Original research article

Intercostal drainage, Indications and outcomes-1592 cases-a prospective study

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ABSTRACT:

INTRODUCTION: Inter costal drainage (also called tube thoracostomy) is a common procedure in daily clinical practice which is performed to drain fluid, blood, or air from the pleural cavity. It also serves as a route to in still antibiotics (post-pneumonectomy empyemas), sclerosing agents (pleurodesis), as well as fibrinolytics, DNAse, and/or saline (complicated para pneumonic effusions and empyemas

Aim: to study the aetiology and outcomes of intercostals drainage in patients admitted in various medical college hospitals in Tamilnadu , South India.

Materials and methods: All the patients undergone intercostals drainage in various medical college hospitals in Tamil nadu, India between Jan 2017 – Nov 2018 are taken for study

Results: Out of 1592 cases, Male 1228(77%) Female 364(23%) Pneumo thoraces, 504(32%) Haemothoraces, 372 (23%) Haemo- pneumo thoraces112(7%), pleural effusion 540 (33%) pyo thoraces 64(4%), 912(57%) 0n right side,616 (39%)are on left side,64 (4%)are on both sides.998(62%) cases are due to trauma, and 680 (38 %) due to infection, inflammation and neoplasm.

Conclusion: Tube thoracostomy is a life saving procedure which can be performed by trained surgeons , indwelling pleural catheters (IPC) are becoming a first-line palliative therapy for symptomatic malignant and persistent benign pleural effusions

Key words : Pleural effusion, haemo pneumo thorax, inter costal drainage

INTRODUCTION:

Chest drainage procedures can be classified based on the anatomical regions of the pleural space, lung parenchyma, and mediastinum. In this original research article we studied indications, techniques (including adjunctive procedures), and management of image-guided per cutaneous drainage procedures of the chest .Indwelling pleural catheters (IPC) are becoming a first-line palliative therapy for symptomatic malignant and persistent benign pleural effusions

Chest Tube Types and Sizes

There are many kinds of chest tubes or catheters, but they are basically classified according to size and method of insertion. Commercially available chest tubes are made of different materials, including polyvinyl chloride, polyethylene, and silicone. They can be straight, angled, or coiled at the end (“pig-tail”). They contain a number of holes along the side and the tip, and all have a radio opaque stripe with a gap that serves to mark the most

proximal drainage hole (“sentinel” hole). Some tubes have a double lumen, the small one normally being used for irrigation.

The internal diameter and length of chest tubes determine the air or liquid flow rate through the drain, according to the Poiseuille's law (liquids) and the Fanning equation (gases)_ The size of a chest tube refers to its outer diameter and is given in “French” (F) or “Charrière” (Ch), with 1F corresponding to one-third millimeter. Thus, a 12F tube is 4 mm in diameter. Chest tube sizes usually range between 8F and 36F . A general distinction is made between small-bore chest tube (SBCT) and large-bore chest tube (LBCT), but the threshold size to establish this categorization is being set at either 14F or 20F. For the purpose of this review, SBCT are defined as 14F or less, and LBCT as greater than 14F, unless otherwise indicated. Within this categorization, some authors also prefer to consider a group of medium-bore tubes (16–24F). IPC is a fenestrated silicone 15.5F catheter, 66 cm in length with side holes over the distal 24 cm, which is tunneled to prevent dislodgment and infection.

The optimal chest tube size for the management of pleural diseases is still a matter of debate. The British Thoracic Society guidelines suggest that in pneumothoraces and effusions of a malignant or an infectious nature (including empyemas) SBCT are usually adequate, although there is a lack of randomized trial data. However, the Therapeutic Interventions in Malignant Effusion (TIME1) randomized controlled trial found that 12F chest tubes were associated with a higher pleurodesis failure than 24F chest tubes (30% vs. 24%) in 100 patients with malignant effusions, suggesting that chest tube size matters for pleurodesis efficacy12. Moreover, even though the smaller chest tubes resulted in significantly less pain than the larger ones, the difference was not likely clinically significant (mean visual analog scale of 22 vs. 26.8)

Based upon expert opinion, use of chest tubes ≥20F is recommended in the following situations (1) there is clinical concern for the presence of an on-going air leak (or significant risk of it, as in traumatic pneumothorax or bronchial dehiscence), (2) iatrogenic pneumothorax from barotrauma (mechanical ventilation), (3) hemothoraces, and (4) postoperative drainage of the chest cavity.

Techniques for Chest Tube Placement

SBCT and medium-bore chest tubes are typically placed using the Seldinger technique, whereas LBCT (>24F) can be inserted by blunt dissection or the trocar technique. The Seldinger technique has become the most widespread method of tube placement because of the ease of insertion and increased patient comfort14. Conversely, the trocar technique is obsolete and should never be employed since it significantly increases the risk of misplaced drains and organ perforation15.

The insertion of a chest tube can be performed at the bedside or the endoscopic suite for most patients, with the exception of those which are placed after cardio-thoracic surgery. A single chest tube is sufficient for most drainage indications, but occasionally two simultaneous or consecutive tubes may be necessary for the effective drainage of non-communicating infected fluid collections following a trial of intrapleural fibrinolytics.

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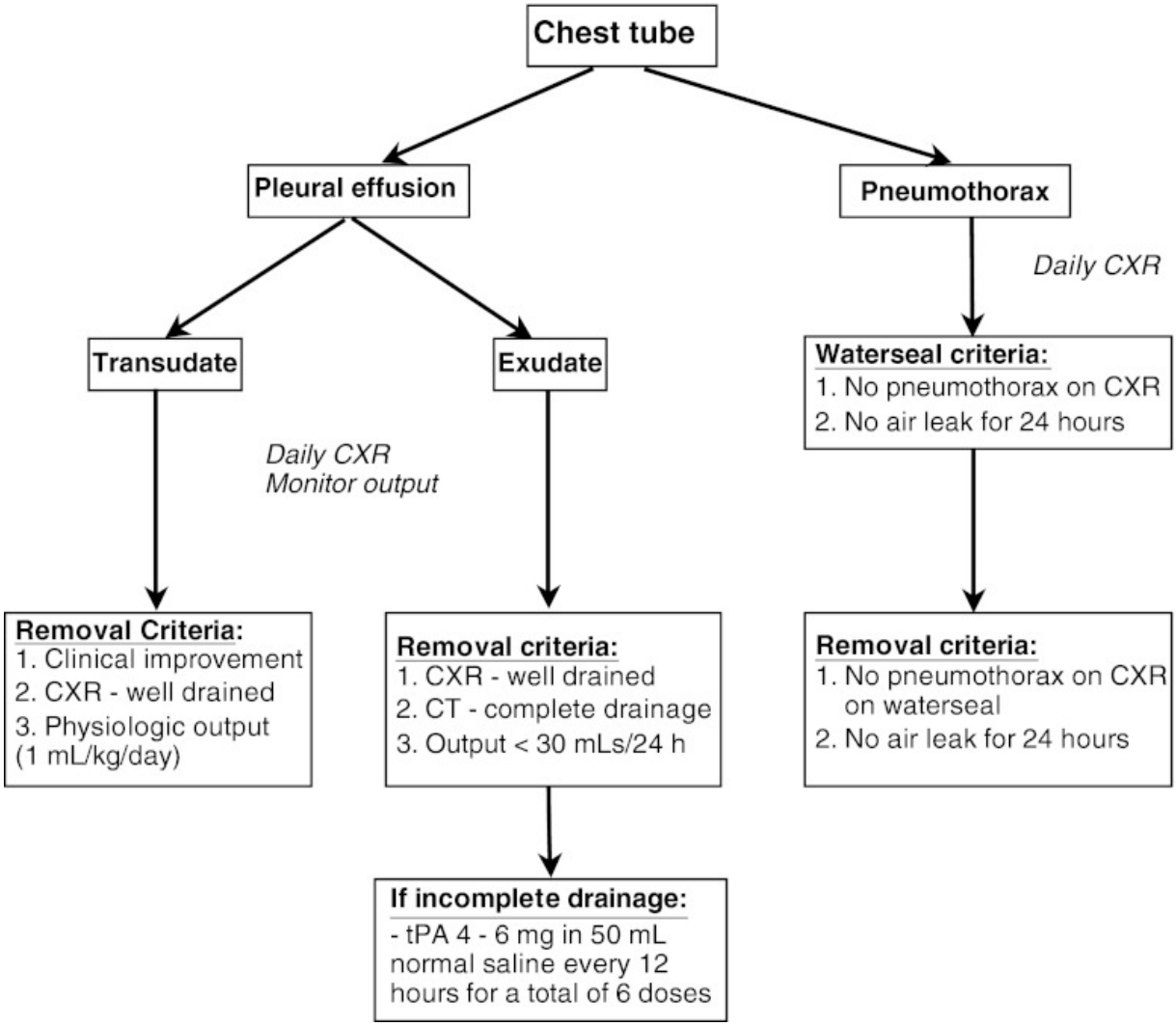

The Pleural Space: Pathologic Conditions

Infectious, inflammatory, hemorrhagic, and iatrogenic processes can all result in pleural space-based abnormalities.

Pneumothorax is an imaging finding and clinical condition in which air accumulates within the pleural space. Pneumothoraces can be either spontaneous, associated with underlying lung disease (lymphangioleiomyomatosis, blebs, etc.), or the result of traumatic injury to the chest wall, pulmonary parenchyma, or airways

Several options exist if clinical and radiographic assessment determines that drainage is inadequate. Occasionally, the indwelling chest tube requires repositioning to enhance the drainage of loculated collections. Also, conversion to a catheter with a larger lumen may promote adequate drainage of thick pus or bloody material. Intrapleural administration of fibrinolytic medication may aid in septated collections or collections with multiple locules a recent study has found that the combination of intrapleural tissue plasminogen activator (tPA) and DNase improved fluid drainage in patients with pleural infection and reduced the frequency of surgical referral and the duration of the hospital stay.

Most chest tubes are suitable for leaving inside the pleural space for more than 2 weeks. However, the longer the tube remains, the greater the risk of local infectious complications. On the other hand, aspiration drain systems designed for therapeutic thoracenteses (8F), which may occasionally be used for draining small empyematous collections, are usually made of polyurethane and should be removed no later than three days after their initial insertion5.

Chest tubes are withdrawn when they reach their predefined therapeutic goals or become nonfunctional. In patients with pneumothoraces or following thoracic surgery, a clamping trial and a chest radiograph are unnecessary prior to removal of tube thoracostomy to detect recurrent pneumothorax, provided a digital recording drainage device shows that the patient has no air leaks. Acceptable air flows for chest tube removal are below 20 mL/min for 8–12 hours when no suction is applied, or less than 40 mL/min for 6 hours in accordance with other authors. However, when conventional analogue pleural drainage devices are employed, the chest tube is pulled out if the lung remains fully expanded on a chest radiograph performed off suction, and no air bubbling in the water seal chamber is observed. A bubbling chest tube should never be clamped, since this may lead to tension pneumothorax. If doubts on the presence of an air leak exist, some clinicians prefer to perform a clamp trial, a risky manoeuvre that requires close monitoring of the patient and generally leads to unneeded delay of chest tube removal.

In cases of pleural effusion, the fluid output threshold for chest drain removal is not standardized and depends on the underlying disease. In postoperative situations, chest tubes can be safely withdrawn with daily outputs up to 450 mL/24 hr31. Following pleurodesis, some pulmonologists remove the drain when fluid production is below 100–150 mL/day while others do it at a specific time (e.g., 24 hours) after the instillation of the sclerosing agent, regardless of fluid volume output32.

In preparation for removal, the tube should be taken off suction, placed on water seal and removed quickly at the end of expiration during a Valsalva manoeuvre while placing a sterile dressing over the insertion site31. After suturing the opening, an occlusive dressing with povidone-iodine is applied to the wound.

In IPC patients, when the pleural fluid output drops to less than 50 mL on three consecutive drainages, spontaneous pleurodesis is assumed, provided a bedside US rules out the presence of pleural fluid (i.e., the declined drainage cannot be attributed to catheter blockage). In these circumstances the pleural catheter may be removed. Spontaneous pleurodesis occurs in about 50% of patients. For IPC withdrawal, the adhesions surrounding the cuff need to be freed, usually with a metallic groove director.

The average rate of complications during or following placement of a chest tube is less than 10% , and mainly depends on operator experience, the size of the tube and use of imaging to guide insertion. Fewer complications appear when experienced operators insert SBCT under image guidance. In a British audit of 58 hospitals, 824 chest drain procedures were evaluated, of which 83% corresponded to SBCT, 80% made use of the Seldinger technique, and about half were performed under real-time US36. The most frequent immediate complications were pain , failure to place the drain and vasovagal reactions while delayed complications included pain , drain blockage , accidental dislodgment , and subcutaneous emphysema . As far as LBCT (≥20F) is concerned, commonly reported post-insertion complications are mal position , drain blockage , organ injuries , and empyema .

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Results:

in our study Out of 1592 cases 1228(77%) are male 364(23%) female, 504(32%)pneumo thoraces, 372 (23%)haemothoraces, 112(7%)haemo pneumo thoraces, pleural effusion 540 (33%), pyo thoraces64(4%), 912(57%) 0n right side,616 (39%)are on left side,64 (4%)are on both sides.998(62%) cases are due to trauma,and 680 (38 %) due to infection, inflammation and neoplasm

Characteristics	**Category**	**Frequency**
Age (years)	Below 20	172
	21--40	449
	41-59	592
	≥ 60	379
Gender	Male	1228(77%)
	Female	364(23%)
Body Mass Index (kg/m^2)	19-25	987(62%)
	>25	605(38%)
Cause	Trauma	998(62%)
	Infections	651(36%)
	Neoplasms	29(2%)
LUNG involved	RIGHT	912(57%)
	LEFT	616(39%)
	BOTH	64(4%)
PATHOLOGY	HAEMOTHORAX	504(32%)
	PNEUMOTHORA	372(23%)
	HAEMO +PNEUMO	112(7%)
	PLEURAL EFFUSION	540(34%)
	PYOTHORAX	64(4%)
Other associated Health Problems	DM	166(10%)
	SHT BOTH	79(5%)
		128(8%)

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Conclusion

Tube thoracostomy is a Life saving procedure which can be performed by trained pulmonologists and surgeons. Other than postoperative chest tubes, most procedures consist of the US-guided insertion of SBCT with the Seldinger technique in patients with pneumothoraces, complicated parapneumonic effusions/empyemas, or malignant pleural effusions. Hemothoraces usually require LBCT, which can be placed by Seldinger or blunt dissection techniques. Detection of air leaks in patients with pneumothoraces or following thoracic surgery has been greatly improved with the use of electronic CDS. Finally, IPC are becoming a first-line therapy of symptomatic malignant and persistent benign pleural effusions. They are commonly placed as a day case and allow long-term intermittent fluid drainage in the outpatient setting. Treating doctors should be familiar with the common complications that may occur during or after chest tube insertion, some of which are potentially dangerous (e.g., malposition, hemothorax, infection, organ injury, or re expansion pulmonary edema).

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