomy for parenchymal preservation for treating a pulmonary vein pseudoaneurysm. Pulmonary conservation in this case was important due to the patient's longstanding history of tobacco use and the possibility of later development of COPD, emphysema or non-small cell lung cancer. Traditionally, the standard resection for a central left upper lobe lesion has been a complete left upper lobectomy. Upper lobe trisegmentectomy

(lingula preserving), video assisted or open, is a well-described parenchymal preserving technique for early stage left apical lung cancer [11]. In this case, parenchymal preservation is used to limit long-term morbidity for the patient.

Conclusion

Traumatic pulmonary vein pseudoaneurysms are rare with few cases reported in the literature. Pseudoaneurysm rupture with life threatening hemoptysis or arteriovenous fistula formation with resultant heart failure are late causes of mortality. Angioembolotomy can be utilized to treat the pseudoaneurysm in certain cases. For injuries not amenable to minimally invasive techniques, formal anatomic pulmonary resection has been utilized. If pulmonary resection is planned, a parenchymal preserving operation such as a segmentectomy should be considered as this is a safe and effective option with reasonable morbidity.

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