



## Case Report

## Left ventricular perforation with catheter decompression

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## ABSTRACT

Thoracostomy tube placement is one of the more common procedures performed in the Emergency Department, most commonly for treatment of pneumothorax or hemothorax but occasionally for drainage of empyema or pleural effusion. Thoracostomy may be a life-saving procedure with a wide range of complication rates reported, ranging from 19.4–37%, most commonly extrathoracic placement. Most recent meta-analyses showed a relatively stable complication rate of 19% over the past three decades with the vast majority being benign in nature. We present a case with the rare complication of thoracostomy in which of a small-caliber thoracostomy tube was placed in the left ventricle. Although thoracotomy was performed to remove the catheter, the patient remained virtually asymptomatic and had an uneventful course.

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## 1. Introduction

Thoracostomy tube placement is one of the more common procedures performed in the Emergency Department, most commonly for treatment of pneumothorax or hemothorax but occasionally for drainage of empyema or pleural effusion. Thoracostomy may be a life-saving procedure with a wide range of complication rates reported, ranging from 19.4–37%, most commonly extrathoracic placement. Most recent meta-analyses showed a relatively stable complication rate of 19% over the past three decades with the vast majority being benign in nature [3,5]. We present a case with the rare complication of thoracostomy in which of a small-caliber thoracostomy tube was placed in the left ventricle. Although thoracotomy was performed to remove the catheter, the patient remained virtually asymptomatic and had an uneventful course.

## 2. Case report

A 27-year-old man with no past medical history presented to the Emergency Department with the chief complaint of a stab wound which caused shortness of breath. He denied chest pain more than once. Vitals were entirely normal with the exception of a respiration

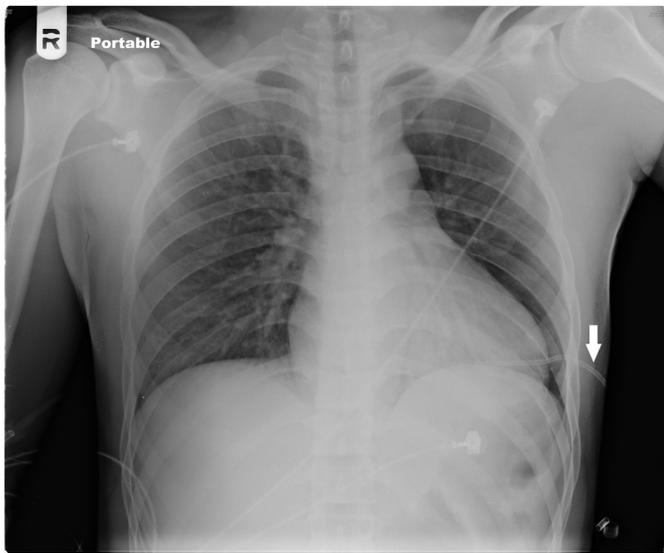
rate of 22 breaths per minute. Exam revealed only a small and apparent shallow laceration on the right posterior chest which did not require pain medication. The patient reported to having been stabbed in the back with a small sharp object prior to arrival. Chest X-ray and CT chest showed left moderate pneumothorax with apex of the lung projecting over the posterior third rib, a very small right pneumothorax, and mild cardiomegaly. An 8-French catheter was placed ventral (anterior) to the L mid axillary line between the 5th and 6th ribs. The procedure was performed with a standard thoracentesis kit with a straight catheter and stylet. When the catheter was attached to suction, approximately 50 ml of pulsatile frank blood were evident. Point of care ultrasound, chest X-ray (Fig. 1), and CT chest (Fig. 2) confirmed that the distal tip of the thoracostomy tube terminated within the left ventricle without signs of pericardial effusion. All vital signs remained stable until he was transferred to the operating room for the catheter removal. Sternotomy with primary repair of the left ventricle puncture site with a single absorbable suture was completed without complication. No transfusion was required. The left thoracostomy tube was removed on postoperative day 5. Repeat chest X-ray showed stable mild cardiomegaly and stable biapical small pneumothoraces. The patient remained asymptomatic and was discharged on postoperative day 6.

## 3. Discussion

Chest tube thoracostomy is often performed by Emergency Physicians, especially in cases of emergent thoracic trauma. Indications for

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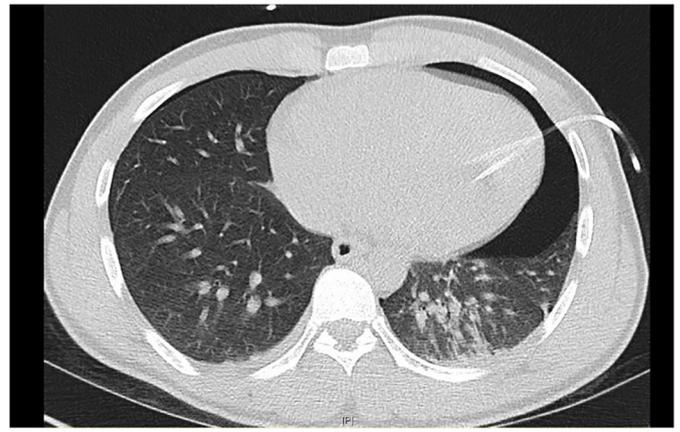
**Fig. 1.** Portable chest X ray demonstrating intracardiac location of catheter (arrow).

chest tube thoracostomy include pneumothorax, hemothorax, traumatic injury, chylothorax, and others. Surgical placement should be considered for those with history of transplantation, intrathoracic scarring, and pleurodesis. There is little evidence that large caliber tubes are therapeutically superior particularly for pneumothorax; smaller tube sizes have been recommended to increase patient comfort level [4,5].

The major complications of chest tube thoracostomy can potentially be life-threatening, often requiring corrective surgical intervention. These complications can generally be divided into insertional position and technique, infective/immunologic, or equipment failure. The insertional complications depend on the provider's technique and can be serious due to puncturing or laceration of adjacent organs, such as lung, diaphragm, liver, mediastinum, esophagus, or heart [5–10]. Chest tube placement is not standardized but it is suggested to be inserted in the “safe triangle” area described in Advanced Trauma Life Support (ATLS) or British Thoracic Society (BTS) guidelines. ATLS guideline recommends identification of 5th intercostal and mid-axillary line and incision in between the mid-axillary and anterior axillary lines [5,6]. In our patient, the chest thoracostomy catheter is placed (Fig. 1) in the 5th or 6th intercostal space and clearly anterior (ventral) to the mid-axillary line (Fig. 2). Emergency medicine providers should be aware that cardiomegaly and perhaps other anatomic variants may increase the risk of misadventure in chest tube placement.

Thoracostomy was traditionally performed using a large bore (often 32-French) chest tube but more recently, using smaller catheters which are more comfortable and cause less scarring has become common, particularly when evacuating air rather than blood or pus. Many different evacuation tools have been described, ranging from utilizing large bore central vein-type catheters to pig-tailed devices. Unlike the traditional chest tube where an entry into the pleural cavity is most often confirmed by placing the gloved finger through the surgically created wound (the blind, trocar entry has been largely abandoned in recent years), these small-catheter techniques most commonly employ a stylet to puncture the chest wall and the parietal pleura followed by direct catheter placement or placement using an over-the-wire Seldinger technique.

It is notable that of the 5 reported cases of cardiac perforation illustrated in the literature, all were associated with a small catheter, and apparently, a stylet or trocar was utilized for pleural puncture. The outcomes of these cases were remarkably benign, with the exception



**Fig. 2.** CT scan demonstrating left ventricular location of catheter, pneumothorax and lack of pericardial effusion.

of one patient who died unexpectedly of unknown causes 13 days after an uneventful repair. Most of the cases were performed in intensive care unit [1–3,7]. It is not clear if use of a different catheter kit and the Seldinger technique would or would not be safer than the stylet technique. In either case, the actual puncture takes place without tactile confirmation of intra-pleural location.

In conclusion, our case of left ventricular cardiac puncture during the catheter treatment of pneumothorax is particularly disturbing as the placement was at a generally agreed upon vertical level. In the AP diameter it appears to be clearly ventral to the mid axillary line, perhaps near the anterior axillary line. Clinicians should consider modifications to the standard technique, perhaps utilizing a puncture site that is more superior and dorsal than usual in cases where the pneumothorax is left sided and there is a reason to suspect cardiomegaly. Practitioners should be aware that if inadvertent intracardiac placement does occur, the catheter should not be blindly removed, and prompt thoracic surgery consultation is required. A favorable outcome appears likely.

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