

A Comparison Between Conventional and Thoracoport Technique for Tube Thoracostomy in Pneumothorax

Ishaq. T. K¹, Arun. S^{2*}

¹MBBS, MS, Senior Resident,

²MBBS, MS, FMAS, Assistant Professor,

Department of General Surgery, Government Medical College, Kozhikode, Kerala, India.

ABSTRACT

Background: Pneumothorax is a medical emergency where there is an abnormal collection of air in the pleural space. After confirming the diagnosis chest tube is placed into the pleural space which allows the air or fluid to escape from the pleural space. Newer methods of tube thoracostomy using Seldinger and thoracoport techniques are replacing the conventional method. The TP technique is said to be safer, faster when compared to the conventional one.

Aim: To compare the time required for the tube thoracostomy and whether tube thoracostomy can be performed by a single medical person without assistance. As well as complication rates using both conventional and thoracoport techniques.

Materials and Methods: Out of total 80 patients, 40 patients underwent tube thoracostomy using thoracoport and remaining 40 by conventional method randomly for pneumothorax.

Results: Mean procedural time by conventional was high when compared to thoracoport technique. Need for assistance and complications were high in conventional to thoracoport method.

Conclusions: Tube thoracostomy using thoracoport has a statistical advantage over conventional technique in terms of procedural duration, need for assistance and complications and this method will definitely revolutionise the emergency management of pneumothorax.

Keywords: Pneumothorax, Tube Thoracostomy, Thoracoport.

*Correspondence to:

Dr. Arun. S,
Assistant Professor,
Department of General Surgery
Government Medical College, Kozhikode, Kerala, India.

Article History:

Received: 07-06-2019, Revised: 01-07-2019, Accepted: 12-07-2019

Access this article online

Website: www.ijmrp.com	Quick Response code 
DOI: 10.21276/ijmrp.2019.5.4.010	

INTRODUCTION

Pneumothorax (PT) is defined as an abnormal collection of air in the pleural space between lung and the chest wall. It is characterised by sudden onset of sharp one sided chest pain and shortness of breath. In a minority of cases the air enters the chest by a one way valve mechanism, which is a life threatening condition called tension pneumothorax leading to hypoxia and hypotension. Pneumothorax is a common cause of morbidity and mortality in emergency department.¹ After confirming the diagnosis clinically and radiologically, a thoracostomy tube (TT) is placed into the pleural space after blunt dissection of the chest wall, with the outer end of the tube connected to an underwater seal. This allows the air or fluid to escape from the pleural space, and prevents anything returning to the chest.² Anatomic structures potentially affected during TT placement includes primary and secondary injuries of the lung, intercostal or intrathoracic vasculature, esophagus, stomach, liver, spleen, diaphragm, major blood vessels, and even cardiac structures.³ Newer methods of TT using Seldinger and thoracoport [TP] techniques are replacing the conventional method. The TP technique is said to be safer,

faster when compared to the conventional one. Primary spontaneous pneumothorax is likely due to the formation of small sacs of air (blebs) in lung tissue that rupture, causing air to leak into the pleural space.. Secondary pneumothorax is caused by rupture of damaged pulmonary tissue, and occurs primarily in patients diagnosed with pulmonary disease, such as pulmonary emphysema.^{4,5} Secondary spontaneous PT is a critical state where pulmonary function is decreased with severe symptoms and dyspnoea is out of proportion to the PT resulting in high mortality. Recurrence is high in secondary PT, with a grim prognosis due to delayed pulmonary expansion. Many a times repeated TT is required. Despars et al demonstrated that incidence of PT is on the rise after invasive procedures.⁶ Traumatic PT are caused by injury to lung parenchyma with or without chest wall involvement, deceleration injuries or sudden increase in intra thoracic pressure. By using TP technique it would increase the efficiency in the management of PT. It is said to reduce the time requirement, need of assistance and incidence of malposition of tube and related complications.

AIM

To compare the Time required for the tube thoracostomy whether tube thoracostomy can be performed by a single medical person without assistance.

Complication rates using both conventional and thoracoport techniques.

MATERIALS AND METHODS

Patients presenting to emergency department at a tertiary care centre in North Kerala with pneumothorax of various aetiology

within a period of two years were included in this study. Sample size was 80 with 40 patients underwent tube thoracostomy using thoracoport and remaining 40 by conventional method randomly .All patients above 13years with spontaneous or traumatic pneumothorax were included in this study. Persons below 13years, pleural effusion, empyema thoracis, prophylactic tube thoracostomy hemothorax, hemopneumothorax for various indications were excluded. Duration of the procedure was calculated in minutes from instillation of local anaesthetic upto the TT drain fixation done for PT.

Table 1: Method of insertion Vs procedure time

Method of insertion	Procedure time				Total
	<5mins	6-10 mins	11-15 mins	16-20 min	
Conventional technique	0	0	23	17	40
	0%	0%	57.50%	4%	100.0%
Thoracoport technique	15	12	13	0	40
	37.5%	30%	32.5%	0%	100%
Total	15	12	36	17	80
	18.75%	15%	45%	21.25%	100.0%

Table 2: Percentage of complication rates

Complications	Bleeding%	Malposition %	Surgical emphysema%	Infection %
Conventional technique	79	70	81	64
Thoracoport technique	21	30	19	36

RESULTS

The mean procedural time of tube thoracostomy by conventional method was 13.5 minutes and that of thoracoport technique was 08.6 minutes. Assistance was needed in all cases done by conventional method, whereas a single person could do it by thoracoport method which was a very important advantage. Complications like bleeding occurred in 11 patients out of which 73% were in conventional arm while 27% was in thoracoport arm, tubal malposition was to a tune of 79% to 21% in conventional compared to thoracoport method respectively.

DISCUSSION

The term 'pneumothorax' was first coined by Itard and then Laennec in 1803 and 1819 respectively. It is a surgical emergency warranting tube thoracostomy (TT).⁷ Several techniques are being used for TT, with conventional technique being the most preferred one.⁸ In this study we compared both conventional technique and thoracoport technique in terms of procedural time, need of assistance and complication rates.

Conventional technique (CT) for tube thoracostomy: After confirming the pneumothorax by xray or by USG⁹ an informed consent was taken and patient was shifted to the procedure room. First step was positioning of the patient and confirming the site for chest tube insertion. Awake and cooperative patients lie supine with arm on the affected side abducted and flexed at elbow and hand kept beneath the head widely exposing the axillary area and lateral chest wall. TT should be ideally inserted in the triangle of safety.^{10,11} British Thoracic Society recommends the tube is inserted in an area described as the "safe zone", a region bordered by: the lateral border of pectoralis major, a horizontal line inferior to the axilla, the anterior border of latissimus dorsi and

a horizontal line superior to the nipple. More specifically, the tube is inserted into the 5th intercostal space slightly anterior to the mid axillary line.

This position minimises the risk to underlying structures when compared to the other parts of the chest wall. The area is wiped with povidone iodine or chlorhexidine solution and draped with sterile towels. Lignocaine 1% is used to anaesthetise the skin, subcutaneous tissue, intercostals muscles upto the parietal pleura, periosteum of the above and below ribs .This will form an anaesthetic tunnel through which TT can be easily performed. Aspiration of air confirms the site. Majority of persons uses 28-32F thoracic catheter.¹² Skin is incised with no 15 or 22 scalpel and is kept away. The subcutaneous and muscular layer is bluntly dissected parallel to the ribs with a haemostat and the pleura is breeched with the haemostat in closed position .Once this is done there will be sudden gush of air developed in pneumothorax. Index finger is introduced through the wound to release any adhesions of pleura to the chest wall. The curved haemostat is closed on top of the thoracostomy tube and is directed upwards or downwards as in pneumothorax or effusion respectively. A very good retraction and assistance is needed in this technique. The chest tube needs to be advanced far enough into the thorax so that its most peripheral intake portal (i.e. the "sentinel hole"), rests within the pleural space. It's fixed to the chest wall by No1 braided black silk horizontal mattress sutures. Outer end of the tube is connected to an underwater sealed container.¹³ After suturing, dressings are applied for hygienical reasons covering the wound. First, a y-slit compress is used around the tube. Second, a compress (10 x 10 cm) is placed on top and finally an adhesive plaster is added in a way that tension is avoided.

Thoracoport Technique

This type of TT was initially done after thoracoscopic surgeries where it was safe, easy and with less complication. The initial steps like patient position, preparation are all the same as in CT. TP technique requires a 11.5 mm thoracoport, No 15 BP knife, intercostal drainage system, instruments for anaesthetising and preparing the patient.

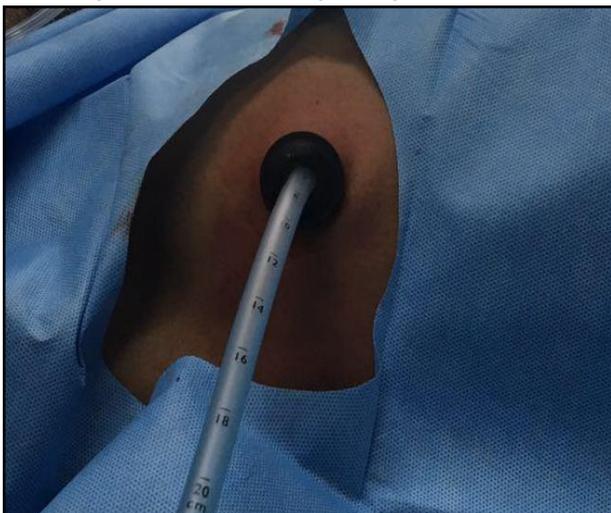
Fig.1: Thoracoport



Fig 2: Insertion of thoracoport



Fig.3: Tube thoracostomy through thoracoport.



Thoracoport consists of a threaded sleeve and a blunt tipped obturator with a hood at its end.(Fig1).

A 1cm incision is put over the skin in the triangle of safety following which the thoracoport is introduced by rotatory movement of it through the anaesthetised intercostal space towards the pleura (Fig 2).

Once the thoracoport breaches the pleura, the obturator is removed but sleeve is retained. This threads on the sleeve, prevents its slippage during the procedure. The thoracostomy tube is introduced through it and finally sleeve is removed (Fig 3).

The tube is kept inside the chest cavity taking care that the sentinal hole is 2cm inside the chest wall. The tube is anchored to the skin after connecting it to an underwater seal as in CT. The wound is covered with gauze and adhesive plaster is applied.¹⁴

The tips to say that the tube is properly positioned inside the thoracic cavity are gush of air, fogging of the tube, swinging movement of water column in the underwater seal, pleural fluid draining through the tube or by visualising the tube by USG.

A check xray is taken after the procedure to confirm the position of the tube inside the chest cavity. Daily output through the TT is measured and chest auscultation performed. When air entry is good and serous drainage is less than 30 ml for three consecutive days and confirmed by a chest xray, the TT can be removed safely.¹⁵

In our study 40 patients who underwent TT by the TP method, 64% were completed by 6-10 minutes, 15% took less than 5 minutes and 21% were completed by 11-15 minutes. Out of 40 cases in CT arm, 46% cases took 11-15 minutes and 54% took 16-20 minutes and none were completed below 10 minutes which was statistically significant. Average duration for TP technique was 08.6 minutes compared to 13.5 minutes by CT. Of the 12 cases of tubal malposition, 79% (9 cases) were with CT and rest 21% (3 cases) in PT which is statistically significant. The malposition rate by CT was comparable with the work done by Baldt et al from USA.¹⁶

Post procedural pain was less in TP compared to CT. Surgical emphysema after the procedure was seen in 10 cases with 7 cases (70%) in CT and 3 cases (30%) in PT. This rapidity and ease of TT by TP helps in tiding over of crisis period, makes it more patients compliant and reduces the procedure and wound related complications. Post procedural bleeding and tube malposition were less in the TP arm which is statistically significant. No assistance was required for TP technique when compared to CT and this was comparable with the results of Sreejayan et al.

CONCLUSIONS

Tube thoracostomy using thoracoport technique has a statistical advantage over conventional technique in terms of procedural duration, need for assistance and complications like post procedural bleeding, tubal malposition.

It can be performed single handedly in a safe, convenient, compliant manner in an emergency setting. Potential disadvantage may be the cost factor but comparing the morbidity associated with the conventional technique, thoracoport technique will be cost effective in the coming times and this will definitely revolutionise the emergency management of pneumothorax.

REFERENCES

1. Isaka M, Asai K, Urabe N. Surgery for secondary spontaneous pneumothorax: risk factors for recurrence and morbidity. *Interactive cardiovascular and thoracic surgery*. 2013 May 14;17(2):247-52.
2. Kesieme EB, Dongo A, Ezemba N, Irekpita E, Jebbin N, Kesieme C. Tube thoracostomy: complications and its management. *Pulmonary medicine*. 2012;2012
3. MacDuff A, Arnold A, Harvey J. Management of spontaneous pneumothorax: British Thoracic Society pleural disease guideline 2010. *Thorax*. 2010 Aug 1;65(Suppl 2):ii18-31.
4. Luh SP. Diagnosis and treatment of primary spontaneous pneumothorax. *Journal of Zhejiang University SCIENCE B*. 2010 Oct 1;11(10):735-44.
5. Noppen M. Spontaneous pneumothorax: epidemiology, pathophysiology and cause. *European Respiratory Review*. 2010 Sep 1;19(117):217-9.
6. Despars JA, Sassoon CS, Light RW. Significance of iatrogenic pneumothoraces. *Chest*. 1994 Apr 1;105(4):1147-50.
7. Yarmus L, Feller-Kopman D. Pneumothorax in the critically ill patient. *Chest*. 2012 Apr 1;141(4):1098-105.
8. Parlak M, Uil SM, van den Berg JW. A prospective, randomised trial of pneumothorax therapy: manual aspiration versus conventional chest tube drainage. *Respiratory medicine*. 2012 Nov 1;106(11):1600-5.
9. Nagarsheth K, Kurek S. Ultrasound detection of pneumothorax compared with chest X-ray and computed tomography scan. *The American surgeon*. 2011 Apr 1;77(4):480-4.
10. Kirmani BH, Page RD. Pneumothorax and insertion of a chest drain. *Surgery (Oxford)*. 2014 May 1;32(5):272-5.
11. Kuhajda I, Zarogoulidis K et al. Tube thoracostomy; chest tube implantation and follow up. *Journal of thoracic disease*. 2014 Oct;6(Suppl 4):S470.
12. Cooke DT, David EA. Large-bore and small-bore chest tubes: types, function, and placement. *Thoracic surgery clinics*. 2013 Feb 1;23(1):17-24.
13. Maturu VN, Agarwal R. Tube Thoracostomy. *Manual of ICU Procedures*. 2015 Aug 31:163.
14. sreejayan.M.P,Arun.S,M.D.Krishna. Tube thoracostomy using soft thoracoport, a novel technique in the placement of intercostals drains.*JMSCR*2016;4(9):12777-12780.
15. Griggs C, Fagenholz PJ. Chest Tubes and Pneumothorax. *Critical Care Secrets E-Book*. 2018; 22:147.
16. Baldt MM, Bankier AA, Germann PS, Pöschl GP, Skrbensky GT, Herold CJ. Complications after emergency tube thoracostomy: assessment with CT. *Radiology*. 1995 May; 195(2): 539-43.

Source of Support: Nil.

Conflict of Interest: None Declared.

Copyright: © the author(s) and publisher. IJMRP is an official publication of Ibn Sina Academy of Medieval Medicine & Sciences, registered in 2001 under Indian Trusts Act, 1882. This is an open access article distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Cite this article as: Ishaq. T. K, Arun. S. A Comparison Between Conventional and Thoracoport Technique for Tube Thoracostomy in Pneumothorax. *Int J Med Res Prof*. 2019 July; 5(4):41-44. DOI:10.21276/ijmrp.2019.5.4.010