

CASE REPORT

# A rare case of occult splenic rupture after left pneumonectomy

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## Abstract

Cardiopulmonary resuscitation (CPR) techniques are now well-established and play a crucial role in improving survival in cardiac arrest. Recognized complications associated with CPR include injury to the upper abdominal viscera, including the liver, stomach and spleen. We present a rare case of occult splenic rupture following cardiac arrest in a 63-year-old male immediately after left pneumonectomy. We discuss potential mechanisms predisposing the spleen to injury in this case, and highlight the difficulty of promptly identifying such a traumatic injury within the confines of a cardiac arrest scenario. Clinicians should be aware that anatomical changes following thoracic surgery may render the intra-abdominal viscera at increased risk of injury following CPR.

## INTRODUCTION

Cardiopulmonary resuscitation (CPR) is a potentially life-saving intervention following cardiac arrest [1]. However, it may be associated with traumatic injury to the upper abdominal organs, namely the liver, stomach and spleen [2–4]. We here describe a rare case of occult splenic rupture complicating resuscitation efforts in post-operative cardiac arrest occurring immediately after left pneumonectomy.

## CASE REPORT

A 63-year-old male smoker was admitted for elective surgical resection of a left upper lobe squamous cell carcinoma, diagnosed 2 months previously. His medical history included psoriasis, lumbar disc prolapse and previous laparoscopic cholecystectomy without concomitant haematological or neoplastic disease. Mediastinoscopy demonstrated only reactive changes in the sampled lymph nodes; therefore, informed consent was obtained for left upper lobectomy.

At bronchoscopy, tumour was seen to involve the orifice of the left upper lobe bronchus. A left upper lobe sleeve resection was initially performed via left posterolateral thoracotomy, with routine stapling and division of the left superior pulmonary vein and upper lobe pulmonary artery branches. Following this however, lung reinflation was not possible and left pneumonectomy was completed uneventfully with surgical haemostasis and placement of a single basal chest drain.

Following extubation, the patient became hypotensive and bradycardic with excessive chest drainage. With the patient in a right lateral position, external CPR alongside emergent rethoracotomy were performed. Active bleeding from a disrupted left inferior pulmonary vein staple line was controlled with sutures. Once cardiac output was regained, the patient was stabilized with minimal inotropic support, and left ventricular pacing wires were sited. Satisfactory haemostasis was achieved. Unfortunately, haemodynamic instability recurred after chest closure, this time without large-volume chest drainage, and the patient could not be resuscitated after a second cardiac arrest.

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Referral was made to the coroner for post-mortem investigation. Examination demonstrated a distended peritoneal cavity containing at least 1200 ml of blood. In addition, a subcapsular haematoma measuring 9 × 5 cm was noted on the upper pole of the spleen in association with a 3 × 2 cm laceration; a second 3.5 × 4 cm laceration was also present on the inferior pole. The left 2nd–7th ribs, right 2nd–5th ribs and the right 8th rib were fractured in the mid-axillary line. The diaphragm was intact without perforation. The coroner concluded that the intra-abdominal bleeding had originated from the spleen, although there was no pathological evidence attributing this to the recent surgical intervention. The acute splenic rupture was considered to be consequent to the first episode of CPR.

## DISCUSSION

External cardiac massage in combination with ventilatory support and timely defibrillation has been demonstrated to enhance outcomes following cardiac arrest [1]. Nevertheless, recognized complications associated with the technique include rib and sternal fractures, and injuries to the pleura, pericardium, heart and great vessels [2]. Gastric mucosal tears have been found in 9–12% of patients following CPR [3], while liver lacerations are reported in 2% [2]. Splenic rupture is a rarer occurrence, present in 0.3% of 705 patients undergoing post-mortem examination after CPR [4]. We believe that the present case is the only report of splenic rupture subsequent to CPR, occurring immediately post-operatively.

The prompt and accurate identification of occult intra-abdominal bleeding after CPR, particularly so soon after major thoracic surgery, represents a diagnostic challenge. We recognized the onset of hypovolaemic cardiac arrest following left pneumonectomy, instituted CPR accordingly and were able to control active bleeding from a disrupted staple line via emergency thoracotomy. The patient's rapid deterioration following the initial successful resuscitation, however, was not accompanied by profuse chest drainage and was attributed to a primary myocardial event rather than intrathoracic haemorrhage. A second re-thoracotomy at this stage would likely have yielded no additional diagnostic benefit, since the culprit splenic lesion would not have been visualized. Basic radiological studies, such as an erect chest radiograph to reveal free subdiaphragmatic air, or abdominal ultrasound, could have been performed had the patient not destabilized after the first cardiac arrest. Furthermore, exploratory laparotomy in this already precarious situation would be very hazardous and rapid arrest of bleeding might not have been achieved within the confines of a cardiac arrest scenario.

In the present case, acute splenic rupture was attributed to traumatic chest compressions delivered during CPR. Pre-existing infective or neoplastic diseases causing splenomegaly might have predisposed this enlarged organ to rupture during CPR, but none were present in our patient. While left-sided rib fractures were sustained during resuscitation, these were not in a location to cause splenic injury. There was no evidence of

intra-operative diaphragmatic perforation. The 'spontaneous' rupture of an apparently normal spleen following left-sided lung resection has been described, but splenic rupture in the context of CPR immediately subsequent to left pneumonectomy has not been reported before.

It is known that major left lung resections may be accompanied by varying degrees of left diaphragmatic elevation [5]. Thus, we propose that elevation of the left hemidiaphragm to occupy part of the cavity resulting from left pneumonectomy may have caused the spleen to reside in a slightly higher anatomical position than normal, especially in a supine patient. This, perhaps combined with chest compressions over the lower border of the sternum, may have led to significant compressive forces being transmitted over the spleen, precipitating laceration and rupture. This mechanism of injury may also happen following left-sided lobectomy, especially if the lower lobe is resected. An alternative explanation would be upper abdominal adhesions after previous cholecystectomy, which might have anchored the spleen to an abnormally high subcostal position.

In conclusion, concealed intra-abdominal visceral injury may occur during CPR and complicate resuscitation efforts by contributing to persistent hypotension. Clinicians should be aware that intrathoracic volume changes following major procedures, such as pneumonectomy or lobectomy, may 'lift' the spleen into a higher anatomical location, rendering it at risk of injury during CPR. Finally, special attention should be paid to the desired position of chest compressions to prevent excessive force being directed over the upper abdominal viscera.

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## CONFLICT OF INTEREST STATEMENT

None declared.

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