Cardiac tamponade: a rare complication after pulmonary lobectomy

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Abstract

Objective: Pulmonary lobectomy for lung cancer is a well-established and safe operation. This report serves to highlight an important complication and an underlying essential surgical principle when performing pulmonary resections, to avoid a potentially fatal outcome.

Methods: A case report is presented. We describe an unusual case of cardiac tamponade complicating a left upper lobectomy.

Results: The few cases described in the literature are reviewed to reveal interesting causative mechanisms. The intrapericardial anatomy of the pulmonary hilum is discussed.

Conclusions: A high index of clinical suspicion is required in refractory, unexplained hypotension after lung resection. Strict adherence to secure pulmonary vein ligation is as important as it is in dealing with the pulmonary artery.

Keywords: Lung cancer surgery; Lobectomy; Cardiogenic shock

1. Introduction

Pulmonary lobectomy for lung cancer offers the best chance of survival with a low mortality rate [1,2]. We describe a case with an unusual postoperative cardiac complication, which serves to emphasize an important surgical principle.

2. Materials and methods

A 58-year-old man presented with a 9-month history of left pectoral chest pain. He was a recent ex-smoker with a normal pulmonary function test and no other comorbidities. Chest X-ray and computed tomography (CT) scan disclosed an operable lung mass lesion, abutting the left upper chest wall. CT-guided biopsy suggested a diagnosis of a malignancy.

He underwent an uncomplicated left upper lobectomy with limited chest wall resection and reconstruction. After 12 h of uncomplicated postoperative progress, he became acutely unwell with significant hypotension. There was no evidence of bleeding and the chest X-ray was entirely normal. The blood gases were normal. ECG, however, showed widespread pericarditic-like ST segment elevation (Fig. 1). There was no angina.

Echocardiography showed a 2-cm global pericardial effusion with right ventricular compression. Three hundred millilitres of dark blood was drained percutaneously from the pericardium with immediate improvement in haemodynamics (Fig. 1). Fluid cytology and microbiology were unremarkable.

We did not perform a re-thoracotomy to inspect the pericardial side of the hilum as the pigtail catheter had stopped draining and a check echocardiogram showed no fluid re-accumulation. He then made a complete recovery until discharge. Pre-discharge echocardiography reaffirmed a normal pericardial space. The postoperative histopathology showed a completely resected poorly differentiated non-small cell carcinoma.

3. Results

The patient was doing well on follow-up at 9 months.

In our case, the left superior pulmonary vein was clamped, divided and oversewn near its pericardial reflection. In retrospect, we had difficulty at this point due to the tumour size and proximity. The pericardium, however,
was not opened. We surmise that the superior pulmonary vein may have partially retracted to lie intrapericardially at some point and therefore was not fully incorporated in the suture line. Unrecognized, the suture line oozes into the pericardial sac. Being a low-pressure system, a relatively small venous bleed may stop with the normal coagulation process, as in our case. The definitive strategy postoperatively, if there is any element of doubt as to a continuing bleed, should be a prompt intrapericardial inspection of the hilum to secure the suture line compromise. No obvious abnormal bronchial anomaly was noted at the initial operation.

4. Discussion

The current mortality rate for lobectomy is less than 3% and about 6% for a pneumonectomy. Nagasaki et al. [2] reviewed 961 postsurgical patients and Ginsberg et al. [1] published postoperative data on 2220 patients who underwent operations for the treatment of lung cancer. The incidence of major complications was about 10%. Respiratory complications comprise 60%. In descending order these include atelectasis, pneumonia, pulmonary emboli, respiratory failure, empyema/bronchopleural fistula and tension pneumothorax. Cardiac problems account for about 20% and extrathoracic complications including stroke, gastrointestinal ulceration, renal failure and peripheral vascular events were seen in about 10%.

Cardiac complications commonly include atrial and ventricular arrhythmias, congestive cardiac failure and myocardial infarction. Pericardial effusion as a metastatic manifestation of lung cancer has been well described. However, the description of this potentially fatal complication after a pulmonary lobectomy remains exceedingly rare in the literature. The few reported cases reveal some of the involved mechanisms.

McLean et al. [3] attributed this unusual complication to a rare bronchial arterial anatomical variation. The aberrant right bronchial artery came off the intrapericardial portion of the aorta. After the lobectomy, this vessel retracted into the pericardial sac where it bled causing a pericardial tamponade following a right upper lobectomy.

The bronchial arteries vary in number, size and origin. They usually arise from the descending aorta or intercostal arteries, occasionally from the subclavian or innominate arteries and rarely from the internal mammary artery or even the coronary artery. The most extensive anatomic study was reported by Cadwell [4]. Usually there is only one right bronchial artery which arises from the third posterior intercostal or upper left bronchial artery, while there are usually two left bronchial arteries which arise from the thoracic aorta, between the fifth and sixth thoracic vertebrae. Cadwell found this arrangement in 40% of 150 cadavers. Very rarely a bronchial artery arose from the aortic arch.

Tovar [5] described a case of sudden haemodynamic collapse intraoperatively from cardiac tamponade during a left lower lobectomy. A vascular clamp was applied to a portion of the inferior pulmonary vein proximal to the pericardial reflection as the tumour was very close to the hilum. The inferior pulmonary vein was then transected. This was followed by electromechanical dissociation and cardiac arrest. The inferior pulmonary vein had slipped off the clamp and bled freely into the pericardial sac. They suggest that the vessel is therefore best oversewn as it is being divided, especially if it is close to the pericardial reflection.

Morimoto et al. [6] described the occurrence of cardiac tamponade from an ascending aortic injury presenting on the 13th postoperative day following a right upper lobectomy and a complete lymph node dissection. Pretracheal lymph node dissection of the right upper mediastinum exposes parts of the ascending aorta and pericardium that become visible between the trachea and the superior vena cava. In this patient, the aorta and pericardium may have suffered injuries from the diathermy during lymph node dissection. A longitudinal laceration on the right lateral wall of the ascending aorta was found on the pericardiectomy.

Meticulous attention to the pulmonary veins near the pericardial reflection is essential. Easy access and control of the vein may be difficult due to the proximity of the tumour to the hilum. It is best to avoid a vascular clamp if it encroaches on the pericardial reflection of the vein. If it is used, the vein should preferably be oversewn before its complete division. The entire circumference of the suture line on a finite stump of the vein must be visible for inspection if the pericardium is not opened to avoid this complication.

The safe and simple alternative is to open the pericardium for intrapericardial suture ligation or vascular staple division of the vein.

In 1946, Allison advocated intrapericardial ligation of pulmonary vessels in order to permit a safer and yet more
radical operation for cancer [7]. In the preantibiotic era, sepsis was shown not to be a contraindication to opening the pericardium as long as it was left in free communication with the pleural space afterwards. The pericardial sac appears to drain into the pleural space and becomes sealed off in 2–3 days. Detailed intrapericardial anatomy of the pulmonary hilum was described by Allison and later by Healey and Gibbon [8]. The left pulmonary veins may merge to form a common trunk before entering the left atrium. Cadaver dissections by Healey and Gibbon showed that the common vein was more frequent on the left side; 25% compared to 3% on the right. These common veins may form outside the pericardium, at the edge of the sac or within the sac. In the great majority (55–77%) it formed at the edge and was more prone to problems in difficult resections. Also, more than four-fifths of the circumference of the common vein was visible within the serous pericardial sac on the left as compared to about one-half the circumference on the right. This would increase the incidence of an intrapericardial communication and collection of blood if there was suture line compromise.

Allison also describes in detail the surgical approach including the anatomy of pericardial reflections and recesses required to free up the pulmonary vessels intrapericardially for a secure ligation. The approach is easier on the left. Division of the vestigial fold of Marshall above the superior vein facilitates the exposure. A double reflection of pericardium below the inferior vein is absent and this allows for easier isolation.

Strict adherence to the surgical principle and a high index of clinical suspicion cannot be overemphasized. This delayed presentation highlights the potentially fatal course of even the slightest compromise and the importance of a visibly secure closure of the pulmonary vein during pulmonary resections.

References