

Traumatic Right Pulmonary Artery Rupture after Accidentally Being Stepped on the Chest

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Traumatic pulmonary artery rupture is a rare, life-threatening injury. Currently, no strict guidelines for its management exist. Herein, we report a successful surgical repair of a right pulmonary artery rupture caused by being stepped on.

Key words: 1. Trauma
2. Pulmonary artery
3. Cardiopulmonary bypass

Case report

A thin 75-year-old woman was transferred to Kyungpook National University Hospital with a complaint of chest wall pain resulting from her chest being stepped on while she was lying down supine. Her initial systolic blood pressure and heart rate were 137 mm Hg and 73 beats/min, respectively. She was mentally alert. Her hemoglobin level was 11.8 g/dL, and electrocardiography revealed a normal sinus rhythm. An initial chest computed tomography (CT) scan revealed a right hemothorax, multiple rib fractures, and a sternum fracture. There was an approximately 1.2-cm right pulmonary artery (PA) blind pouch that was suspicious for a rupture, 4 cm apart from the main pulmonary trunk, accompanied by diffuse bronchial anthracofibrosis (Fig. 1A, B). The patient was immediately transferred to the operating room for surgical repair with normothermic heart-beating cardiopulmonary bypass (CPB). The injured

right PA was approached through a median sternotomy. CPB was established by arterial cannulation of the ascending aorta near the aortic arch and bicaval venous cannula without venting. Upon opening of the right PA, an approximately 1.5-cm ruptured area of tissue was present at the distal superior aspect of the right PA before branching (Fig. 2A). Proximal and distal clamping of the PA was not performed due to lack of space, and the field of view was secured using a pediatric intracardiac sucker. After removing the injured tissue and hematoma, the black-pigmented enlarged calcified lymph node was visible next to the injured tissue. PA angioplasty was performed along the healthy PA borders with bovine pericardium with 6-0 Prolene in a running fashion (Fig. 2B). After definite deairing before closing the PA, routine closure was performed. The total operative time was 123 minutes, and the CPB time was 37 minutes.

The patient's postoperative course was uneventful,

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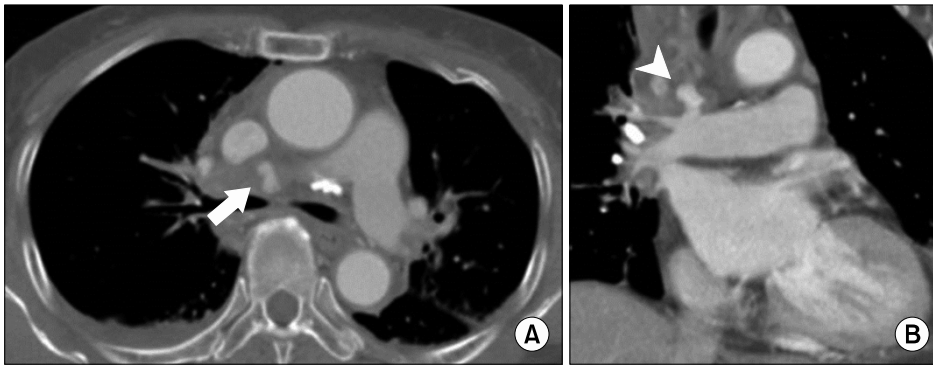


Fig. 1. (A) Initial CT scans showing the formation of a blind pouch that was suspicious for a PA rupture at the distal superior aspect of the right PA (white arrow). (B) Initial CT scans showing right PA rupture (white arrowhead) before the right PA branching and diffuse bronchial anthracofibrosis. CT, computed tomography; PA, pulmonary artery.

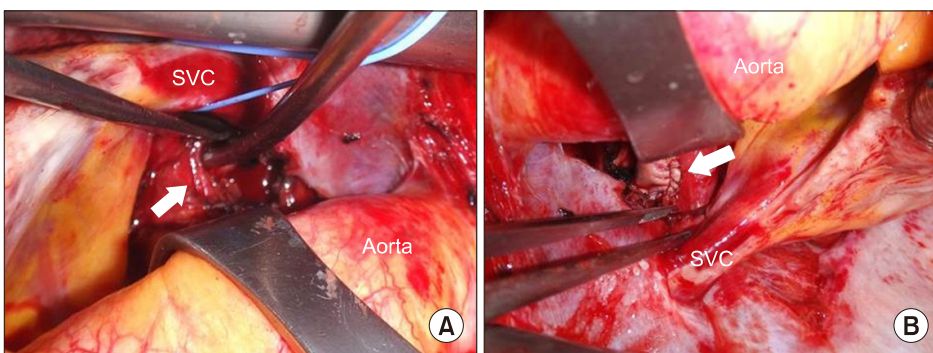


Fig. 2. (A) Operative findings showing approximately 1.5 cm of ruptured right pulmonary tissue (arrow). (B) Operative findings showing right pulmonary artery angioplasty performed with bovine pericardium (arrow). SVC, superior vena cava.

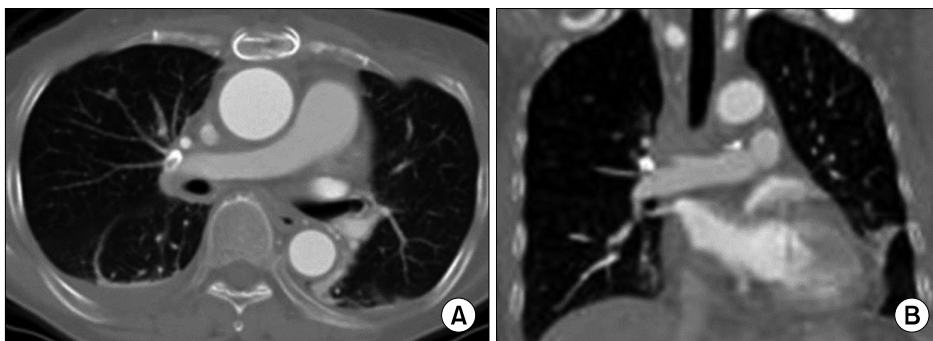


Fig. 3. (A) Postoperative CT scans showing a patient pulmonary artery without leakage, and no evidence of pseudoaneurysm. (B) Coronal view of CT. CT, computed tomography.

and the patient was extubated following usual procedures, without any adverse events. On postoperative day (POD) 10, CT revealed a patent PA and no evidence of pseudoaneurysm (Fig. 3A, B). The patient was discharged on POD 20 without complications and was placed on a routine outpatient follow-up schedule.

The patient provided written informed consent for publication of clinical details and images.

Discussion

The circulation of the PA is relatively low-pres-

sure; however, it is tricky to manipulate given the thin and friable nature of the PA wall. In addition, transection or rupture of even a small branch of the PA can cause fatal exsanguination [1]. Spontaneous PA injury can occur as a complication of chronic PA hypertension, leading to pulmonary aneurysm rupture. The cases of traumatic PA injury described in the literature mainly involve iatrogenic trauma following PA catheterization. In severe blunt chest trauma, traumatic PA injuries are very rare compared to aortic injuries [1-5]. In a previous report, Kemmerer et al. [6], in an autopsy series, found only 4 cases of blunt PA injuries among 585 deaths in fatal traffic

accidents.

There is no definitive consensus regarding the management of traumatic PA rupture, and management should be based on the involved lesion, the patient, and the competence of the trauma center.

Management of traumatic PA injuries is difficult; no definitive consensus exists, as surgical treatment remains associated with high perioperative mortality [2]. Above all, in PA surgical repairs, CPB should be used to avoid the risk of fatal bleeding and to maintain hemodynamic stability. Pereira and Narrod [7] suggested that more extensive injuries (greater than 50% of the circumference of the PA) are consistent with an arterial transection and require the institution of CPB for complete visualization and repair. In addition, circulatory arrest as well as CPB should be considered for nearly complete transection of the PA or complete visualization of the extent of the injury. However, the complications of median sternotomy and CPB should be considered. In such a situation, resection of the injured part and anastomosis of the healthy PA borders are technically challenging for trauma surgeons [2].

Patients with massive hemothorax may require thoracotomy. An injury of the PA at the hilum is thus diagnosed and treated, often requiring lung resection [8]. The surgical approach used for the patient is determined by the location of the lesion and associated injuries; however, when choosing an approach, the top priority should be to ensure hemodynamic stability.

The low pressure of the PA allows conservative treatments; however, it is not known when a pseudoaneurysm achieves complete resolution and stability, and trauma surgeons should be aware that some stimuli may cause a delayed rupture. Demondion et al. [4] reported a case in which a right PA rupture was managed with conservative treatment because of severe head trauma. More generally, the authors concluded that an initial conservative management strategy must be considered when anticoagulation is contraindicated.

An endovascular approach may also be acceptable [9,10]. However, a large stent for the PA is rarely available in an emergency situation, and using a coil or plug at the rupture site or pseudoaneurysm poses a risk of migration.

In this case, although the patient was geriatric, she

had no pre-existing conditions predictive of a poor prognosis prior to the surgical intervention. Although her vital signs were stable, we decided to perform immediate open repair because an absence of bleeding could not be guaranteed in light of the increasing amount of hemothorax in serial CT scans. Bronchial anthracofibrosis and an enlarged calcified lymph node were present in close proximity to the injured tissue. According to the surgical findings, we could assume that PA was damaged by surrounding stiff tissues when an external stimulus was given. In addition, in geriatric patients with decreased elasticity of the PA, usage of the patch technique must be considered as a main surgical approach for repair.

In conclusion, traumatic PA rupture is an unusual occurrence that only a few surgeons encounter. In this report, a case of surgical repair of traumatic right PA rupture was presented. The patient was accidentally stepped on by another individual. However, the majority of PA ruptures are caused by vehicular traffic accidents. Therefore, the case presented above is highly unusual in terms of its cause.

Conflict of interest

The authors declare that they have no competing interests.

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We certify that this report is our own work and all sources of information used in this report have been fully acknowledged.

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