

Association Between Chest Tube Size and Complication Rates in Trauma Patients

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Introduction

- Chest tubes are among the most commonly performed hospital procedures to evacuate/monitor hemothorax, prevent tension pneumothorax, re-expand the lung, and relieve pressure in the pleural space.
- Common indications: trauma and postoperative needs or other causes of pleural air/fluid accumulation (e.g., malignancy).
- Risks of injury and infection due to the proximity of vital structures: lung, heart, diaphragm, phrenic nerve, thoracic duct, major vessels.
- Complication rates may be influenced more by tube size and insertion technique than by the exact placement location.

Aims and Objectives

- Goal: Evaluate how chest tube size, in the context of trauma injury severity, affects complication rates (infection, LOS/ICU stay, bleeding, organ injury, need for additional tubes).
- Prior research exists, but often examines only limited variables, uses models instead of patient data, or does not account for how injury severity influences tube size selection.
- This project focuses on a specific component of a larger retrospective study on chest tube complications in trauma patients at Corewell Health Royal Oak.

Methods

- Retrospective study at CHWBUH using trauma patients ≥18 years old from Jan 1, 2011–Dec 1, 2022.
- Data sources: ACS TQIP, Royal Oak trauma database and Epic EMR
- Variables: Revised Trauma Score, comorbidities, mechanism of injury, provider training level, hospital length of stay, and complications.
- Analysis supported by an OUWB Research Institute biostatistician.
- Patients divided into two main groups:
 - Single chest tube**
 - Multiple chest tubes**
- Single-tube group further subdivided by tube size
- Multi-tube group analyzed separately for complication patterns.

Figure 1: Study Population Demographics.

Characteristic	Total (N = 481)	Single-Tube Group (n = 422)	Multiple-Tube Group (n = 25)
Patients identified	1,000	—	—
Age	≥18 years (adults)	≥18 years	≥18 years
Sex	Male & Female	Male & Female	Male & Female
Group assignment	—	Chest tube placed once	Required multiple chest tubes
Tube size stratification	—	Stratified by tube size, including pigtails	—
Outcomes assessed	Complications and clinical outcomes	By tube size (pigtails → large bore)	Overall complications

Results

Figure 2: Complications Associated with Chest Tube Size in Trauma Patients

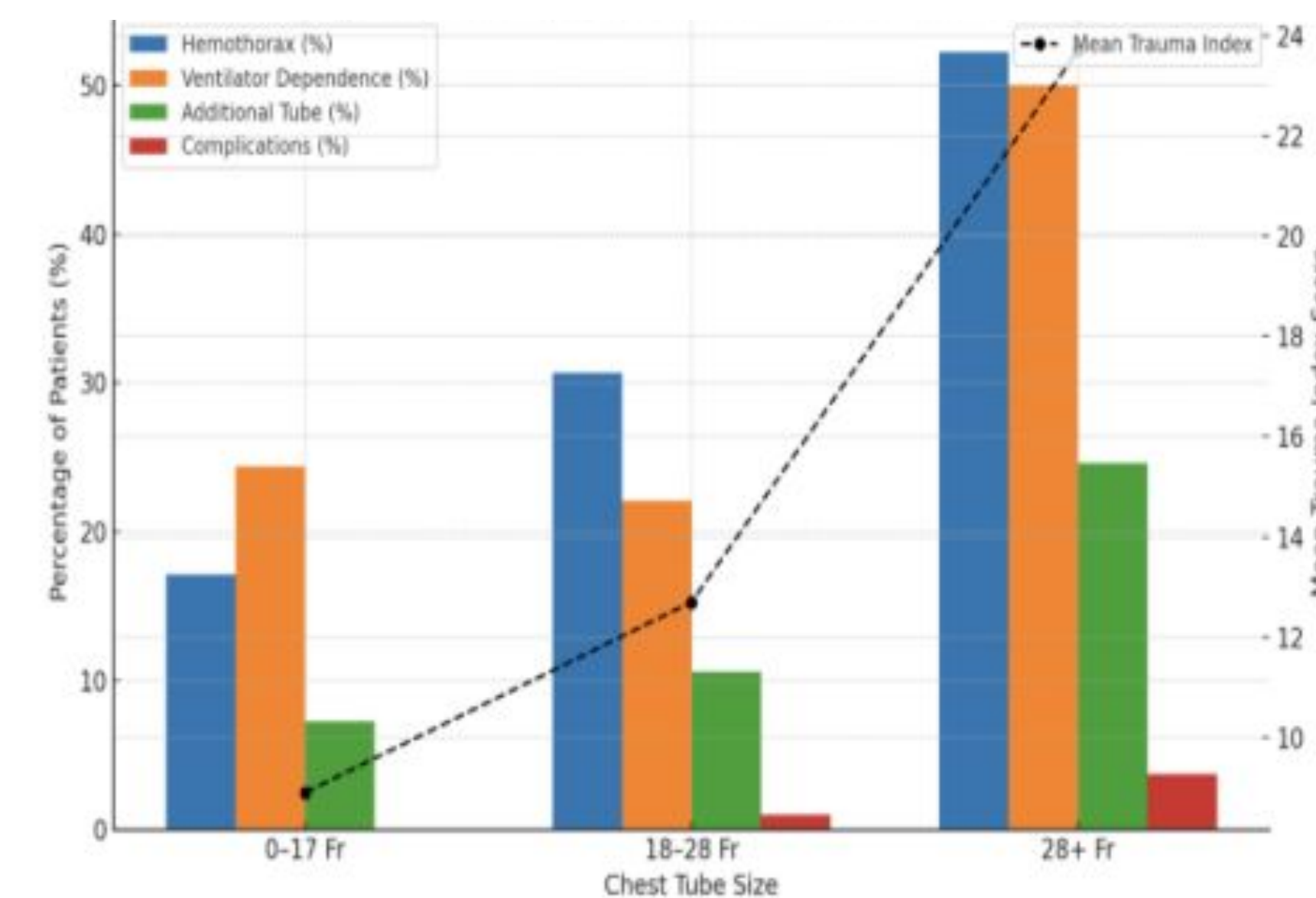


Figure 3: Summary of Complications Associated with Chest Tube Size (Fr)

Small (0–17 Fr / Pigtails)	Older, less severe trauma; low complications & escalation
Medium (18–28 Fr)	Moderate trauma severity; stable outcomes; slight increase in additional tubes
Large (28+ Fr)	Severest trauma; highest ventilator dependence & additional tube needs
Overall Trend	Larger tubes → more severe trauma & interventions

- Smallest tubes were placed primarily in older patients with more comorbidities, lower trauma severity, and elective or semi-urgent indications.
- Medium tubes were used most often for rib fractures and moderate trauma severity.
- Largest tubes were placed in younger patients with higher trauma severity, hemothorax, and emergent indications, often associated with longer hospital stays and increased ventilator dependence.
- Complications were rare across all tube sizes, though larger tubes showed a slightly higher need for additional tubes and ventilator support.

Conclusions

CHEST TUBE SIZE & OUTCOMES IN TRAUMA PATIENTS

TUBE SIZE SELECTION FACTORS

Patient Characteristics

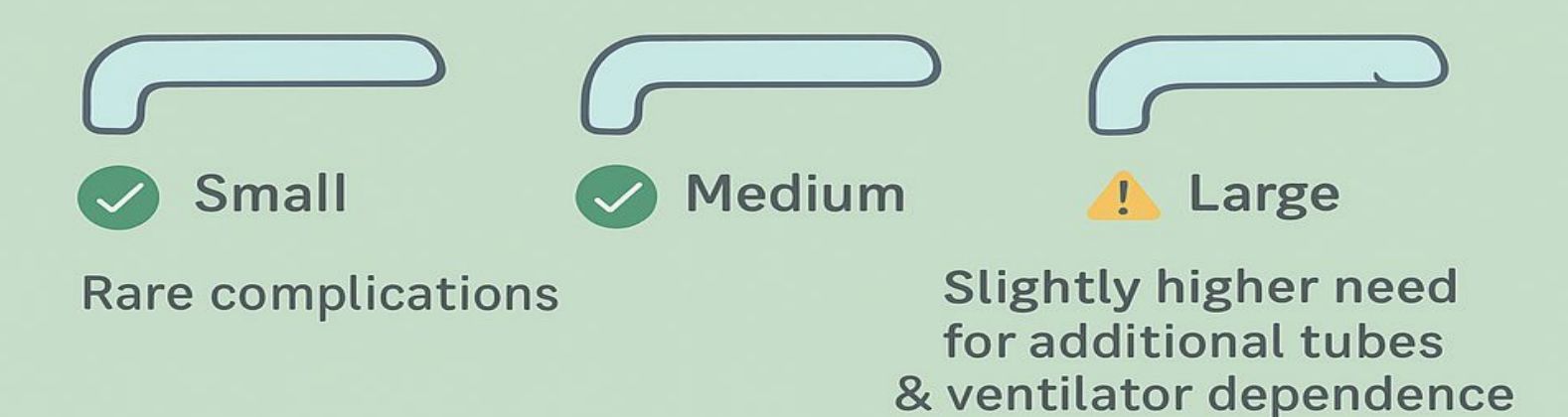


Injury Severity



Tube size is influenced by both patient factors and injury severity

COMPLICATIONS BY TUBE SIZE



KEY TAKEAWAYS

- Tube size is tailored to patient and injury characteristics
- Safety: Low complication rates overall
- Larger tubes → more likely to need extra interventions

References

- Stawicki StanislawPA, Kwiatt M, Tarbox A, et al. Thoracostomy tubes: A comprehensive review of complications and related topics. *International Journal of Critical Illness and Injury Science*. 2014;4(2):142.
- Revised Trauma Score. MDCalc. Accessed June 5, 2023. <https://www.mdcalc.com/calc/683/revised-trauma-score>
- Moran ME, Nash JE. Revised Trauma Scale. PubMed. Published 2022. <https://www.ncbi.nlm.nih.gov/books/NBK556036/>
- Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A Revision of the Trauma Score. *Journal of Trauma and Acute Care Surgery*. 1989;29(5):623-629. Accessed July 22, 2022. https://journals.lww.com/jtrauma/abstract/1989/05000/a_revision_of_the_trauma_score.17.aspx
- Jeong JH, Park YJ, Kim DH, et al. The new trauma score (NTS): a modification of the revised trauma score for better trauma mortality prediction. *BMC Surgery*. 2017;17(1).
- Menger R, Telford G, Kim P, et al. Complications following thoracic trauma managed with tube thoracostomy. *Injury*. 2012;43(1):46-50. doi:<https://doi.org/10.1016/j.injury.2011.06.420>
- Chen RB, Hu H, Matro E. Transcatheter arterial embolization for intercostal arterial bleeding in a patient after chest tube insertion. *Journal of thoracic disease*. 2015;7(7):E194-7.
- Coulter TD, Maurer JR, Miller MT, Mehta AC. Chest wall arteriovenous fistula: an unusual complication after chest tube placement. *The Annals of Thoracic Surgery*. 1999;67(3):849-850.
- Benns MV, Egger ME, Harbrecht BG, et al. Does chest tube location matter? An analysis of chest tube position and the need for secondary interventions. *Journal of Trauma and Acute Care Surgery*. 2015;78(2):386-390.
- Rishi. Catheter Sizing - French Versus Gauge. RK.MD. Published June 6, 2018. Accessed June 5, 2023. <https://rk.md/2018/catheter-sizing-french-versus-gauge/>

Acknowledgements

Oakland University William Beaumont School of Medicine
Corewell Health William Beaumont University Hospital
MQTIP Database
American College of Surgery