

# Intercostal drainage tube or intracardiac drainage tube?

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## ABSTRACT

Although insertion of chest drain tubes is a common medical practice, there are risks associated with this procedure, especially when inexperienced physicians perform it. Wrong insertion of the tube has been known to cause morbidity and occasional mortality. We report a case where the left ventricle was accidentally punctured leading to near-exsanguination. This report is to highlight the need for experienced physicians to supervise the procedure and train the younger physician in the safe performance of the procedure.

**Key words:** Chest drain tube; Intercostal drainage tube; Intracardiac drainage tube

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## INTRODUCTION

A chest drain tube is indicated for insertion through the chest wall to allow for drainage of fluid, blood, air, or pus out of the chest. Up to 20% of the complications have been reported with the insertion of chest drains, especially when performed by junior doctors.<sup>[1]</sup> The complications generally arise due to malposition of the catheter, inadequate insertion, subcutaneous insertion, or improper fixation of the tube. We report a case where the intercostal tube penetrated the left ventricle in a patient with no previous abnormality of either the heart or the chest wall.

## CASE REPORT

A male aged 35-year-old was admitted to a local hospital with alleged history of road traffic accidents. The chief complaints were chest pain and difficulty in breathing. It was initially diagnosed as left hemothorax with bilateral multiple rib fractures and left clavicle fracture. A left intercostal drainage tube (ICD) with trocar was inserted and a gush of blood was seen streaming through the tube. This was assumed to be from the hemothorax and when the bottle filled up, ICD was clamped. Next day, the tube was unclamped with no drainage due to clotted blood. The patient continued to have breathlessness and

so he was referred to our hospital for further management.

On admission, his vitals were stable and ICD tube was found to be nonfunctional. A chest X-ray done on admission showed moderate pleural effusion. The ICD was in the direction of the heart and not the apex of chest [Figure 1]. In two-dimensional-echocardiography, no tamponade was seen. On the 2<sup>nd</sup> day, the ICD was adjusted, but there was no drainage and hence the ICD was removed. On removal, a gush of blood spurted out through the ICD insertion site, the wound was pressed tightly, and elastoplast was applied. His condition deteriorated and had an episode of hypotension. The patient was resuscitated with crystalloids and shifted to Intensive Care

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Unit. One fresh frozen plasma and two packed red blood cells were also administered since his hemoglobin level prior to the bleed was 9.8 g/dl. He stabilized thereafter.

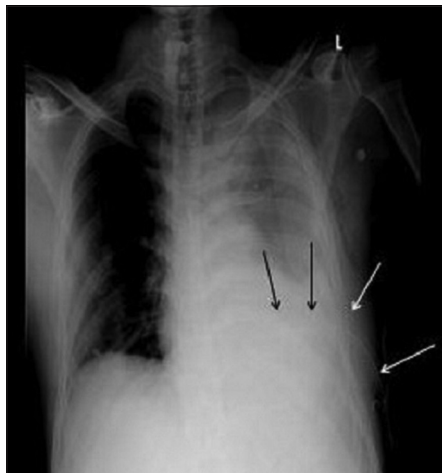
Emergency contrast-enhanced computerized tomography scan was done. The scan showed an active extravasation of contrast from the left ventricular wall to subcutaneous plane of the left lateral chest wall along the previous ICD tube tract which therefore suggested ventriculo-subcutaneous fistula due to the ICD tube [Figures 2 and 3].

A surgical intervention was required as an emergency. Intraoperatively, a 2 cm opening in the left pericardium and a similar opening in the lateral side (4 cm from the atrioventricular groove) of the left ventricle were seen. The pericardium had 250 ml of straw-colored fluid and the left pleural cavity had 500 ml of dark blood.

Surprisingly, there was no blood in the pericardial cavity as the pericardium was stuck to the left ventricle at that area. The left lung was collapsed. The perforation was sutured with 40 pledgeted prolene sutures. Postoperative period was uneventful. He was on a small dose of inotrope and fiber-optic bronchoscopy was done twice to clear the secretions. He was discharged on postoperative day 12 with a settled chest X-ray [Figure 4].

## DISCUSSION

Although insertion of the chest drain tube is a common medical practice, inaccurate insertion of the tube can have tragic consequences such as perforation of the left and right ventricles.<sup>[1]</sup> The National Patient Safety Agency, UK, undertook a survey in 2008 to provide a database for the incidence of risk and harm relating to chest tube insertion. From a total number of 12,512



**Figure 1:** Chest X-ray antero-posterior view revealing the chest tube direction toward the heart shift of mediastinum and haziness left chest



**Figure 2:** Computerized tomography with contrast, transverse section showing the leak from the left ventricle to subcutaneous tissue



**Figure 3:** Computerized tomography coronal section showing the leak from the left ventricle



**Figure 4:** Chest X-ray postero-anterior view postoperative before discharge

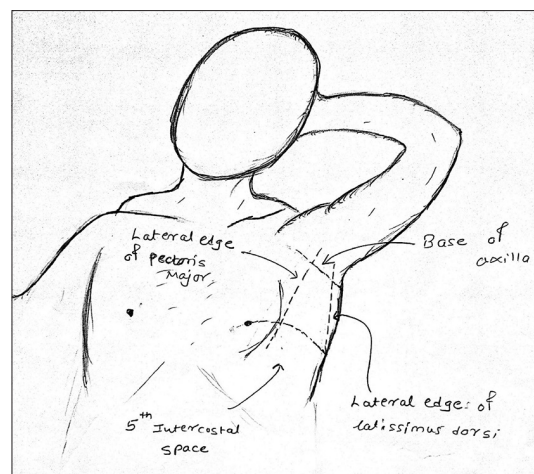
reported tube insertions, 15 (0.11%) insertions resulted in severe harm (damage to vessels, trachea, and liver) and a further 12 (0.09%) resulted in death (puncture of lungs, heart, liver, and hemorrhage).<sup>[2]</sup>

Studies done prospectively as well as retrospectively in different clinical settings found the rate of chest tube malposition (CTM) to be over 20%.<sup>[3]</sup> Existing case report literatures on CTMs include fatal complications such as perforation of the lung, heart, and injury to the pulmonary artery. There has also been a reported case of phrenic nerve injury leading to paralysis of the diaphragm.<sup>[4,5]</sup> Most of the complications happened because of inexperienced doctors doing the procedure, lack of fundamental knowledge and skill to insert a chest drain securely, wrong site of insertion, and deficiency in diagnosis.<sup>[2]</sup>

In one of such cases, opacification of the left side of the chest in an X-ray was mistaken to be pleural effusion. The chest tube which had been inserted without ultrasound guidance had actually perforated the left ventricle. Although removal of the drain under general anesthesia was uneventful and the patient was hemodynamically stable, the patient succumbed to pneumonia after prolonged mechanical ventilation.<sup>[6]</sup> A similar case was reported by Goltz *et al.*, wherein the chest tube was placed on the left side in the sixth intercostal space without ultrasound guidance. The chest tube perforated the hypertrophied left ventricle, passed through the mitral valve into the left atrium, exiting via a pulmonary vein. The tip was in the middle lobe of the opposite lung. The authors mentioned that there was a resistance in passing the tube at a depth of 2–3 cm, but it was assumed to be adhesions and the tube was advanced.<sup>[7]</sup>

The British Thoracic Society (BTS) guidelines indicate that the insertion should be done within the area known as the “safe triangle” [Figure 5]. This triangle is bound by the lateral border of pectoralis major and the lateral border of latissimus dorsi and a horizontal line passing through the apex of the axilla.<sup>[8]</sup>

To minimize the risk of complications, prior to the procedure, clinical signs, chest radiograph of the patient, and the site for insertion should be reviewed. The use of image guidance such as ultrasonography should be considered in cases when fluid or air cannot be aspirated with a needle at the time of anesthesia and especially for cases of empyema and effusions.<sup>[8]</sup>



**Figure 5:** Safe triangle area

In addition, training of junior doctors in the art of safe chest drain insertion should be a priority as highlighted in the latest BTS guideline.<sup>[9]</sup> Individual hospitals can setup their own safety guidelines and protocols to minimize the risks to the patients. Insertion of smaller chest drains is better done with ultrasound guidance followed by Seldinger’s technique. Larger ICDs (24–32 F) are best inserted after blunt dissection and digital palpation.<sup>[9]</sup> The use of trocar is optional, but the insertion should be controlled and the person inserting it must be experienced. One can envisage the loss of control with the use of trocar, and a sudden uncontrolled movement can easily cause injury to different organs including the heart.

To conclude, we have highlighted a case of malpositioning of an ICD tube which had resulted in injury to the left ventricle. The malpositioning of the tube may be a case of gross negligence or simply the lack of skill and expertise to perform the procedure. This definitely calls for a stringent action from all institutes and hospitals to work on proper safe training and also develop safety protocol in the line of the BTS guideline.

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#### Conflicts of interest

There are no conflicts of interest.

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