

## COMPARISON OF ANTERIOR TUBE THORACOSTOMY AND POSTERIOR TUBE THORACOSTOMY IN THE MANAGEMENT OF HEMOTHORAX

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**Abstract:** *Trauma to the chest occurs through blunt or penetrating injury and may lead to the development of hemothorax, pneumothorax, etc. Management of chest trauma involves surgical treatment such as tube thoracostomy. This study aimed to compare the evacuation of hemothorax after chest trauma by anteriorly and posteriorly placed chest tubes in terms of the requirement of any further invasive surgical intervention. One hundred thirty-two patients who fulfilled the inclusion criteria were enrolled and divided into two groups of equal number, i.e., 66 each. Patients in group A underwent anterior tube thoracostomy, and group B underwent posterior tube thoracostomy. All patients after the 7th post-op day of chest intubation had a chest x-ray and ultrasonography of the chest. Patients who had retained clotted hemothorax underwent further invasive surgical intervention. The mean age of the patients, duration of trauma, and duration of stay in the hospital in anterior vs. posterior thoracotomy were  $35.48 \pm 10.34$ ,  $12.54 \pm 5.79$  and  $13.58 \pm 6.55$  and  $37.42 \pm 9.68$ ,  $14 \pm 6.27$  and  $9.45 \pm 3.4$ , respectively. 48.5% of patients needed secondary intervention in Group A, whereas 9% needed it in Group B. Comparison of both groups was done by Chi-square test, and a p-value of 0.000 was obtained. Posterior intubation was more effective compared to anterior tube thoracostomy in preventing the patient from further surgical intervention.*

**Keywords:** Chest Wall Trauma, Hemothorax, Tube Thoracostomy.

### Introduction

Chest trauma accounts for 57% of all thoracic injuries. Chest trauma is of two types (1) Blunt chest trauma (Trauma with no apparent breach of the chest wall) and (2) Penetrating chest trauma (Trauma with a breach of the chest wall). Blunt chest trauma is associated with a high risk of morbidity and mortality (Manay et al., 2017). Rib fractures constitute a major part of blunt chest trauma, about 33.3% (Veysi et al., 2009), and each additional rib fracture is associated with an increasing likelihood of developing complications (Chien et al., 2017; Dunham et al., 2015). It may cause pulmonary contusion (Nasr-Esfahani et al., 2019), flail chest, hemopneumothorax, myocardial contusion, etc. Penetrating chest trauma may cause hemothorax, pneumothorax, lung lacerations, etc. If required, management of chest trauma focuses on a combination of effective analgesia, chest physiotherapy, respiratory care, early mobilization, and surgical intervention like chest tube thoracostomy and thoracotomy (Gage et al., 2014; Huang et al., 2018).

In selected Pneumothorax or Hemothorax (HTx) cases, chest intubation (Tube Thoracostomy) is required to drain the pleural cavity and ensure lung expansion to its pre-injury state. If chest radiography

shows that a hemothorax is large enough to obscure the costo-phrenic sulcus or is associated with a pneumothorax, it should be drained by tube thoracostomy (Alsofi et al., 2019; Latif et al., 2018; Nasr-Esfahani et al., 2019).

An anterior chest tube may drain free fluid (blood) in the pleural cavity, at least during the early phase of trauma, when fluid surrounds the lung. However, entrapment of the chest tube between the anterior surface of the lung and the chest wall may happen, which may fail an anteriorly placed chest tube in draining blood gravitating posterior to the lung and the dependent part of the pleural cavity, which may require posterior placement of chest tube subsequently or placement of chest tube posteriorly at time of first presentation after trauma to drain the hemothorax completely even from gravitating and dependent part of the pleural cavity (Matsumoto et al., 2015).

Retained HTx may necessitate further surgical intervention (Tube adjustment, Reintubation, Thoracotomy, or VATS) for definitive management. This study aims to compare the evacuation of hemothorax after chest trauma by anteriorly and posteriorly placed chest tubes in terms of the

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requirement of any further invasive surgical intervention.

**Methodology**

This study was conducted from January 2020 to December 2022 with a sample size of 132 patients (66 patients in each group) estimated by using a 5% level of significance, 95% power of test with expected % age posterior insertion as 43% and anterior insertion as 6%.11 Probability simple random sampling method was used for sampling the data. Patients between 15-70 years of age of either gender, isolated chest trauma with hemothorax on chest Xray PA view presenting as obscured costophrenic sulcus and duration of injury and presentation to hospital <24 Hours were the inclusion criteria, whereas the patients requiring Emergency thoracotomy for damage control like (bleeding >1500ml in 24 Hour or > 200ml in initial 4-6Hour, Injuries to Visceral compartment of mediastinum), already having clotted hemothorax, documented on USG chest, coagulopathy documented on Pt, APTT, INR >1.5. And patients with other co-morbidities like Tuberculosis, COPD, and Asthma were excluded from the study. Informed consent was taken before the study. Patients were recruited from the Thoracic Surgery Department

and Accident & Emergency Department, KEMU/Mayo Hospital Lahore. Baselines for hematological and radiological investigations necessary for this patient to meet the inclusion and exclusion criteria were done. Patients with inclusion criteria fulfilled were intubated anteriorly or posteriorly, which will be selected by lottery after proper consent and documentation.

The chest tube was taken out after 7 days of intubation when the lung was clinically expanded, and complete evacuation of hemothorax was documented on CXR and Ultrasound chest, and subsequently, patients were discharged. Patients having retained clotted hemothorax were planned for further invasive surgical intervention.

**Results**

The study enrolled 132 participants. The mean age of the patients, the mean duration of trauma, and the mean duration of stay in the hospital in the anterior thoracostomy group were 35.48±10.34 years, 12.54±5.79 hours, and 13.58±6.55 days, respectively, and in the posterior thoracostomy group it was 37.42±9.68, 14±6.27 and 9.45±3.4, respectively (table 1).

**Table 1: Means of Quantitative Variables**

Groups	N	Data	Age (years)	Duration of Trauma (hours)	Duration of Stay in Hospital (days)
Anterior tube thoracostomy	66	Mean±Standard deviation	35.48±10.34	12.54±5.79	13.58±6.55
Posterior tube thoracostomy	66	Mean±Standard deviation	37.42±9.68	14±6.27	9.45±3.4

A comparison of both groups was made by Chi-square test, and the need for intervention in Posterior tube thoracostomy was found to be significantly low with a p-value of 0.0001

compared to anterior tube thoracostomy, as depicted in Table 2.

**Table 2: Comparison between Both Groups in Terms of Need for Secondary Intervention**

Need for Secondary Intervention	Group		Total	P Value
	A	B		
Yes	32 (48.5%)	6 (9%)	38 (57.5%)	0.0001
No	1 (1.5%)	27 (41%)	28 (42.5%)	
Total	33 (50%)	33 (50%)	66 (100%)	

**Discussion**

The current study results revealed that 48.5% of patients needed secondary intervention in patients

who underwent anterior chest tube placement, whereas 9% of patients with posterior chest tube placement needed secondary intervention. Comparison of both groups revealed a statistically

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significant difference, as indicated by a p-value of 0.000. Thus, posterior chest tube placement was better in managing hemothorax patients because it drained blood completely in most patients that gravitated posterior to the lung and the dependent part of the pleural cavity.

The ATLS guidelines proposed that in primary care, chest tube insertion should be done posteriorly along the side of the chest wall. A posteriorly placed chest tube is utilized in monitoring hemothorax volume. However, tubes placed posteriorly have the potential to act as drains that are non-functional for evacuating pneumothoraces, and additional chest tubes may be needed. Hence, inserting the tubes in the chest wall posteriorly is not mandatory.

Over the years, tube thoracostomy has been considered a standard treatment for treating hemothorax caused by blunt and penetrating chest trauma (Rahimi-Movaghar et al., 2016).

Early proactive care in the form of adequate evacuation of fluid in the pleura by thoracostomy or thoracotomy to reduce morbidity is the key to managing acute hemothorax successfully (Zhu et al., 2018). Retained hemothorax after a traumatic injury increases the duration of stay and total cost of hospital and is a leading source of morbidity in trauma patients. Patients with retained hemothorax are 12 to 16 times more likely to develop post-traumatic empyema (Navsaria et al., 2004). The actual rate of retained hemothorax in trauma patients who get a chest tube thoracostomy is unknown. According to epidemiological research, it occurs in between 4 and 20% of all chest tube insertions after trauma (Rezende-Neto et al., 2012). There are disagreements over what constitutes a retained hemothorax, such as the lack of a widely accepted definition.

It was revealed by Aho et al. that the complications, including the inability to complete evacuation, development of clotted hemothorax, or conversion into empyema, were mainly related to the positioning of tube thoracostomy (Hernandez et al., 2018).

The current study also determined that a posteriorly placed chest tube was associated with less requirement of secondary intervention (such as reintubation of chest tube, thoracentesis, VATS, and decortication). It also revealed that the position of the chest tube was very important in determining an additional intervention and that the posteriorly placed chest tube was associated with better outcomes than the anteriorly placed chest tube.

## Conclusion

Based on the results, the posterior intubation was more effective compared to anterior tube thoracostomy in preventing the patient from further surgical intervention.

## Conflict of interest

The authors declared the absence of a conflict of interest.

## References

- Alsofi, R. S. A. A., Attash, S. M., and mothafar Hammodat, O. (2019). Management of Traumatic Hemothorax a Retrospective Study of 165 Cases in AL-Jamhoori Teaching Hospital in Mosul. *Iraqi Postgraduate Medical Journal* **18**.
- Chien, C.-Y., Chen, Y.-H., Han, S.-T., Blaney, G. N., Huang, T.-S., and Chen, K.-F. (2017). The number of displaced rib fractures is more predictive for complications in chest trauma patients. *Scandinavian journal of trauma, resuscitation and emergency medicine* **25**, 1-10.
- Dunham, C. M., Hileman, B. M., Ransom, K. J., and Malik, R. J. (2015). Trauma patient adverse outcomes are independently associated with rib cage fracture burden and severity of lung, head, and abdominal injuries. *International Journal of Burns and Trauma* **5**, 46.
- Gage, A., Rivara, F., Wang, J., Jurkovich, G. J., and Arbabi, S. (2014). The effect of epidural placement in patients after blunt thoracic trauma. *Journal of Trauma and Acute Care Surgery* **76**, 39-46.
- Hernandez, M. C., El Khatib, M., Prokop, L., Zielinski, M. D., and Aho, J. M. (2018). Complications in tube thoracostomy: systematic review and meta-analysis. *The journal of trauma and acute care surgery* **85**, 410.
- Huang, F.-D., Yeh, W.-B., Chen, S.-S., Liu, Y.-Y., Lu, I.-Y., Chou, Y.-P., and Wu, T.-C. (2018). Early management of retained hemothorax in blunt head and chest trauma. *World journal of surgery* **42**, 2061-2066.
- Latif, A., Choudry, Z. A., and Ghaffar, J. (2018). Management of Chest Trauma in Allama Iqbal Memorial Teaching Hospital, Sialkot. *Age* **4**, 74.
- Manay, P., Satoskar, R. R., Karthik, V., and Prajapati, R. P. (2017). Studying morbidity and predicting mortality in patients with blunt chest trauma using a novel clinical score. *Journal of Emergencies, Trauma, and Shock* **10**, 128.
- Matsumoto, S., Sekine, K., Funabiki, T., Yamazaki, M., Orita, T., Shimizu, M., Hayashida, K., Kishikawa, M., and Kitano, M. (2015). Chest tube insertion direction: is it always necessary to insert a chest tube posteriorly in

- primary trauma care? *The American Journal of Emergency Medicine* **33**, 88-91.
- Nasr-Esfahani, M., Boroumand, A. B., and Kolahdouzan, M. (2019). Early intubation vs. supportive care in management of severe blunt chest trauma; a randomized trial study. *Archives of academic emergency medicine* **7**.
- Navsaria, P. H., Vogel, R. J., and Nicol, A. J. (2004). Thoracoscopic evacuation of retained posttraumatic hemothorax. *The Annals of thoracic surgery* **78**, 282-285.
- Rahimi-Movaghar, V., Yousefifard, M., Ghelichkhani, P., Baikpour, M., Tafakhori, A., Asady, H., Faridaalae, G., Hosseini, M., and Safari, S. (2016). Application of ultrasonography and radiography in detection of hemothorax; a systematic review and meta-analysis. *Emergency* **4**, 116.
- Rezende-Neto, J. B. d., Pastore Neto, M., Hirano, E. S., Rizoli, S., Nascimento Jr, B., and Fraga, G. P. (2012). Management of retained hemothoraces after chest tube thoracostomy for trauma. *Revista do Colegio Brasileiro de Cirurgioes* **39**, 344-349.
- Veysi, V. T., Nikolaou, V. S., Paliobeis, C., Efstathopoulos, N., and Giannoudis, P. V. (2009). Prevalence of chest trauma, associated injuries and mortality: a level I trauma centre experience. *International orthopaedics* **33**, 1425-1433.
- Zhu, M., Li, Y., and Wang, Y. (2018). Design and experiment verification of a novel analysis framework for recognition of driver injury patterns: From a multi-class classification perspective. *Accident Analysis & Prevention* **120**, 152-164.



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