

Prospective study on use of stylet for tube thoracostomy procedure – A pilot study

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Abstract:

Background: Tube thoracostomy is a standard procedure for the evacuation of air, blood, or other materials from the pleural space. This paper describes a modification of the Seldinger technique that facilitates chest tube insertion using stylet. The technique is simple to use, effective and safe. It employs standard, inexpensive materials to insert chest tubes in such a way as to minimize the potential traumatic complications inherent in other techniques.

Materials and Methods: Fifty patients who fulfill the inclusion criteria were recruited for the study after obtaining informed written consent from patients. Tube thoracostomy was inserted under the guidance of stylet. On the check X-ray chest PA view, extra thoracic location of the drain and angulation of the drain in the interpleural space were considered tube malposition. The cases confirmed as tube malposition depending on poorly air and fluid drainage, and because of that the pulmonary expansion could not be possible adopted as ineffective drainage. Complications were defined as insertional (visceral or parietal injuries of the intercostal artery or intraparenchymal lung), positional (extrathoracic placement or atypical intrathoracic placement resulting in tube failure and replacement) or infectious (wound infection or empyema).

Results: Study group comprised of 46 male patients (92%) and 4 female patients(8%). 5 patients required bilateral tube thoracostomy. The mean age of the patients was 46.28 years. The most common mode of injury was road traffic accident (Table 1). The most common complication was positional (Table 2). 1 (1%) patient developed tube malposition, which led to ineffective drainage. ICD was repositioned for this patient. No other complications occurred in study group ($p = 0.001$). In the patients with no TM, the mean drain removal time was 2.63 days, while in the patients with TM, the mean drain removal time was 7 days ($p = 0.001$).

Conclusion: This procedure has proven to be a safe, effective, and gentle method for the insertion of chest tubes. The technique causes minimal trauma to the patient and can be easily accomplished with materials that are readily available in most medical settings.

Key Word: Thoracostomy; Stylet; Chest tubes.

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I. Introduction

Tube thoracostomy is the most commonly performed surgical procedure in emergency room. The standard technique for the insertion of intercostals drainage tube involves the administration of local anesthetic, incision of the skin, and dissection of the soft tissues to enter the pleural space. The thoracostomy tube is then introduced into the pleural space through the dissected tract. Several methods have been introduced for the introduction of the chest tube through the tract. Traditionally, there are two principal methods of tube thoracostomy: the blunt dissection technique and the trocar technique. The blunt technique does not involve the use of a sharp lance, and that the pleural space can be accessed with a finger to ensure that the pleural space has been entered and allows for digital lysis of adhesions. The tip of the tube is then gripped with a clamp, which is then used to introduce it into the pleural space. It has been well documented that the intercostal insertion of a chest tube with a clamp is not only a painful procedure, but also that the incision must be extended to allow for the combined diameter of both the chest tube and the clamp. This often leads to spillage of the pleural fluid and leakage around the catheter after the clamp is withdrawn from the incision. Also, any extension of the incision leads to a longer scar, and is therefore less desirable from a cosmetic standpoint. Alternatively, trocars have been used in one of two fashions: either the trocar is used to perforate the chest wall or it is fitted in the chest tube to serve as a guide after blunt dissection of the chest wall has been performed. There are a host of

documented complications including perforation of the lung [1,2], heart [3], liver, spleen, and other internal organs [4]. In an attempt to minimize the risk of such complications, several methods and instruments have been proposed for inserting intercostals chest drains. Among these are the use of endoscopic trocars [5,6], a needle-guidewire technique [7], and the blunt tip trocar, pleural catheter, and flexible introducer. Although these methods and equipment have been demonstrated as effective in the insertion of chest tubes, they require the purchase of additional equipment that is often rather expensive. In an attempt to minimize the risk of such complications and to avoid purchase of expensive instrument, we developed a technique for insertion of intercostals chest drain using stylet which is a low cost instrument and easily available at emergency room of hospitals.

II. Material And Methods

Design of study: Prospective observational study

Duration of study: 6 months

Period of the study: March 2020 to September 2020

Study centre: Department of General Surgery, Chengalpattu Medical College & Hospital, Chengalpattu.

Study population: Chest injury cases who requires tube thoracostomy intervention at Chengalpattu Medical College Hospital, Chengalpattu.

Sample size: 50

Inclusion criteria: Patients with injury to the chest who requires intervention of intercostal drainage insertion

Exclusion criteria:

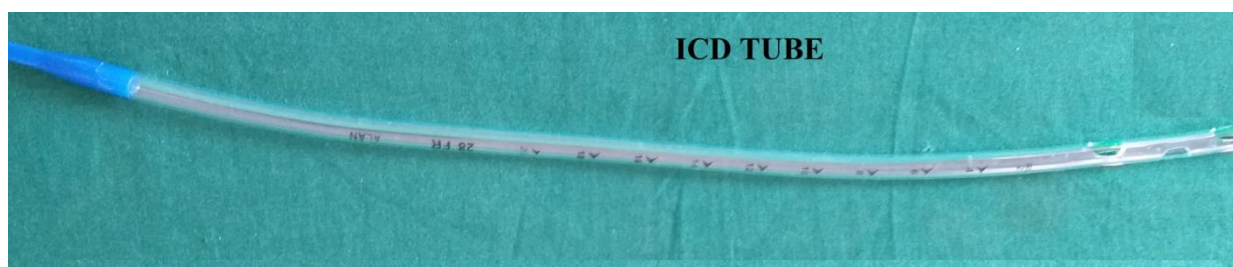
- Age of the patient < 18years.
- Patients not willing to give a written informed consent.
- Patients with injury to the chest who does not require intervention of intercostal drainage insertion.

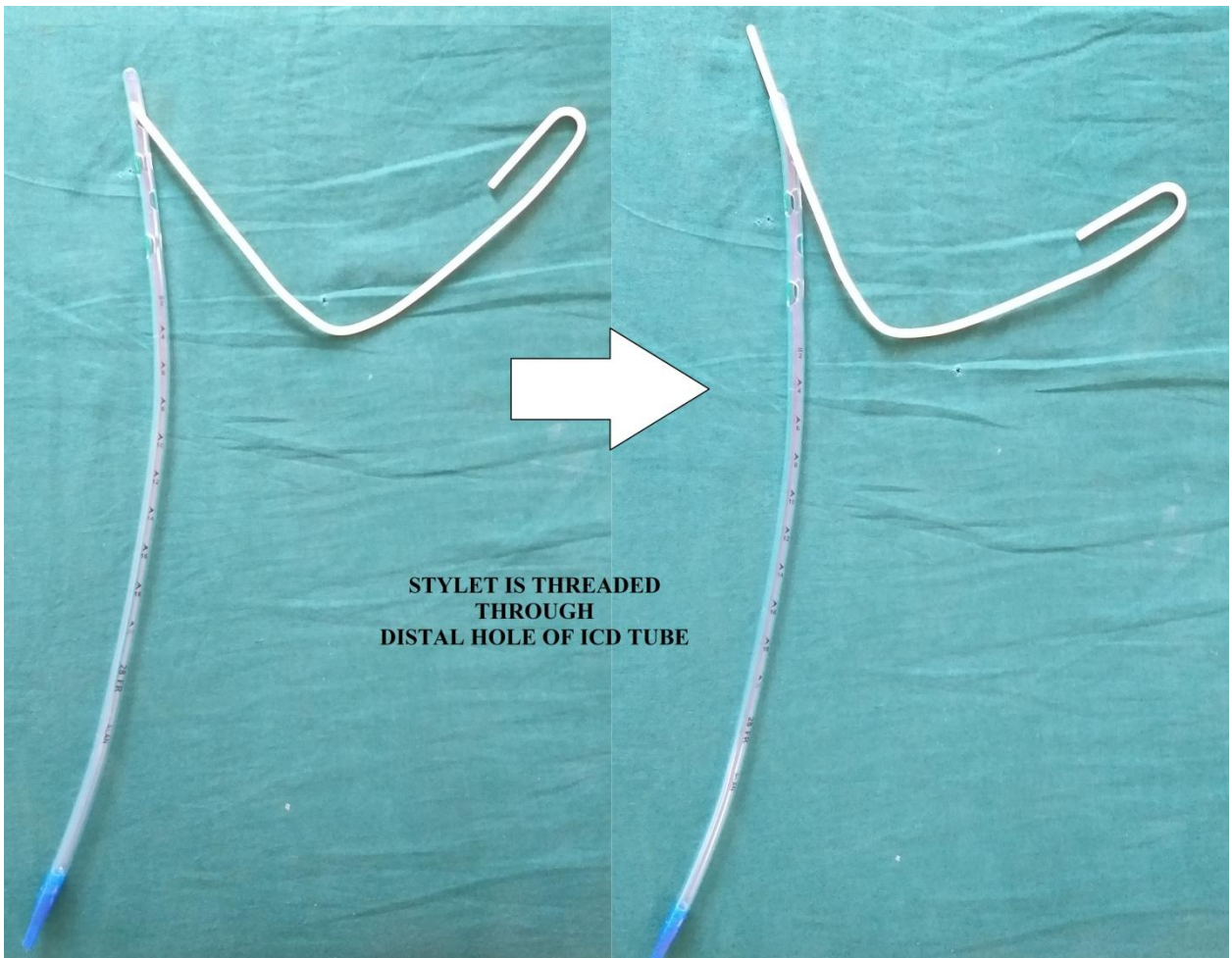
Methodology:

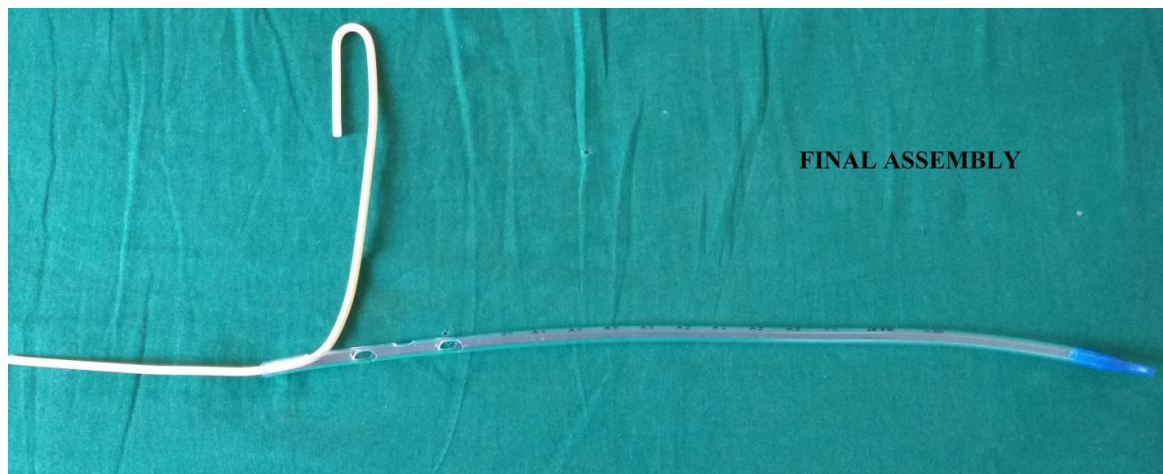
- Fifty patients who fulfill the inclusion criteria will be recruited for the study.
- Intercostal drainage tube is inserted under the guidance of stylet.
- Effectiveness of using stylet for tube thoracostomy is evaluated.

Surgical Technique

As an inexpensive and effective method of chest tube insertion that minimizes the risk of complications inherent in the use of a trocar, we have used stylet as a guide over which the chest tube is inserted. Before incision of the chest wall, a stylet is used as a guide. The stylet is fitted into the chest tube, entering the drainage hole on the side, and exiting through the tip so that it extends approximately 10 to 15 cm beyond the end of the chest tube. After the incision site is selected, local anesthetic is administered and an incision that is only large enough to accommodate the chest tube is made through the skin. Blunt dissection into the pleural space is then performed with the use of a curved artery forceps. After access to the pleural space has been gained, the clamp is withdrawn from the chest wall. The tip of the stylet is introduced into the pleural space and aim it in the desired direction. The stylet is advanced several centimeters inside the pleural space. The chest tube is then advanced over the stylet into the pleural space, using it as a guide. After the chest tube has been placed in the desired location, the stylet is withdrawn from the lumen of the tube. The chest tube is then fixed in place with a modified Jo'burg technique.







Procedure methodology:

After obtaining informed written consent from patients, fifty patients who fulfill the inclusion criteria were recruited for the study. Tube thoracostomy was inserted under the guidance of stylet. On the check X-ray chest PA view, extra thoracic location of the drain and angulation of the drain in the interpleural space were considered tube malposition. The cases confirmed as tube malposition depending on poorly air and fluid drainage, and because of that the pulmonary expansion could not be possible adopted as ineffective drainage. Complications were defined as insertional (visceral or parietal injuries of the intercostal artery or intraparenchymal lung), positional (extrathoracic placement or atypical intrathoracic placement resulting in tube failure and replacement) or infectious (wound infection or empyema).

Statistical analysis;

Data was analyzed using SPSS version 20 (SPSS Inc., Chicago, IL). Chi-square was performed.. The level $P < 0.05$ was considered as the cutoff value or significance.

III. Result

Study group comprised of 46 male patients (92%) and 4 female patients(8%). 5 patients required bilateral tube thoracostomy. The mean age of the patients was 46.28 years. The most common mode of injury was road traffic accident (Table 1). The most common complication was positional (Table 2). 1 (1%) patient developed tube malposition, which led to ineffective drainage. ICD was repositioned for this patient. No other complications occurred in study group ($p = 0.001$). In the patients with no TM, the mean drain removal time was 2.63 days, while in the patients with TM, the mean drain removal time was 7 days ($p = 0.001$).

Table No 1

MODE OF INJURY	NO.	PERCENTAGE
Road traffic accident	28	56
Accidental fall	12	24
Assault	7	14
Bull gore injury	2	4
Train traffic injury	1	2

Table No 2

COMPLICATIONS	NO.	PERCENTAGE
Insertional	0	0
Positional	1	2
Infectious	0	0

IV. Discussion

Tube thoracostomy is the most commonly performed surgical procedure in emergency room [9,10]. One of the important factors affecting the complication rates is the method by which ICD tube is inserted. Severe complications have been reported when tube thoracostomy procedure is done using blind or trocar technique [11-14]. This paper describes a modification of the Seldinger technique using stylet developed at Department of General Surgery, Chengalpattu Medical College & Hospital, Chengalpattu that facilitates chest tube insertion. In this method, application of drain with under the guidance of stylet can prevent pulmonary parenchymal injuries, cardiac, esophageal and major vascular injuries that can occur by trocar technique and blind technique.

This technique has advantages over other two techniques.

1. When the drain is not directed towards the apex in the pleural space, it is termed as TM. This complication occurs in 4 locations: intraparenchymal, fissural, extrathoracic locations, and angulation of the drain in the pleural space. Although TM usually occurs in urgent TT procedures, it may also be associated with the method of TT used. In a study where TM was defined in fissural or parenchymal location, trocar technique was shown to increase the risk of TM [15]. In this method, application of drain without finger exploration can cause pulmonary parenchymal injuries because of the impossibility of determination of the pleural adhesions. Also pulmonary, cardiac, esophageal and main vascular injuries may occur by trocar that has a sharp point en route pleural space. In the other hand failing the trocar assistance; it could not be possible to place the drain into the pleural space without TM formation. This identified modified combined technique has a purpose to take advantages of the other two techniques.
2. On the other hand, angulation of the drain in blunt technique is not a rare occasion. In such cases, poor drainage may be associated with the angulation point and the degree of angulation of the drain because angulation often reduces the diameter of the lumen. This may result in failure in effective drainage depending on the diameter of the parenchymal defect particularly in pneumothorax. Some authors recommend the withdrawal and reinsertion of the drain in case of TM, while others suggest keeping the drain in its place if effective drainage is achieved [16]. Although leaving the drain at its location even when TM is determined seems plausible, perhaps the only exception is intraparenchymal location of TM. This may cause prolonged air leak and its potential complications. Moreover, after the drain is removed, the resultant air leak from the defect that is caused by the drain may lead to pneumothorax or hemothorax or both.

With the use of the method described here using stylet, we aimed to reduce the incidence of intrapleural angulations, which are commonly observed in blunt technique, and intraparenchymal-fissural locations, which are common with trocar technique, as well as pulmonary and cardiovascular injury.

V. Conclusion

This procedure has proven to be a safe, effective, and gentle method for the insertion of chest tubes. The technique causes minimal trauma to the patient and can be easily accomplished with materials that are readily available in most medical settings. Furthermore, because the diameter of the tract through the chest wall is better tailored to the outside diameter of the chest tube, the risk of leakage is minimized and the smaller incision is cosmetically more favorable. However, comparative studies are required to prove superiority of this technique over other techniques in inserting chest tubes.

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