



## The Pigtail Catheter for Pleural Drainage: A Less Invasive Alternative to Tube Thoracostomy

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### Abstract

Thoracostomy tubes are a mainstay of treatment for removing fluid or air from the pleural space. Placement of a chest tube is, however, an invasive procedure with potential morbidity. In an effort to reduce these complications, the use of percutaneous pigtail catheters in place of traditional large-bore tubes for thoracostomy and pleural drainage has been described.

**Aim:** To determine the role of pigtail catheters in adult population for drainage of pleural effusion.

**Methods:** It was an observational study. All consecutive patients with pleural effusion requiring drainage were subjected to either tube thoracostomy or pig tail drainage. A clinical questionnaire was prepared for retrieving data. Outcomes of interest were time to drain and total duration of hospital stay.

**Results:** A total of 92 patients (71men and 21women; age range, 17-86 years; mean age, 54±15 years) were enrolled into the study. Thirty five patients were treated with traditional chest tubes, whereas 57patients were treated with pigtail catheters. There were no significant differences in either drainage days or hospitalization days between the chest tube group and pigtail catheter group (9.81±6 vs. 9±5.6; 13.8±6 vs. 13 ± 5.7).

**Conclusion:** The pigtail catheter offers reliable treatment of effusions and is a safe and less invasive alternative to tube thoracostomy. There was no significant difference in time to drain duration of hospital stay in both the groups.

**Keywords:** Pleural effusion; Tube thoracostomy; Pigtail catheter

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### Introduction

Pleura is divided into two layers, a parietal layer which lines the inner aspect of the chest wall and a visceral layer which covers the lung and lines the inter lobar fissures [1]. Tube thoracostomy is a valuable tool for the treatment of various pathologic conditions of the pleural space. Recent literature suggests that treatment with small caliber tube thoracostomy is equally effective and less painful than treatment with large caliber tube thoracostomy in the treatment of pleural infection [1-3]. Additionally, it has been shown that wire-guided chest tube placement allows for more accurate positioning when compared with the classic surgical technique [4]. Placement of a chest tube is, however, an invasive procedure with potential morbidity. Complications include hemothorax, perforation of intrathoracic organs, diaphragmatic laceration, empyema, pulmonary edema, and Horner's syndrome [5,6]. In an effort to reduce these complications, the use of percutaneous pigtail catheters in place of traditional large-bore tubes for thoracostomy and pleural drainage has been studied in very few studies [5-8]. The present study was planned to see the benefit of pigtail drainage over conventional tube thoracostomy for draining pleural fluid.

### Material and Methods

It was a prospective observational study and was conducted at a tertiary care academic institute in department of pulmonary medicine. Study period was April 2012 to April 2013. Informed consent was obtained from the patients for participation in the study. The study was approved by institute research committee.

#### Study subjects

**Inclusion criteria:** All consecutive patients above age of 18 years with diagnosis of pleural effusion requiring drainage were screened for the study.

## Modified Seldinger technique

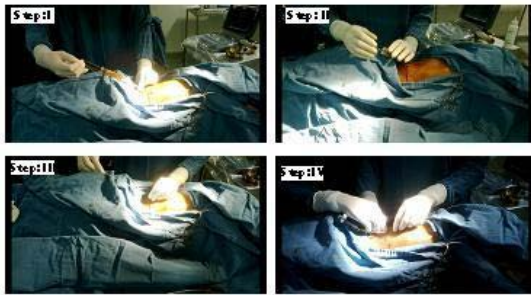


Figure 1: Steps of Modified Seldinger technique.

### Exclusion criteria

Post traumatic effusion and iatrogenic effusion were excluded. A detailed history and thorough clinical examination was done for all included patients. A clinical questionnaire was prepared to retrieve patient details. Complete blood count, renal function test, liver function test, prothrombin time, activated partial thromboplastin time and other relevant investigations were done. Chest radiograph was taken before and after the procedure as and when needed. Patients requiring drainage were subjected to either tube thoracostomy or pigtail catheter drainage as per discretion of treating physician. All procedures were done at bedside. Ultrasound guidance was used as and when necessary.

### Intervention

Intercostal drainage (ICD) was inserted as per BTS guidelines for insertion of ICD [9]. Modified Seldinger technique [10] was used for pigtail insertion (Figure 1). The details of the procedure are as follows: A needle insertion is made just above the top of the lower rib to avoid injury to the intercostal neurovascular bundle. Few ml of pleural fluid is withdrawn to confirm that the distal end of the needle is well inside the pleural cavity. Then the guide wire is passed in to the pleural space through the needle. A dilator is used thereafter to create adequate tract. A pigtail is inserted in such a way that the side holes are well inside the pleural cavity. The pigtail is then attached to standard thoracic drainage system.

Beside pigtail catheter and ICD insertion, standard therapy as per etiology of the effusion was given to all the patients. For tuberculous pleural effusion anti TB drugs as per WHO guidelines were given [11]. For parapneumonic effusions antibiotics were given as per the IDSA recommendations [12]. Intra pleural instillation of streptokinase (dose 2.5 lac units q12 hrly up to 6 doses) was done for loculated pleural effusion if required [13]. Malignant pleural effusion patients were subjected to talc or betadine pleurodesis prior to removal of tube or pigtail [14]. Bed side ultrasound guidance was used for all the patients as and when required [15].

### Primary and secondary endpoints of the study were defined as below

#### Primary End points:

- Time required for complete clearance (From time of insertion to complete radiological resolution + 24 hour drain < 50 ml)
- Duration of hospital stay (Day of admission to day of discharge)
- Success (Clearance of opacity in CXR without need for

Table 1: Baseline demographics of the study cohort.

Variable	Pigtail group n=57	ICD group n=35
Age (y) mean $\pm$ SD	54.7 $\pm$ 16	55.4 $\pm$ 15
Gender:		
Male	47 (78.9%)	26(74.3%)
Female	10 (17.5%)	9 (25.7%)
Side of effusion		
Right	29(50.8%)	19(54.3%)
Left	28(49.1%)	16(45.71%)
Diagnosis:		
TB	15(26.31%)	8(22.8%)
Pneumonia	31(54.4%)	21(60%)
Malignancy	9(15.8%)	4(11.4%)
Undiagnosed	2(3.5%)	2(5.7%)
Loculation		
Present	44(77.1%)	7
Absent	13(21.2%)	28
Use of Fibrinolysis		
Yes	29	16
No	28	19

repeat intervention/surgery)

#### Secondary End points:

- Intolerable pain following the procedure (Pain score >5 on Universal Pain Assessment scale) [16]
- Patient mobility after the procedure (Good/Average/Poor)

#### Statistical analysis

Descriptive data are presented as mean  $\pm$  SD (range). The relationship between type of drain and duration of hospital stay as well as time to clear and pain scoring and patient mobility after drain were tested using a Chi-squared test in the univariate analysis. P value < 0.05 was taken as statistically significant.

### Results

Total 92 patients were included in the study. There were 57(61.9%) patients in pigtail group and 35 (31.8%) in ICD group. Base line demographics of both the groups are depicted in (Table 1). The mean age and gender percentage were equal in both groups. Pneumonia was the commonest cause of effusion followed by TB and malignancy in both groups. The duration of drainage of pleural fluid using pigtail catheter ranged between three and 30 days with a mean of  $9.81 \pm 6.4$  days whereas it was  $9 \pm 5.6$  days for ICD. Primary and secondary points of the study observations are shown in (Table 2). There was no statistically significant difference found between two groups when compared for time to clearance and duration of hospital stay. P value was <0.001 for pain scores and mobility following the procedure when pigtail group was compared with ICD. Success rate for pigtail was 94.7 % and ICD was 85.7%. Radiological images of patients prior to and following clearance are shown in (Figure 2).

Sub group analysis was done and time to clearance as well as duration of hospital stay was measured for different groups as per different etiologies which is shown in (Table 3).

Complications of pigtail catheter included pain and blockage of the catheter, whereas subcutaneous emphysema and accidental removal requiring re-insertion was noted patients with ICD (Figure 3).

### Discussion

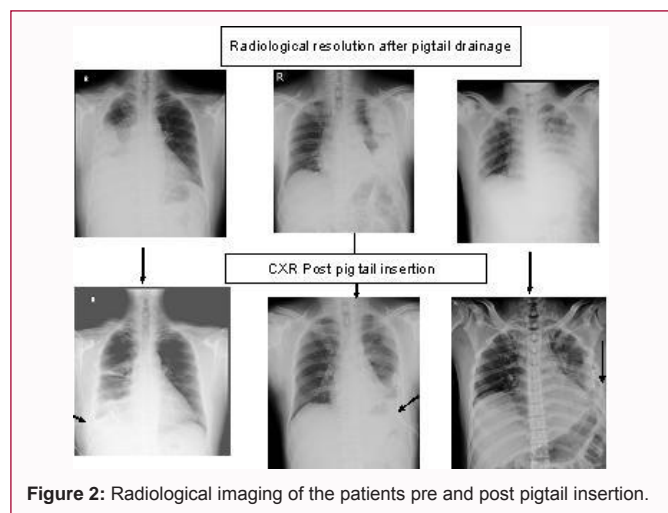
Wide bore chest tubes are conventionally used for drainage of fluid or air from pleural cavity. However, traditional large-bore chest tubes, placed by either blunt dissection or by trocar

**Table 2:** Primary and Secondary End Points.

Variable	Patients who underwent pigtail n=57	Patients who underwent ICD n=35	P value
Duration of hospital stay	13±5.7	13.3±8	0.982
Days taken for total clearance	9.7±5.7	9±5.6	0.955
Need of surgical intervention	3(5.3%)	5(14.3%)	0.134
Pain score > 5	17(29.8%)	23(65.7%)	<0.001
Good mobility after procedure	39(68.4%)	11(31.4)	<0.001

**Table 3:** Subgroup analysis.

Diagnosis	No	Duration in days	Time for clearance	P value
<b>TB</b>				
Pigtail	15	13.3±5.49	9.46±3.96	0.160
ICD	8	11.6±3.37	9.12±4.22	0.075
<b>Pneumonia</b>				
Pigtail	31	12.2±5.24	9±7.25	0.774
ICD	21	10.47±7.22	9±4.22	0.486
<b>Malignancy</b>				
Pigtail	9	16±7.22	10±5.7	0.151
ICD	4	17±7.63	11.5±7.22	0.298
<b>Others</b>				
Pigtail	2	9.5±0.7	6±1.41	0.833
ICD	2	9.5±0.77	6±1.41	0.833

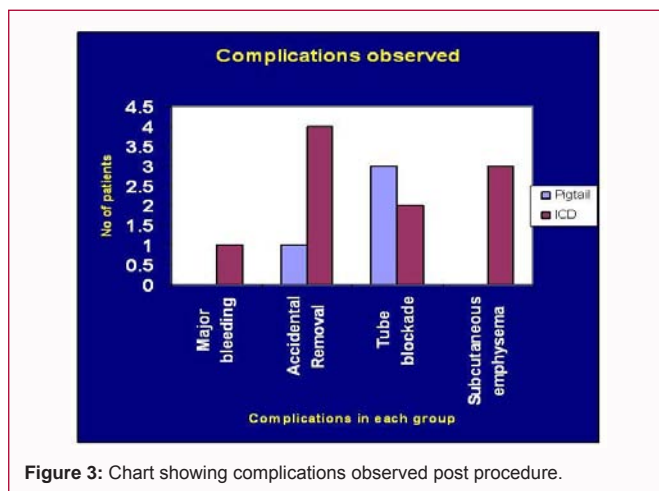


**Figure 2:** Radiological imaging of the patients pre and post pigtail insertion.

assistance, may have significant morbidity. Small-bore chest tubes have become more popular recently because of their effectiveness in a variety of pleural diseases [1-5]. The British Thoracic Society now recommends small-bore chest tubes (10F-14F) for pneumothoraces, parapneumonic effusions, and malignant effusions [17,18]. We compared effectiveness of ICD with pigtail catheter in present study. Pneumonia related effusion was the commonest cause in both groups followed by malignancy and TB. We found that there was no statistically significant difference in duration of hospital stay & time taken for clearance in both the groups. Sixty one percent patients in pigtail group had loculated effusion. Still success rate was higher in pigtail group (94.7%) when compared with ICD group (85.7%). There were no major complication in either group but accidental removal was more common in ICD group. Pigtail catheter caused less pain

**Table 4:** Comparison of present study with other published studies.

Study/year/place	Patients n=	Age y (mean±SD)	Male n= (%)	Duration of hospital stay days (mean±SD)	Time to drainage days (mean±SD)	Success rate %
Adel Salah et al. [18]	51	57.27 ±13.45	29(56.7%)	NA	5.8 ± 2.4	82.4%
Yi-Heng-Liu et al. [15]	276	59.21 ± 18.21	178 (64.5%)	29.23 ± 29.6	6.1 ± 2	72.9%
Sachin Jain et al. [19]	50	NA	NA	3-12	5-7	92%
Présent study 2013 India	57	54.7± 16	47(78.9%)	13±5.7	9.7±5.7	94.7%



**Figure 3:** Chart showing complications observed post procedure.

and allowed good mobility compared to ICD.

We did comparison of our study with previously published Indian and international study. The comparison is shown in (Table 4). It shows that total duration of hospital stay was higher in present study when compared with another Indian study while time to drain was almost similar in all the groups. The success rate in present study was matching with study by Jain *et al* [19], but was higher when compared with studies done in China and Egypt.

The present study had some limitations. It was an observational study conducted in a tertiary care referral centre and may not represent the general population. The study was not randomized and the decision to put pigtail or ICD was solely based on treating clinician’s description. It may have lead to selection bias. Even though, standard of care given to the patients other than ICD and pigtail was similar in both the groups, blinding was not possible considering the nature of the study. The study size was small and large multi center studies are required to extrapolate the results.

**Conclusion**

Pigtail catheters are safe and effective method for drainage of pleural effusion. Time to clearance and total duration of hospital stay was similar in both groups. Pigtail was better tolerated with respect to pain and mobility post procedure. It should be considered as the initial draining method for a variety of pleural diseases in affording patients.

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