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# Comparison between Pigtail Catheter and Intercostal Chest Tube in Drainage of Empyema

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## Abstract

*Background: Pigtail catheters are considered an alternative to conventional intercostal tubes for the drainage of empyema.*

*Aim: To compare the pigtail catheter and intercostal chest tube in the drainage of empyema.*

*Patients and methods: This was a prospective investigation that was carried out at the Chest Department, Al-Azhar University, from January 2023 to December 2023. The research involved a total of forty individuals who were presented with empyema and were diagnosed clinically, radiologically, and by analysis of pleural fluid.*

*Results: There was no statistically significant variance among the two groups concerning age, sex, main complaints (chest pain, dyspnea, fever, and cough), outcome of drainage, the means of the length of drainage of pleural fluid, duration of I.V. antibiotic use, length of hospitalization, and the median total duration of illness, pneumothorax, and dislodged catheter. The average length of time analgesia usage was significantly greater among individuals in group A than those in group B. Chest pain at the site of insertion was significantly complicating the procedure in 55% of patients in group A in contrast to 20% of cases in group B ( $P = 0.048$ ), while blockage of the catheter was significantly complicating the procedure in 35% of patients in group B compared to only 5% of patients in group A ( $P = 0.044$ ).*

*Conclusion: Pigtail catheters are safe and are beneficial alternatives for the evacuation of empyema. There was no significant difference in the outcome, duration of drainage, and time of hospital stay between the pigtail and chest tube groups. Pigtail was better tolerated in terms of pain and mobility after intervention. It can be used as a primary therapeutic option for empyema.*

**Keywords:** Pigtail Catheter; Intercostal Chest Tube; Drainage of Empyema

## 1. Introduction

Utilizing an intercostal tube to evacuate empyema is a crucial therapeutic choice. The placement of an intercostal tube is a medical procedure that carries the risk of complications.<sup>1</sup>

Hazards such as hemothorax, organ damage, diaphragm rupture, pulmonary edema, and Horner's syndrome.<sup>2</sup>

In a trial to prevent such risks, the usage of pigtail catheters as an alternative to conventional intercostal tubes for drainage of empyema has been described.<sup>3</sup>

Some studies suggest that a small-sized catheter is equally effective and less traumatic than a conventional chest tube in managing empyema.<sup>4</sup>

The objective of this research was to compare the pigtail catheter and intercostal chest tube in

the drainage of empyema.

## 2. Patients and methods

This was a prospective investigation carried out at the Chest Department, Al-Azhar University, from January 2023 to December 2023. The investigation involved a cohort of forty cases who exhibited empyema, which was detected using clinical evaluation, radiological imaging, and pleural fluid analysis. The pleural fluid analysis encompassed physical, chemical, and bacteriological investigations.

The patients were separated into 2 groups: Group (A), which involved twenty cases managed by intercostal chest tube insertion for drainage of empyema, and Group (B), which included twenty patients managed by pigtail catheter insertion for drainage of empyema.

Prior to their enrollment in this investigation, every participant provided informed consent.

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All the cases underwent the following: full history-taking, Complete clinical examination, A plain chest X-ray was done before intervention and during admission when needed, and three days after the removal of the catheter, a C.T. chest was done if required to exclude marked location at the time of diagnosis. Laboratory investigations and pleural fluid examination include physical observation of the colour and viscosity of the pleural fluid sample chemical analysis, including LDH and total proteins, to apply light criteria for confirming the exudative nature of effusion<sup>5</sup> and bacteriological examination. A pigtail catheter with a size of 12–16 French was inserted into patients in group B using the modified Seldinger method.

The procedure was as follows: a trocar containing a hollow needle affixed to a syringe was utilized to penetrate the pleura initially; fluid was then aspirated to verify the correct placement. To avoid causing damage to the neurovascular bundle, the catheter was inserted slightly above the inferior rib. Following the removal of the hypodermic, a guide wire was inserted into the needle lumen. During the removal of the needle, the guide wire remained in position, and a dilator was utilized to enlarge the aperture through which the catheter would be inserted. After removing the dilator and unwinding the pigtail, the catheter was inserted into the pleural space via the guide wire. The guide wire was ultimately severed as the distal end of the catheter began to coil within the thoracic cavity. Subsequently, the catheter was linked to a drainage apparatus until the fluid was entirely drained.<sup>6</sup>



Figure 1. Pigtail catheter.

**Statistical Analysis:** It was performed utilizing the SPSS computer package version 25.0 (IBM for Windows, Armonk, NY: IBM Corp., USA). We examined numerical data for normality using the Shapiro-Wilk test. For descriptive statistics, the mean  $\pm$  S.D., median [interquartile range (IQR)], incidence, and percentage were utilized for qualitative variables. A chi-square test or Fisher exact test, an independent sample t-test, and a Mann-Whitney test were utilized. The statistical

techniques were verified, assuming a significant level of p below 0.05.

### 3. Results

*Table 1. demographic data of the examined groups.*

VARIABLE	GROUP A (N = 20)	GROUP B (N = 20)	T-TEST	P-VALUE
AGE(YEARS)			0.69	0.490
MEAN $\pm$ SD	45.5 $\pm$ 10.4	43.1 $\pm$ 10.9		
MIN – MAX	25 – 59	26 – 61		
SEX			FET	
MALE	12 (60.0)	11 (55.0)	0.10	1.000
FEMALE	8(40.0)	9(45.0)		

Values presented as mean  $\pm$  SD were analyzed by an independent sample t-test. Values presented as numbers and percents were analyzed by the Fisher exact test.

It revealed that the average age of group A was 45.5  $\pm$  10.4 years, which varied from 25 to 59 years, and the mean age of group B was 43.1  $\pm$  10.9 years, which varied from 26 to 61 years, with no significant variance among the 2 groups (P = 0.490). And 60% of patients in group A were male, compared to 55% in group B, with no significant variance among the two groups (P = 1.000).

*Table 2. Main complaints of patients of the examined groups.*

COMPLAINTS	GROUP A N = 20 (%)	GROUP B N = 20 (%)	FET	P-VALUE
CHEST PAIN	20 (100.0)	19 (95.0)	1.03	1.000
DYSPNEA	15 (75.0)	13 (65.0)	0.48	0.731
FEVER	18 (90.0)	17 (85.0)	0.23	1.000
COUGH	12 (60.0)	13 (65.0)	0.11	1.000

It showed that the vast majority of patients in both groups were complaining of chest pain and fever, with no significant variance among the two groups (P = 1.000). Dyspnea was experienced by 75% of cases in group A and 65% of cases in group B, while 60% and 65% of patients in both groups suffered from coughs, with no significant variance among both groups (P equals 0.731 and 1.000, respectively).

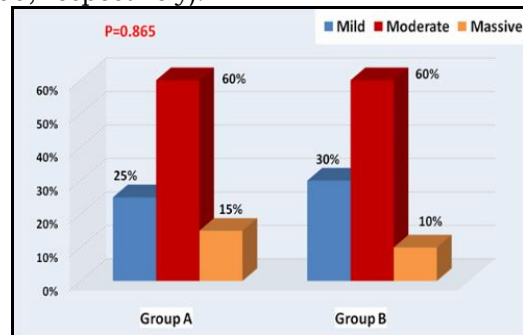


Figure 2. Size of empyema on X-ray chest.

*Table 3. Duration of illness before admission in the studied groups.*

VARIABLE	GROUP A	GROUP B	T-TEST	P-VALUE
DURATION OF ILLNESS(DAYS)			1.22	0.229
MEAN $\pm$ SD	6.1 $\pm$ 1.7	5.4 $\pm$ 1.9		
MIN – MAX	4 – 9	2 – 8		

It revealed that the mean duration of illness before admission in group A was 6.1  $\pm$  1.7, which

ranged from 4 to 9 days, and in group B, it was  $5.4 \pm 1.9$ , which ranged from 2 to 8 days, with no significant variance among both groups ( $P$  equals 0.229).

*Table 4. Outcome of drainage in the examined groups.*

OUTCOME	GROUP A N = 20 (%)	GROUP B N = 20 (%)	FET	P- VALUE
SUCCESSFUL DRAINAGE	17 (85.0)	16 (80.0)	0.17	1.000
FAILED DRAINAGE	3 (15.0)	4 (20.0)		

It showed that the outcome of drainage of pleural fluid was successful in 85% of cases in group A in contrast to 80% in group B, with no significant variance among the two groups ( $P = 1.000$ ).

*Table 5. Other determinants of outcome amongst the examined groups.*

DETERMINANTS OF OUTCOME (DAYS)	GROUP A	GROUP B	T- TEST	P- VALUE
DURATION OF DRAINAGE MEAN $\pm$ SD MIN – MAX	9.2 $\pm$ 3.3 5–13	10.4 $\pm$ 4.1 4–15	1.02	0.314
DURATION OF ANALGESIA USE MEAN $\pm$ SD MIN – MAX	5.9 $\pm$ 1.3 4–8	3.5 $\pm$ 1.1 2–5	6.15	<0.001*
DURATION OF I.V ANTIBIOTICS USE MEAN $\pm$ SD MIN – MAX	9.1 $\pm$ 2.1 6–13	8.8 $\pm$ 2.7 5–14	0.39	0.697
DURATION OF HOSPITAL STAY MEAN $\pm$ SD MIN – MAX	12.4 $\pm$ 4.2 6–17	10.7 $\pm$ 4.1 5–16	1.29	0.203
TOTAL DURATION OF ILLNESS MEDIAN [IQR] MIN – MAX	17 [13– 21] 8–23	15 [11– 19] 9–21	1.52	0.136

Values present as median [IQR] were analyzed by Mann-Whitney U test.

Values present as mean  $\pm$  SD were analyzed by Independent Samples t-test.

It showed that the mean length of analgesia usage was significantly greater among cases in group A than those in group B ( $5.9 \pm 1.3$  vs.  $3.5 \pm 1.1$ ;  $P < 0.001$ ), while the means of the length of drainage of pleural fluid, duration of I.V. antibiotic use, length of hospitalization, and the median total duration of illness did not significantly vary among both groups ( $P$  equals 0.314, 0.697, 0.203, and 0.136, respectively).

*Table 6. Complications of drainage in the examined groups.*

COMPLICATIONS	GROUP A N = 20 (%)	GROUP B N = 20 (%)	FET	P- VALUE
CHEST PAIN AT SITE OF INSERTION	11 (55.0)	4 (20.0)	5.23	0.048*
PNEUMOTHORAX	2 (10.0)	1 (5.0)	0.36	1.000
BLOCKED CATHETER	1 (5.0)	7 (35.0)	5.63	0.044*
DISLODGED CATHETER	1 (5.0)	1 (5.0)	0.00	1.000

\*: Significant.

It showed the complications of drainage in both groups. Chest pain at the site of insertion was significantly complicating the procedure in 55% of patients in group A in contrast to 20% of cases in group B ( $P = 0.048$ ), while blockage of the catheter was significantly complicating the procedure in 35% of patients in group B compared to only 5% of patients in group A ( $P = 0.044$ ). Pneumothorax and dislodged catheters were insignificant complications in both groups, ranging from 5–10%.

#### 4. Discussion

Intercostal tubes serve as the fundamental component in the treatment of pleural effusion and pneumothorax. However, chest tubes, inserted by dissection or trocar, may have potential hazards. Many physicians prefer pigtail catheters because of their effectiveness in many pleural diseases.<sup>7</sup>

BTS recommends small-bore (10–14 F) intercostal tubes for pneumothorax, malignant effusion, and parapneumonic effusion.<sup>8</sup>

Pigtail catheters are significantly less traumatic to implant and leave a substantially smaller residual scar than chest tubes.<sup>9</sup>

In the present study, we compared an intercostal tube with a pigtail catheter in cases of empyema. Age and sex distribution showed no significant difference among cases treated with an intercostal tube and those treated with a pigtail catheter. Also, comorbid conditions, duration of illness before intervention, and size of pleural effusion were similar in the examined groups.

We found that there was no statistically significant variance in the period of drainage, intravenous antibiotic usage duration, and length of hospitalization in both groups. These results are in agreement with an Indian study that was conducted by Asmita AM and his colleagues in 2016. Their study extended to include the role of pigtail catheters in the drainage of both malignant and tuberculous effusions in addition to empyema.<sup>10</sup>

In our study, the outcome showed no statistically significant difference in both groups. Success rates for intercostal tube and pigtail catheter drainage were 85% and 80%, respectively.

Success rates in other research were comparable to our results. Liu YH and his colleagues found that the success rate of the pigtail catheter in empyema was 72.2%.<sup>4</sup>

A more recent study has included both transudative and exudative pleural effusions, one of which was empyema, which stated a success rate of 83%.<sup>11</sup>

On the other hand, our findings disagree with the results of a study conducted by Liang S.J. and his colleagues; they found that the success

rate of ultrasound-guided pigtail catheter drainage of empyema was 42%.<sup>12</sup> The low success rate of their research can be clarified by the fact that it was done on critically ill cases in the ICU.

The duration of usage of analgesics was significantly lesser in the pigtail group than in the chest tube group in the current study. Pigtail catheters do not press on the neurovascular bundle or alter the geometry of the intercostal space, so they cause less pain.<sup>4</sup>

In contrast, chest tubes induce pain through compression of the neurovascular bundle located at the apex of the intercostal space, owing to their excessive size.<sup>1</sup>

Regarding complications of the procedures in both groups, chest pain that required more doses of analgesia was the main complication in patients treated with intercostal tubes.

On the other hand, blockage of the catheter that required repeated washing with normal saline was the main complication in patients treated with a pigtail catheter. These complications were reported in different studies.<sup>9,11,13,14</sup>

#### 4. Conclusion

Pigtail catheters are safe and are beneficial alternatives for the evacuation of empyema. There was no significant difference in the outcome, duration of drainage, and time of hospital stay between the pigtail and chest tube groups. Pigtail was better tolerated in terms of pain and mobility after intervention. It can be used as a primary therapeutic option for empyema.

#### Disclosure

The authors have no financial interest to declare in relation to the content of this article.

#### Authorship

All authors have a substantial contribution to the article

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#### Conflicts of interest

There are no conflicts of interest.

#### References

1. Kesime, EB.; Dongo, A.; Ezemba, N., et al. Tube thoracostomy: complications and its management. *Pulm Med.* 2012; 2012: 256878.
2. Tsai, TH.; Wu, SG; Chang, YL., et al. Effusion immunocytochemistry as an alternative approach for the selection of first-line targeted therapy in advanced lung adenocarcinoma. *J Thorac Oncol.* 2012; 7(6): 993-1000.
3. Hantera, M.; Abdel-Hafiz, H. Chest tube versus pigtail catheter in the management of empyema. *The Egyptian Journal of Chest Diseases and Tuberculosis.* 2019 Jul 1; 68 (3): 390-393.
4. Liu, YH.; Lin, YC.; Liang, SJ., et al. Ultrasound-guided pigtail catheters for drainage of various pleural diseases. *Am J Emerg Med.* 2010; 28 (8): 915-921.
5. Mason, RJ.; Broaddus, VC.; Martin, TR., et al. *Murray and Nadel's textbook of respiratory medicine E-book: 2-volume set.* Elsevier Health Sciences; 2010 Jun 9.
6. Frenidin, J.; Obel, N. Catheter drainage of pleural fluid collections and pneumothorax. *J Small Anim Pract.* 1997; 38 (6): 237-242.
7. Rahman, NM.; Maskell, NA.; Davies, CW., et al. The relationship between chest tube size and clinical outcome in pleural infection. *Chest.* 2010; 137 (3): 536-543.
8. Bediwy, AS.; Amer, HG. Pigtail catheter use for draining pleural effusions of various etiologies. *International Scholarly Research Notices.* 2012; (1), 143295.
9. Pierrepont MJ, Evans A, Morris SJ, Harrison SK, Doull IJ. Pigtail catheter drain in the treatment of empyema thoracis. *Arch Dis Child.* 2002; 87 (4): 331-332.
10. Asmita, A; Mehta, A.; Gupta, AS., et al. Diagnostic utility of adenosine deaminase in exudative pleural effusions. *Lung India.* 2014; 31 (2): 142-144.
11. Jayakrishnan, B.; Kashoob, M.; Al-Sukaiti, R., et al. Percutaneous Ultrasound-guided Pigtail Catheter for Pleural Effusions: Efficacy and Safety. *Oman Med J.* 2021; 36 (2): e248.
12. Liang, SJ.; Tu, CY.; Chen, HJ., et al. Application of ultrasound-guided pigtail catheter for drainage of pleural effusions in the ICU. *Intensive Care Med.* 2009; 35 (2): 350-354.
13. Lin, CH.; Lin, WC.; Chang, JS. Comparison of pigtail catheter with chest tube for drainage of parapneumonic effusion in children. *Pediatr Neonatol.* 2011; 52 (6): 337-341.
14. Maskell, NA.; Medford, A.; Gleeson, FV. Seldinger chest drain insertion: simpler but not necessarily safer. *Thorax.* 2010; 65 (1): 5-6.