Open Access

Original Article

Incidence of Neuralgia in Post-Thoracotomy Patients at the Department of Thoracic Surgery of a Tertiary Care Hospital: A Cross-Sectional Study

Ali Zaman Khan, Farhan Ahmed Majeed, Adeel Wyne, Muhib Ullah, Adnan Younis Panni, Fazila Khan

Department of Thoracic Surgery, Combined Military Hospital/National University of Medical Sciences (NUMS), Rawalpindi Pakistan

ABSTRACT

Objective: To determine the incidence, characteristics, and associated factors of Post-thoracotomy neuralgia (PTN).
Study Design: Cross-Sectional Study.
Place and Duration of study: Department of Thoracic Surgery, Combined Military Hospital, Rawalpindi Pakistan, from Sep 2024 to Sep 2025.
Methodology: A total of 336 consecutive adult patients undergoing thoracotomy were evaluated at 1-, 3-, and 6-month post-procedure. The primary outcome measured was Post-thoracotomy neuralgia (PTN). Parametric and multivariable logistic regression analyses was used to analyze the data.
Results: Among 336 patients (mean age 39.2±15.4 years; 248(73.8%) male), PTN was observed in 234(69.6%) patients. Pricking pain subtype was reported in 168 PTN patients (71.8%). Severity improved over time: no pain was reported by 100(42.9%) patients at 3 months and 159(67.9%) patients at 6 months; severe pain was absent at both 3 and 6 months. Post-operative altered sensation was reported by 155(66.1%); predominantly hypoesthesia 129(83.3%), mainly at the anterior lower chest 97(75.0%).
Conclusions: We found that PTN occurs in a significant proportion of patients following thoracotomy. Female gender and larger incisions were identified as independent factors associated with a higher risk of PTN.

Keywords: Chronic Pain, Neuralgia, Pain Management, Thoracotomy, Treatment Outcome.

How to Cite This Article: *Khan AZ, Majeed FA, Wyne A, Ullah M, Panni AY, Khan F. Incidence of Neuralgia in Post-Thoracotomy Patients at the Department of Thoracic Surgery of a Tertiary Care Hospital: A Cross-Sectional Study. Pak Armed Forces Med J 2025; 76(Suppl-1): S314-S318. DOI: https://doi.org/10.51253/pafmj.v76iSUPPL-1.13934*

INTRODUCTION

Post-thoracotomy neuralgia (PTN) is one of the most common and debilitating chronic pain conditions seen in thoracic surgery.[1] It has been reported that 30–50% of patients who undergo thoracotomy develop chronic pain, with a significant proportion experiencing neuropathic symptoms.[1-3] It has been emphasized that PTN is one of the most common chronic post-surgical pain syndromes. Nearly half of the patients continued to experience neuropathic pain 6–12 months after thoracotomy.[4-6] These findings are especially troubling because thoracotomy is often performed for conditions like lung cancer, trauma, and oesophagal disease, where long-term survival is possible, but quality of life may be compromised by pain.

The mechanisms underlying PTN are multifactorial. Direct injury to intercostal nerves during rib retraction or fracture is the primary cause, supplemented by inflammation, ischemia, and scar tissue formation.[7] Central sensitization and psychosocial factors further influence pain persistence. Despite advances in anaesthesia and multimodal analgesia, preventive measures are still inadequate, leaving many patients at risk of developing chronic pain.[8]

While PTN has been extensively studied in Western populations.[1,5,7] There is a significant lack of data from South Asia, particularly Pakistan. Pain perception and reporting are shaped by cultural norms; in Pakistan, stoicism and underreporting may hide the true prevalence. Additionally, limited access to advanced pain medications, rehabilitation programs, and chronic pain specialists likely leads to underestimated and poorly managed issues. Existing local research on thoracic surgery mainly focuses on short-term outcomes like complications and mortality, without addressing long-term pain effects. Therefore, the current study was conducted to evaluate the incidence, characteristics, and associated factors of PTN.

METHODOLOGY

This was a cross-sectional study conducted at the Department of Thoracic Surgery at Combined Military Hospital, Rawalpindi Pakistan, over a period of one year from Sep 2024 to Sep 2025 after its protocol was

Correspondence: Dr Ali Zaman Khan, Department of Thoracic Surgery, Combined Military Hospital, Rawalpindi Pakistan
Received: 24 Oct 2025; revision received: 07 Jan 2026; accepted: 13 Jan 2026

reviewed and approved by the Institutional Review Board/Ethical Committee of CMH Rawalpindi (Approval No. 710, dated 17 Sep 2024).

Inclusion Criteria: Patients of either gender aged 14 years or older, undergoing thoracotomy for any indication (e.g., lung cancer, trauma, oesophageal disease) were included.

Exclusion Criteria: Patients with a history of prior thoracotomy or other major thoracic surgeries, any pre-existing chronic pain syndromes (e.g., fibromyalgia, chronic back pain) or any severe cognitive impairments or psychiatric illness that limited reliable reporting were excluded.

Sample size was calculated via OpenEpi calculator based on WHO sample size calculator, taking confidence interval of 95%, margin of error 5%, and an estimated PTN prevalence of 30% based on prior studies.[11,12] The estimated sample size came out to be 322 participants.

Written informed consent was obtained from all participants before data collection, which was done using non-probability consecutive sampling. Confidentiality was protected by anonymizing patient identifiers, and data was stored securely with restricted access. Patient flow can be seen in Figure.

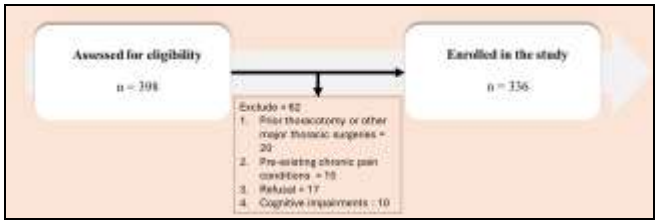

Figure: Patient Flow Diagram

All thoracotomies were performed by consultant thoracic surgeons following institutional protocols. The choice of surgical approach depended on the underlying indication (e.g., lung resection, trauma repair, esophageal surgery). The most common technique included posterolateral thoracotomy, with or without muscle-sparing modifications. Rib spreading or resection was performed as needed to ensure adequate exposure. Intraoperative and perioperative pain management adhered to standard institutional practices, including general anesthesia combined with multimodal analgesia; epidural analgesia was used when clinically indicated. The type of thoracotomy used was documented for each patient and analyzed as a potential predictor of post-thoracotomy neuralgia.

The primary outcome was PTN, defined beforehand as pain lasting at least 3 months after thoracotomy with neuropathic features (such as pricking, burning, tingling) reported on the study questionnaire. PTN status was recorded as Yes or No at or beyond the 3-month assessment.

Pain intensity at 1, 3, and 6 months was measured using a 0–10 numeric rating scale (NRS) (0 = no pain, 10 = worst imaginable). For reporting and figures, NRS was grouped into categories: No pain = 0, Mild = 1–3, Moderate = 4–7, Severe = 8–10. Pain character and sensory disturbance. Among participants experiencing pain, the character (pricking, burning, tingling) and post-operative altered sensation (presence or absence, type—hypoesthesia or hyperesthesia—and location: anterior lower chest; hypochondrium; both) were recorded using structured response options.

Data was gathered using a structured questionnaire, which included patient demographics, surgical details, and pain assessments, which was conducted by trained research assistants under supervision. All questionnaires were reviewed for completeness and consistency.

Continuous variables are presented as Mean±SD, while categorical variables are shown as frequency and percentages. Between-group comparisons (PTN vs. no-PTN) employed independent samples t-test for continuous variables and χ^2 or Fisher's exact test (if cell count is less than 5) for categorical variables. The analysis was conducted using R statistical software (4.4.2).

RESULTS

A total of 336 patients undergoing thoracotomy were studied (mean age 39.2±15.4 years; 248(73.8%) male). The rate PTN was 69.6% (234/336); 95% CI 64.5–74.3. There was no significant age difference between groups (39.4±14.0 vs 38.9±18.3 years, PTN vs no-PTN). Gender distribution showed a non-significant trend (female 29.5% vs 18.6%, p=0.10). Overall, comorbidity patterns differed significantly (p<0.001): hypertension (3.0% vs 5.9%) and COPD (6.0% vs 13.7%) were more frequent among patients with no PTN, whereas diabetes-tuberculosis overlap was observed only in PTN cases (5.1% vs 0.0%). Tuber-culosis (TB) alone remained common in both groups (14.5% vs 17.6%). The distribution of diagnoses also differed significantly (p=0.002), with bronchiectasis predominating among PTN cases (41.9% vs 5.9%), while Aspergilloma lung (11.8% vs 5.1%) and diaphragmatic hernia (5.9% vs 0.4%) were more

frequent in the no-PTN group. The details can be seen in Table-I.

Table-I: Demographic and Clinical Characteristics overall and by Post Thoracotomy Neuralgia Status (n=336)

Characteristic	Overall n=336	Post Thoracotomy Neuralgia		*p*-value
		Present n=234	Absent n=102	
Age (years), Mean±SD	39.24±15.43	39.39±14.04	38.90±18.28	
Gender				0.10
Male	248(73.8)	165(70.5)	83(81.4)	
Female	88(26.2)	69(29.5)	19(18.6)	
Co-morbidities				<0.001
None	210(62.5)	149(63.7)	61(59.8)	
Tuberculosis	52(15.5)	34(14.5)	18(17.6)	
Hypertension	13(3.9)	7(3.0)	6(5.9)	
COPD	28(8.3)	14(6.0)	14(13.7)	
Diabetes mellitus (DM)	14(4.2)	7(3.0)	7(6.9)	
Diabetes + Hypertension	35(10.4)	23(9.8)	12(11.8)	
DM + Tuberculosis	12(3.6)	12(5.1)	0(0.0)	
DM + IHD (Ischemic Heart Disease)	6(1.8)	6(2.6)	0(0.0)	
COPD + IHD + Stroke	6(1.8)	6(2.6)	0(0.0)	
Diagnosis				0.002
Aspergilloma Lung	24(7.1)	12(5.1)	12(11.8)	
Bronchiectasis	55(16.4)	49(20.9)	6(5.9)	
Bullous Lung Disease	2(0.6)	2(0.9)	0(0.0)	
Carcinoma (CA) lung	36(10.7)	24(10.3)	12(11.8)	
Diaphragmatic Hernia	6(1.8)	1(0.4)	6(5.9)	
Empyema Thoracis	154(45.8)	106(45.3)	48(47.1)	
Esophageal Perforation	2(0.6)	2(0.9)	0(0.0)	
Foreign body Bronchus	2(0.6)	1(0.4)	1(1.0)	
Lung Hydatid Cyst Disease	15(4.5)	3(1.3)	12(11.8)	
Paraspinal Mass	12(3.6)	12(5.1)	0(0.0)	
Post-TB destroyed lung	10(3.0)	10(4.3)	0(0.0)	
Ruptured Lung Hydatid Cyst	6(1.8)	6(2.6)	0(0.0)	
Thymoma	1(0.3)	1(0.4)	0(0.0)	
Neuroendocrine tumor	11(3.3)	6(2.6)	5(4.9)	
Indication of Thoracotomy				0.05
Bronchotomy	2(0.6)	1(0.4)	1(1.0)	
Bullectomy	2(0.6)	2(0.9)	0(0.0)	
Decortication	154(45.8)	106(45.3)	48(47.1)	
Esophageal Repair	2(0.6)	2(0.9)	0(0.0)	
Diaphragmatic Hernia Mesh Repair	6(1.8)	1(0.4)	5(4.9)	
Lobectomy	115(34.2)	80(34.2)	35(34.3)	
Mass Excision	12(3.6)	12(5.1)	0(0.0)	
Partial Cystectomy + Capitonnage	21(6.3)	9(3.8)	12(11.8)	
Pneumonectomy	16(4.8)	16(6.8)	0(0.0)	
Right Lower Bilobectomy	5(1.5)	5(2.1)	0(0.0)	
Thymectomy	1(0.3)	1(0.4)	0(0.0)	

**COPD: Chronic Obstructive Pulmonary Disease, Diabetes mellitus: DM. Data are presented as Mean±SD for continuous variables and n(%) for categorical variables*

Laterality (right 65.4% vs 58.8%) was not associated with PTN (p=0.25). The type of thoracotomy was related to PTN (p<0.001): mini-thoracotomy cases were few (n=6) and had 0% PTN, while serratus-sparing and standard posterolateral approaches showed high PTN rates, reflecting the overall case mix. Incision size was associated with PTN (p<0.001), with larger incisions being more common among PTN cases. Rib resection was strongly connected to PTN (97.4% vs. 76.5% having rib resection in PTN versus no-PTN, p<0.001). The details are shown in Table-II.

Table-II: Operative characteristics overall and by Post Thoracotomy Neuralgia status (n=336)

	Overall n=336	Post Thoracotomy Neuralgia		*p*-value
		Present n=234	Absent n=102	
Side of Thoracotomy				0.25
Right	213(63.4)	153(65.4)	60(58.8)	
Left	123(36.6)	81(34.6)	42(41.2)	
Type of Thoracotomy				<0.001
Mini Thoracotomy	6(1.8)	0(0.0)	6(5.9)	
Serratus sparing posterolateral thoracotomy	282(83.9)	198(84.6)	84(82.4)	
Standard posterolateral thoracotomy	48(14.3)	36(15.4)	12(11.8)	
Size of Incision (cm)				<0.001
3-5	6(1.8)	0(0.0)	6(5.9)	
5-7	6(1.8)	6(2.6)	0(0.0)	
7-10	35(10.4)	17(7.3)	18(17.6)	
10-15	104(31.0)	85(36.3)	19(18.6)	
15-20	121(36.0)	79(33.8)	42(41.2)	
20-25	46(13.7)	35(15.0)	11(10.8)	
>25	18(5.4)	12(5.1)	6(5.9)	
Rib Resection				<0.001
Yes	306(91.1)	228(97.4)	78(76.5)	
No	30(8.9)	6(2.6)	24(23.5)	

Table-III :Pain Phenotype, Severity over time and Sensory Disturbance

Pain characteristics (n=234)	
Pricking	168(71.8%)
Burning	48(20.5%)
Tingling	18(7.7%)
Pain Severity over a Time	
Severity at 1 month	
No pain	74(31.6%)
Mild	34(14.5%)
Moderate	102(43.6%)
Severe	24(10.3%)
Severity at 3 months	
No pain	99(42.3%)
Mild	64(27.4%)
Moderate	71(30.3%)
Severe	0(0)
Severity at 6 months	
No pain	156(66.7%)
Mild	57(24.4%)
Moderate	21(8.9%)
Severe	0(0)
Post-operative altered sensation (n=336)	
Yes	221(66.1%)
No	115(33.9%)
Type of altered sensations	
Hypoesthesia	180(83.3%)
Hyperesthesia	36(16.7%)
Site of altered sensation (n=216)	
Anterior lower chest;	168(78%)
Hypochondrium	42(19.4%)
Both	6(2.6%)
Altered sensation at 6 months (n=216)	
Improved	148(68.7%)
Completely recovered	55(25.5)
Completely recovered at 3 months	13(5.8%)

Data presented as n (%)

Among PTN cases, the most common pain character was pricking (71.8%), followed by burning (20.5%) and tingling (7.7%). At the cohort level, pain severity changed significantly over time: at 1 month, most patients reported moderate pain; by 3 months,

42.9% reported no pain, with 28.6% experiencing mild and moderate pain each; by 6 months, 67.9% reported no pain, with 25.0% experiencing mild, 7.1% moderate, and 0% severe.

Post-operative altered sensation was reported by 66.1% of patients; hypoesthesia was predominant (83.3%) compared to hyperesthesia (16.7%). The most common site was the anterior lower chest (75.0%), followed by the hypochondrium (19.4%) and both (5.6%). By six months, most patients experienced improvement (65.7%) or complete recovery (28.6%), with 5.7% noting recovery by three months (Table-III).

DISCUSSION

In this single-centre, cross-sectional study of 336 thoracotomy patients, a higher incidence of PTN was observed. Adjusted analyses identified two factors associated with PTN, including female and larger incision length, especially >10 cm. Age (>35) and side of thoracotomy showed no significant association with PTN. Although a higher burden of comorbidities did not reach statistical significance, having ≥3 comorbidities suggested a possible increased risk. Regarding pain characteristics, the most common phenotype among PTN cases was pricking pain, with severity decreasing over time; about two-thirds reported no pain by six months. Sensory disturbances were common, mainly hypoesthesia at the lower anterior chest, and most patients reported improvement or recovery by six months.

Recent reviews from high-income settings consistently report substantial rates of chronic post-thoracotomy pain at 3–6 months, with a sizeable minority experiencing neuropathic features.[9,10] Several features of our cohort plausibly account for this: a large proportion underwent decortication for empyema, rib manipulation/resection was common, and most operations used posterolateral exposure—each linked to intercostal nerve trauma in prior observational series and reviews of chronic post-surgical pain.[11] Larger incisions likely proxy for greater tissue disruption and rib spreading, aligning with anatomical and mechanistic work that implicates direct intercostal nerve injury, traction ischemia, and scarring in PTN pathogenesis.[12]

The association between female sex and higher odds of chronic post-surgical pain has been observed across procedures (including thoracotomy and mastectomy) in previous studies and is biologically plausible: sex hormones modulate nociceptive processing; women demonstrate heightened central sensitization in experimental paradigms; and psychosocial factors (e.g., sleep disturbance, anxiety) can amplify persistent pain.[13,14] The null effect of age is also consistent with thoracic literature in which surgical/technique-level factors (exposure, rib handling, incision length) dominate demographic predictors. The trend for ≥3 comorbidities fits clinical expectations—multimorbidity may prolong inflammation, impair healing, or increase peri-operative exposures that foster neuropathic pain—though larger samples would be required to confirm precision[15,16]

Importantly, our longitudinal summaries demonstrate a favorable trajectory: while early PTN was frequent, severity regressed from predominantly moderate at 1 month to mostly no/mild by 3–6 months. This pattern mirrors prior thoracic cohorts describing partial recovery from intercostal neuropraxia and attenuation of central sensitization with time.[16] The predominance of hypoesthesia at the anterior chest wall maps to the distribution of intercostal nerves at risk during posterolateral thoracotomy and rib resection/spreading, reinforcing a neuroanatomical basis for symptoms.[17,18]

LIMITATION OF THE STUDY

The research was carried out at a single tertiary care hospital, where the case mix mainly involved open posterolateral thoracotomy and frequent rib manipulation; therefore, the findings may not apply to centers using more minimally invasive surgeries or different perioperative protocols.

CONCLUSION

This study found that PTN occurs in significant proportion of patients following thoracotomy. Female gender and larger incisions were identified as an independent factor associated with higher risk of PTN. Further multicenter studies are required to validate these findings and explore effective preventive strategies.

Conflict of Interest: None.

Funding Source: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

AZK & FAM: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AW & MU: Conception, data analysis, drafting the manuscript, approval of the final version to be published.

AYP & FK: Data acquisition, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Maloney J, Wie C, Pew S, Covington S, Maita M, Kozinn R, et al. Post-thoracotomy Pain Syndrome. Curr Pain Headache Rep 2022; 26(9): 677-681. https://doi.org/10.1007/s11916-022-01069-z
2. Gupta R, Van de Ven T, Pyati S. Post-Thoracotomy Pain: Current Strategies for Prevention and Treatment. Drugs 2020; 80(16): 1677-1684. https://doi.org/10.1007/s40265-020-01390-0
3. Majeed FA, Ali A, Chatha SS, Ahmad G, Wyne A, Paracha N. Management of Malignant Chest Wall Tumors. J Coll Physicians Surg Pak 2021; 31(07): 833-836. https://doi.org/10.29271/jcpsp.2021.07.833
4. Arends S, Böhmer AB, Poels M, Schieren M, Koryllos A, Wappler F, et al. Post-thoracotomy pain syndrome: seldom severe, often neuropathic, treated unspecific, and insufficient. Pain Rep 2020; 5(2): e810. https://doi.org/10.1097/pr9.0000000000000810
5. Gandhi W, Pomares FB, Naso L, Asenjo JF, Schweinhardt P. Neuropathic pain after thoracotomy: Tracking signs and symptoms before and at monthly intervals following surgery. Eur J Pain 2020; 24(7): 1269-1289. https://doi.org/10.1002/ejp.1569
6. Homma T, Doki Y, Yamamoto Y, Ojima T, Shimada Y, Kitamura N, et al. Risk factors of neuropathic pain after thoracic surgery. J Thorac Dis 2018; 10(5): 2898-2907. https://doi.org/10.21037/jtd.2018.05.25
7. Miyazaki T, Doi R, Matsumoto K. Post-thoracotomy pain syndrome in the era of minimally invasive thoracic surgery. J Thorac Dis 2024; 16(5): 3422-3430. https://doi.org/10.21037/jtd-24-158
8. Rogers ML, Duffy JP. Surgical aspects of chronic post-thoracotomy pain. Eur J Cardiothorac Surg 2000; 18(6): 711-716. https://doi.org/10.1016/S1010-7940(00)00569-8
9. Danielsen AV, Andreasen JJ, Dinesen B, Hansen J, Kjær-Staal Petersen K, Simonsen C, et al. Chronic post-thoracotomy pain after lung cancer surgery: a prospective study of preoperative risk factors. Scand J Pain 2023; 23(3): 501-510. https://doi.org/10.1515/sjpain-2023-0016
10. Yin HH, Tse MMY, Wong FKY. Post-operative pain experience and barriers to pain management in Chinese adult patients undergoing thoracic surgery. J Clin Nurs 2012; 21(9–10): 1232–1243. http://doi.org/10.1111/j.1365-2702.2011.03886.x
11. Ranganathan P, Jiwnani S, Pramesh CS. Intercostal nerve protection to prevent post-thoracotomy pain. J Thorac Dis 2019; 11(Suppl 9): S1434-S1435. https://doi.org/10.21037/jtd.2019.03.64
12. Fernandez CA, Narveson JR, Niu F, Norton E, Brown EC, Punja V, et al. In-hospital outcomes of intercostal nerve cryoablation and surgical stabilization of rib fractures. J Trauma Acute Care Surg 2022; 93(5): 695-701. https://doi.org/10.1097/ta.0000000000003623
13. Liu QR, Dai YC, Ji MH, Liu PM, Dong YY, Yang JJ. Risk Factors for Acute Post-surgical Pain: A Narrative Review. J Pain Res 2024; 17: 1793-1804. https://doi.org/10.2147/jpr.S462112
14. Rosenberger DC, Pogatzki-Zahn EM. Chronic post-surgical pain - update on incidence, risk factors and preventive treatment options. BJA Educ 2022; 22(5): 190-196. https://doi.org/10.1016/j.bjae.2021.11.008
15. Armstrong AD, Hassenbein SE, Black S, Hollenbeak CS. Risk factors for increased post-operative pain and recommended orderset for post-operative analgesic usage. Clin J Pain 2020; 36(11): 845–851. http://doi.org/10.1097/ajp.0000000000000876
16. Bekele EA, Tulu TB, Bulto YA, Azibte GT, Birhanu W. Prevalence and associated factors of acute post-operative pain in adult surgical patients: A prospective study. Surg Pract Sci 2024; 19: 100262. http://doi.org/10.1016/j.sipas.2024.100262
17. Small C, Laycock H. Acute post-operative pain management. Br J Surg 2020;107(2):e70–e80. http://doi.org/10.1002/bjs.11477
18. Makkad B, Kachulis B. Challenges in acute post-operative pain management in thoracic surgery. Best Practice & Research Clin Anaesthesiol 2024; 38(1): 64-73. https://doi.org/10.1016/j.bpa.2024.01.002