A possible cause of chest tube malposition

Hyung Il Kim

Department of Emergency Medicine, Dankook University Hospital, College of Medicine, Dankook University, Korea

Tube thoracostomy is one of the essential skills for physicians. However, tube malposition is a common issue, and little is known about the reasons for malposition or the underlying mechanism. This report presents a case of tube malposition with an identifiable cause. A patient with traumatic cardiac arrest and severe chest injury was transported. Bilateral thoracostomy was performed because of tension pneumothorax, and 400 mL of blood was drained from the left tube. However, while securing the tube, it was pushed out by 3–4 cm before complete fixation. The tube was advanced back in further without retrying the tube placement. However, postmortem chest X-ray imaging revealed the malposition of the left tube. The only reason for malposition in this patient was the advancement of the pulled-out tube without replacement. To reduce the rate of tube malposition, it is necessary to reinsert the tube rather than advancing the pulled-out tube.

Key Words: Chest tube, Thoracostomy, Thoracic injury

Introduction

Tube thoracostomy is indicated for pneumothorax, hemothorax, and empyema and is frequently performed in the emergency department, intensive care unit (ICU), operating room, and trauma bay. Tube thoracostomy is one of the essential skills for physicians who treat patients with trauma. Being a common procedure, chest tube malposition occurs frequently. More accurate diagnosis can be made with computed tomography than with X-ray imaging (1). Approximately 30% of malposition cases are diagnosed via computed tomography (2,3).

The incidence and clinical outcomes of tube malposition are widely known; however, its reasons and mechanisms are barely known. Probably, the location of the tube tip is usually confirmed via radiologic imaging after insertion, and there can be a limit to determining the reason for its incorrect positioning. This report presents a case of chest tube malposition during the management, with an identifiable cause. This study has been conducted according to the Declaration of Helsinki.

Case presentation

A 44-year-old woman was hit by a bus, resulting in cardiac arrest. She was transported to our trauma center. Cardiopulmonary resuscitation (CPR) was performed during transportation. On arrival, extensive subcutaneous
emphysema was noted from the neck to the lower legs. CPR and emergency treatment were started according to advanced trauma life support guidelines. Endotracheal intubation was performed. Chest compression was provided using the mechanical CPR device LUCAS (Physio-Control Inc./Jolife AB, Lund, Sweden). Intraosseous and peripheral intravenous lines were established. Breathing sound was not heard, and tension pneumothorax was suspected. Therefore, bilateral thoracostomy was performed, and 80 and 400 mL of blood from the right and left chest tubes were drained, respectively. After 30 min of CPR, she was declared dead. Malposition of the left tube was identified on the postmortem chest X-ray (Fig. 1). The tube was placed in the extrapleural space.

**Discussion**

Malposition occurs in approximately 30% of the cases during chest tube insertion. The intrafissural position is the most frequent tube location, followed by the intraparenchymal and extrapleural spaces (3,4). As mentioned earlier, tension pneumothorax or massive hemothorax was suspected as no breathing sounds were heard on both sides; therefore, bilateral tube thoracostomy was performed.

The right chest tube was successfully inserted, and 80 mL of blood was drained. During left tube insertion, pneumothorax was confirmed via air leakage when dissecting the pleura and approximately 400 mL of blood was drained immediately after insertion. However, the tube was presumably initially placed in the intrapleural space because it was inserted deep enough, and blood drainage more than that of the right side was confirmed after insertion. However, when the tube was secured, it was pushed out by 3–4 cm before complete fixation. This happened with continuous chest compression during CPR. As the operation field remained sterile, the tube was advanced back in further without removing it. No resistance was felt when the tube was advanced. Moreover, a sufficient length of the tube was presumably inserted initially. No additional drainage was noted afterward. Malposition was identified in the postmortem chest X-ray image. Mechanical chest compression was performed; therefore, no concerns of unexpected chest tube migration or movements because of unintentional touch during the rotation of compression were felt by the rescuers. In other words, the tube malposition in this patient was caused by advancing the pulled-out tube without replacing it. When putting the tube back manually, the tube end probably failed to enter the dissection hole and instead entered the extrapleural space. To reduce the chances of abnormal position of the chest tube, it must be fixed well so that it does not come out when securing it. If some parts are pushed out, the tube must be removed first and then reinserted.

The position of the tube tip does not affect the secondary intervention or additional tubes as long as the chest tube is functioning well in the pleural cavity (5). Interestingly, a study reported that clinical outcomes including ICU days and mortality were not different between patients with and without tube malposition (4). However, tube malposition is associated with lung laceration, bronchopleural fistula, lung abscess, empyema, liver injury, tube replacement, and consumption of medical resources (2,6-8); thus, malposition must be avoided.

In this case, definite oscillations were not noted after tube insertion, which was not considered to indicate tube malposition at that time. Because large amounts of air and blood were already drained, the affected lung could have expanded sufficiently, and a fully expanded lung might have prevented oscillations. The use of a portable X-ray machine could help identify oscillations when they are not observed immediately after tube insertion.
Conflict of interest

No potential conflict of interest relevant to this article was reported.

References