Comparison of Single and Double Chest Tube Drainage Management in Patients Undergoing Thoracotomy

Thesis

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ABSTRACT

Background: Drainage of the pleural space after thoracotomy is generally performed by using two chest drains : one tube is placed into the posterior and basilar region to drain fluid, while the other tube is directed towards the apex for removing the air from the chest.

Aim of the Work: comparison of single and double chest tube drainage management in patients undergoing thoracotomy at Cardiothoracic Academy Hospital and and Ain Shams University Specialized Hospital (ASUSH).

Patients and Methods: this study was conducted on patients who undergone thoracotomy at the Cardiothoracic Academy Hospital and Ain Shams University Specialized Hospital throughout the last 6 months from March 2018 till August 2018. Data was collected retrospectively from 40 patients,20 pateints in each group.In the 20 patients in the 'single- tube group', only one chest tube was inserted, and in the 20 patients in the 'double-tube group', two chest tubes were inserted. Pre-, intra- and postoperativ variables in both groups were compared.

Results: ٤٠ patients met all inclusion criteria. The pre- and intraoperative characteristics of the patients were similar in both groups with no significant differences . the single-tube group was found to have a lesser amount of total pleural drainage than the double-tube group but there was no significant difference 202.50 ± 100 cc vs 297.50 ± 101 cc, respectively; ($p > 0.05$).The mean durations of chest tube drainage were 4.40 ± 0.9 days in single tube group while were 5.35 ± 0.7 days in double tube group($p > 0.05$). As regard pain score , there was significant difference .Patients in the single-tube group experienced less pain in the 'early' postoperative periods. The mean NRS score (1-10) on the 12^{th} hours after operation was 7.05 ± 0.9 in the single tube group and 8.05 ± 1.0 in the double tube group ($p = 0.002$) . The mean NRS in the 2nd post operative day was 5.30 ± 1.0 in single tube group while in double tube group was 5.95 ± 1.2 ($p = 0.034$) .The hospital stay were 5.50 days in single tube group and 7.50 ± 1.2 days in double tube group ($p = 0.019$). slightly shorter in the single tube group, the difference was significant. We found no significant difference between the two groups considering complication rates. there were differences as regard prolonged air leak more than 5 days , 2 cases in single tube group while 4 cases in double tube group.

Conclusion: In conclusion, our results showed that the single chest tube drainage is more effective, reduces postoperative pain, hospitalization times and duration of drainage in patients who undergo thoracotomy. Also, it does not increase the occurrence of postoperative complications and redrainage rates. According to the results of our study, a single chest tube should be considered in patients after thoracotomy in common thoracic surgery practice .

KEYWORDS: CHEST TUBE DRAINAGE – THORACOTOMY - THORACIC SURGERY

INTRODUCTION

Chest tube is the most commonly performed surgical procedure in thoracic surgery practice. It is defined as insertion of (chest tube) into the pleural cavity to drain air, blood, bile, pus, chyle or other fluids [(1)].

Drainage of the pleural space after thoracotomy is generally performed by using two chest drains: one tube is placed into the posterior and basilar region to drain fluid, while the other tube is directed towards the apex for removing the air from the chest [(2-5)].

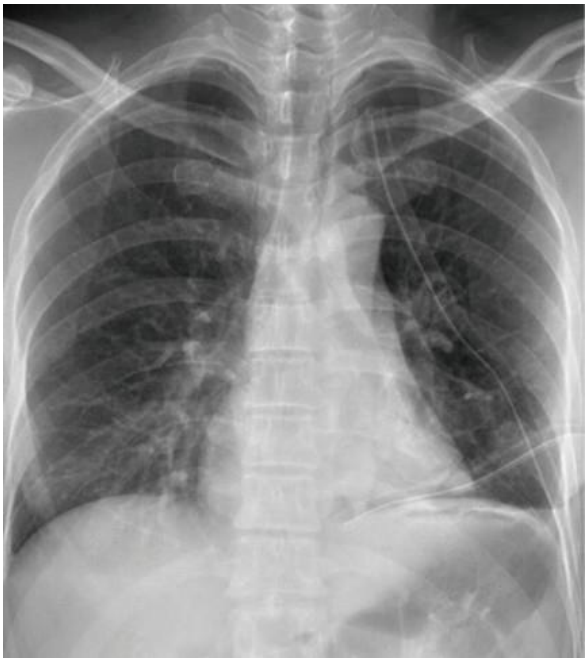

Fig. (1): The conventional apical and basal drains).

It has been accepted that a complete control on fluid and air in the pleural space could only be maintained by inserting

two chest tubes.The use of one chest tube after thoracotomy has been reported in a few studies in the literature [1–5].

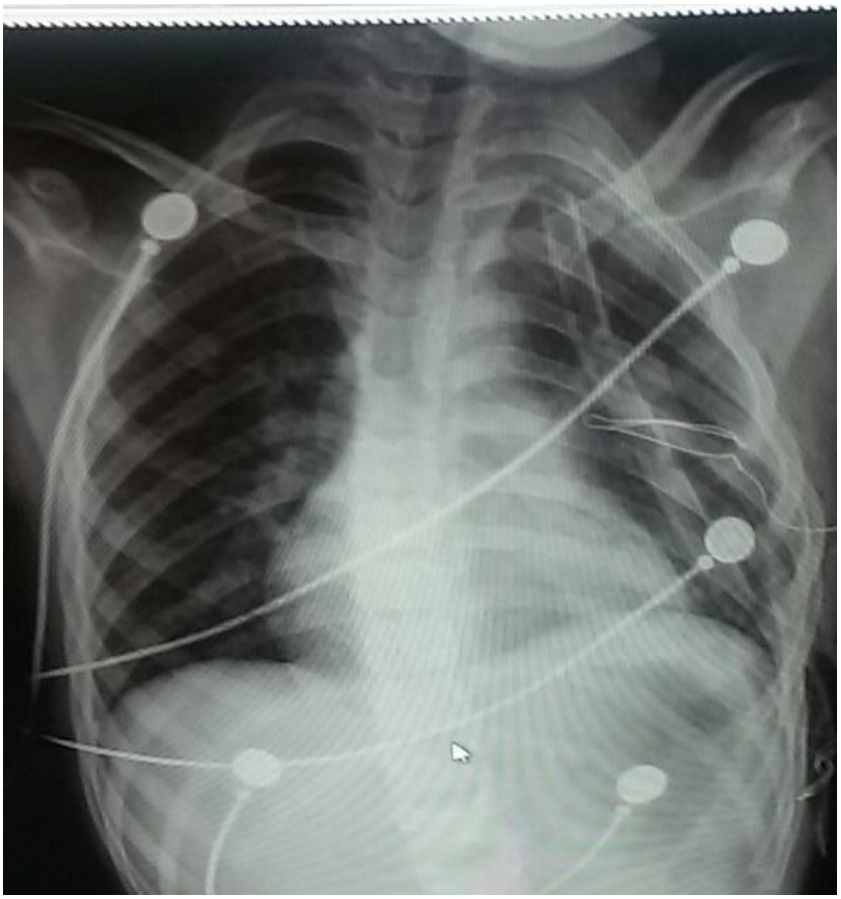

Fig. (2): A single chest drain in the midposition.

Logically, using a single chest tube causes less pain and discomfort during the postoperative period and is more economical. Less pain in the postoperative period may improve the patient's capability to perform respiratory exercises, and thereby, facilitate better lung expansion, decrease the rate of complication and decease hospital stay.

AIM OF THE WORK

Comparison of single and double chest tube drainage management in patients undergoing thoracotomy in the form of pain score, hospital stay, total drainage, residual collection after removal of chest tube and need for another chest tube at Cardiothoracic Academy Hospital and Ain Shams University Specialized Hospital (ASUSH).

REVIEW OF LITERATURE

Chest Tube:

A chest tube, also known as a thoracostomy tube, is a flexible tube that can be inserted through the chest wall between the ribs into the pleural space or mediastinum. Thoracostomy tubes are commonly made from silicone. They range in from 6 French to 40 French. The majority are fenestrated along the sides of the insertion end, and the tubes have a radiopaque stripe. After placement, the distal end of the tube is connected to a pleura-evac system [(6)]. British Thoracic Society (BTS) guidelines suggest that a chest drain should be inserted for a malignant pleural effusion, empyema, after chest truma, some types of pneumothorax and in some cases postoperatively, such as after cardiac surgery [(7-8)].

Indications [(6)(9)]

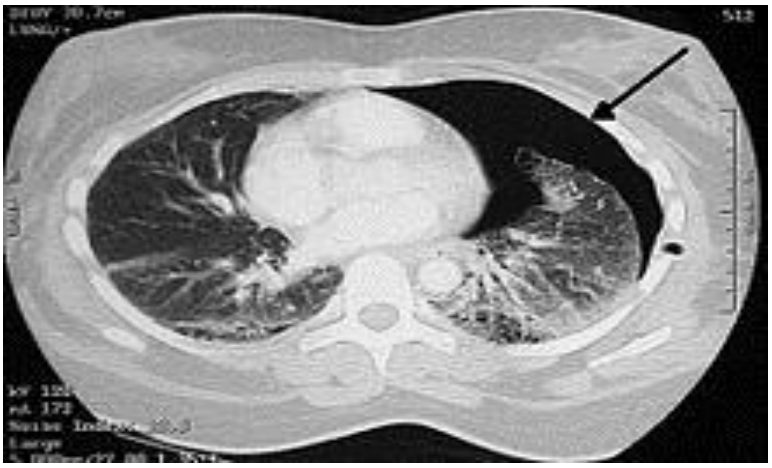

Fig. (3): Left-sided pneumothorax on CT scan of the chest with chest tube in place.

- **Pneumothorax:** accumulation of air or gas in the pleural space
- **Pleural effusion:** accumulation of fluid in the pleural space
- **Chylothorax:** a collection of lymphatic fluid in the pleural space
- **Empyema:** a pyogenic infection of the pleural space
- **Hemothorax:** accumulation of blood in the pleural space
- **Hydrothorax:** accumulation of serous fluid in the pleural space

Complications

Complications of tube thoracostomy can be classified as either technical or infective. Technical causes include tube malposition, blocked drain, chest drain dislodgement, reexpansion pulmonary oedema, subcutaneous amphysema, nerve injuries, cardiac and vascular injuries, oesophageal injuries, residual/postextubation pneumothorax, fistulae, tumor recurrence at insertion site, herniation through the site, chylothorax and cardiac dysrhythmias. Infective complications include empyema and surgical site infections including cellulites and necrotizing fasciitis [(10)].

A survey of junior residents on the anatomical landmarks when inserting an intercostals drain revealed that 45% were placed outside the safe area of chest drain insertion with the most common error (20%) being a choice of insertion too low [(11)]. When a chest drain is placed too low, there is a high

probability of abdominal placement, and chest tube will not only perforate the diaphragm but also will damage intra-abdominal organs.

A 2006 meta-analysis confirmed that 24-hour regimen of a first-generation cephalosporin significantly reduces postinsertion pneumonia and empyema in trauma patients [(12)]. However, the use of prophylactic antibiotics has been found unnecessary in patients with primary spontaneous pneumothorax [(13)].

Silastic tubes are preferred because older tubes have fewer drainage holes, are not well visualized on chest radiographs and produce more pleural inflammation. Silastic chest tubes contain a radiopaque strip with gap that serves to mark the most proximal drainage hole.

There is no evidence to suggest that clamping a chest drain prior to its removal increases success or prevent recurrence of a pneumothorax and may be hazardous. By clamping the chest drain for several hours (4-6 hours), followed by a chest radiograph, a minor air leak may be detected, avoiding the need for later chest drain reinsertion.

Prior to removal of a chest tube, the chest radiograph must show complete expansion of the lung and there should be no air leaks during coughing or suction. Chest tube should be removed with the patient performing a valsalva maneuver or

during expiration. A repeat chest radiograph can rule out a pneumothorax, which can occasionally occur during removal.

The rate of complications associated with tube thoracostomy is from 3% to 18% [14]. In patients with pneumothorax, placement of a chest tube should be safer, since there is a space between the chest wall and the lung. Complication rates of tube thoracostomy have been found to be higher in critically ill patients with about 21% of tube placed intrafissurally and 9% intraparenchymally [15]. Trocar technique of chest tube insertion has been shown to increase the risk of complications such as tube malposition, compared with the blunt dissection technique [16].

Chest tube malposition is the most common complication and has been defined by CT confirmation in four locations: intraparenchymal, fissural, extrathoracic and angulation of the drain in the pleural space [17].

Intraparenchymal tube placement occurs more likely in the presence of pleural adhesions or preexisting pulmonary disease. It can be dramatic if there is associated injury to pulmonary vessels. However, clinical manifestation may be absent and the only clue to the diagnosis may be inadequate drainage of air and fluid.

Fissural (interlobar) tube placement is significantly higher when using the lateral approach of tube thoracostomy,

comparing to the anterior approach. Malfunctioning interfissural tubes should be repositioned or replaced to improve function.

Chest wall (subcutaneous) tube placement is a rare complication with reported incidence between 1-1.8% [18]. An unstable chest wall secondary to multiple rib fractures, haematoma and hurried chest tube insertion are the most common factors [19]. It can be identified clinically by the lack of fluctuation of the fluid level in the drainage system, and radiologically by subcutaneous position of the chest tube. Subcutaneous tube should be removed and replaced correctly into the pleural cavity.

Development of subcutaneous emphysema is a known complication of tube thoracostomy. It is usually presented as subcutaneous crepitation demonstrable clinically or as an occult radiological finding. Extensive subcutaneous emphysema may present with extreme discomfort, disfigurement, anxiety, upper airway obstruction.

Intercostal artery can be injuried during the insertion of chest tube. Intercostal arteries may bleed profusely when traumatized. Dissection during tube insertion should be done above the superior border of the rib to avoid the neurovascular bundles on the groove located on the inferior aspect. If traumatized, thoracotomy for haemostasis is required.