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Original Article

Factors Associated with Postoperative Pain among Patients after Thoracic Surgery in a Tertiary Care Teaching Hospital of Punjab, Pakistan

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Abstract

Objective: To identify factors associated with postoperative pain severity among thoracic surgery patients at a tertiary care hospital in Punjab, Pakistan.

Methods: This cross-sectional study included 284 patients who underwent thoracic surgery between January-September 2025. Pain was assessed using Visual Analog Scale (VAS) at 24, 48, and 72 hours postoperatively. Multiple logistic regression identified independent predictors of severe pain.

Results: Mean age was 52.3±14.6 years; 64.1% were male. Moderate to severe pain (VAS≥4) affected 68.3% at 24 hours, decreasing to 42.6% at 72 hours. Open thoracotomy (OR=4.23, 95% CI: 2.45-7.31, p<0.001), surgery duration >180 minutes (OR=2.89, p<0.001), current smoking (OR=2.34, p=0.001), and BMI≥30 kg/m² (OR=1.87, p=0.023) independently predicted severe pain. Epidural analgesia reduced severe pain risk by 69% (OR=0.31, p<0.001). Poor pain control was associated with increased respiratory complications (28.3% vs 12.1%, p<0.001) and prolonged hospitalization (8.4±2.3 vs 5.6±1.8 days, p<0.001).

Conclusion: Open thoracotomy, prolonged surgery, smoking, and obesity independently predict severe postoperative pain. Epidural analgesia and multimodal protocols can significantly improve outcomes in thoracic surgery patients.

Keywords: Postoperative pain, thoracic surgery, pain management, epidural analgesia, Visual Analog Scale, Pakistan

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Introduction

Postoperative pain represents a major challenge in thoracic surgery, significantly impacting recovery, quality of life, and clinical outcomes[1,2]. Inadequate pain control leads to respiratory complications, delayed mobilization, thromboembolic events, and prolonged hospitalization. Despite advances in surgical and anesthetic techniques, moderate to severe pain affects 40-80% of thoracic surgery patients internationally.[3,4]

The multifactorial nature of postoperative pain involves patient-related factors (age, gender, BMI, smoking status), surgical factors (procedure type, approach, duration), and anesthetic factors (regional vs systemic analgesia). In Pakistan, thoracic surgery units face resource constraints and variable access to advanced analgesic techniques.[5] Data specific to Pakistani populations remains limited, making it challenging to develop evidence-based, context-appropriate pain management guidelines.

This study comprehensively assesses postoperative pain prevalence and severity, identifies demographic and surgical determinants, evaluates current pain management practices, and examines associations between pain control and complications in thoracic surgery patients at Services Hospital Lahore, a major tertiary care center serving Punjab province.

Methods

This cross-sectional observational study was conducted at Services Hospital, Lahore (1600-bed tertiary

teaching hospital) from January 2025 to September 2025. The study received approval from the Institutional Review Board of Services Institute of Medical Sciences and had the IRB number IRB/2025/1565/SIMS. All participants provided written informed consent. A sample size of 256 patients was calculated wic was increased to 284 patients considering dropout.

Patients ≥ 18 years undergoing elective/emergency thoracic surgery, able to communicate pain levels were included while patients cognitive impairment, pre-existing chronic pain disorders, long-term opioid therapy (>3 months), postoperative mechanical ventilation >48 hours were excluded from this study.

Demographic data (age, gender, BMI, smoking status, comorbidities, ASA classification), surgical variables (procedure type, approach, duration, anesthesia technique), pain assessments using VAS (0-10 scale) at 24, 48, and 72 hours, analgesic regimens, and postoperative outcomes (complications, mobilization time, hospital stay, patient satisfaction) were collected by trained research assistants.

Pain severity: Mild (VAS 1-3), Moderate (VAS 4-6), Severe (VAS 7-10).

SPSS version 26.0 was used. Descriptive statistics, independent t-tests, ANOVA, and chi-square tests compared groups. Multiple logistic regression identified independent predictors of severe pain (VAS≥ 7 at 24 hours) with adjusted odds ratios and 95% confidence intervals. P<0.05 was significant.

Results

Demographics and Clinical Characteristics: All 284 patients completed the study. Mean age was 52.3± 14.6 years (range 18-78); 64.1% were male. Mean BMI was 24.8±4.3 kg/m². Current smokers comprised 38.7%, former smokers 28.5%, and never-smokers 32.7%. Common comorbidities included hypertension (34.5%), COPD (31.3%), diabetes mellitus (22.9%), and ischemic heart disease (15.8%). Most patients were ASA II (58.1%) or ASA III (32.4%).

Table 1: *Demographic Characteristics (N=284)*

Characteristic	n (%) / Mean±SD
Age (years)	52.3±14.6
Male gender	182 (64.1%)
BMI (kg/m²)	24.8±4.3
Current smoker	110 (38.7%)
Hypertension	98 (34.5%)
COPD	89 (31.3%)
Diabetes	65 (22.9%)

Surgical Characteristics: Lung resections were most common (42.6%), followed by empyema drainage (23.2%), esophageal surgery (14.8%), mediastinal mass excision (11.3%), and rib fracture fixation (8.1%). Open thoracotomy was performed in 61.6% and VATS in 38.4%. Mean surgery duration was 178.4±68.2 minutes. Epidural analgesia was used in 43.7%, paravertebral blocks in 18.3%, and systemic analgesia alone in 38.0%.

Table 2: *Surgical and Anesthesia Characteristics*

Variable	n (%) / Mean±SD
Lung resection	121 (42.6%)
Open thoracotomy	175 (61.6%)
VATS	109 (38.4%)
Surgery duration (min)	178.4±68.2
Epidural analgesia	124 (43.7%)
Paravertebral block	52 (18.3%)
Systemic opioids only	108 (38.0%)

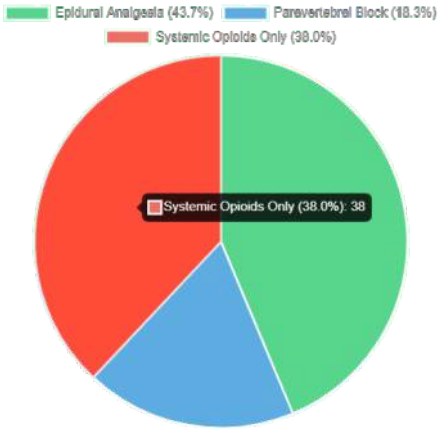

Figure 1: *Pain Management Strategies Distribution*

Pain Patterns: Mean VAS at 24 hours was 5.4±2.1, decreasing to 4.2±1.9 at 48 hours and 3.3±1.7 at 72 hours. Moderate to severe pain (VAS≥4) affected 68.3% at 24 hours, 55.6% at 48 hours, and 42.6% at 72 hours. Severe pain (VAS≥7) occurred in 20.4% at 24 hours, decreasing to 11.3% at 72 hours.

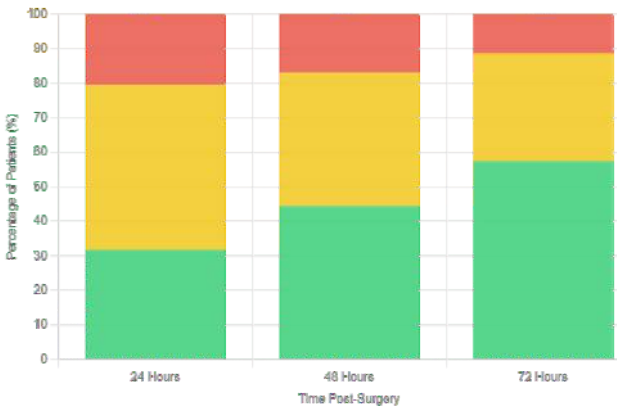

Figure 2: *Pain Severity Distribution Over Time*

Table 3: *Pain Scores Over Time*

Time	Mean VAS±SD	Mild	Moderate	Severe
24h	5.4±2.1	31.7%	47.9%	20.4%
48h	4.2±1.9	44.4%	38.7%	16.9%
72h	3.3±1.7	57.4%	31.3%	11.3%

Distribution of pain severity categories (Mild, Moderate, Severe) at 24, 48, and 72 hours post-surgery. Note the progressive decrease in severe pain over time.

Predictors of Severe Pain: Univariate analysis showed open thoracotomy patients had higher VAS than VATS (6.3±1.9 vs 3.9±1.6, p<0.001). Current smokers reported higher pain than non-smokers (6.1±2.0 vs 4.9±2.0, p<0.001). Obese patients (BMI≥30) experienced more pain than normal BMI (6.2±2.1 vs 5.1±2.0, p=0.004). Surgery >180 minutes was associated with higher pain than <120 minutes (6.0±2.0 vs 4.7±1.9, p<0.001).

Multiple logistic regression identified independent predictors of severe pain (VAS≥7): open thoracotomy (OR=4.23, 95% CI: 2.45-7.31, p<0.001), surgery duration >180 minutes (OR=2.89, 95% CI: 1.67-5.01, p< 0.001), current smoking (OR=2.34, 95% CI: 1.42-3.86, p=0.001), and BMI≥30 kg/m² (OR=1.87, 95% CI: 1.09-3.21, p=0.023). Epidural analgesia was protective (OR=0.31, 95% CI: 0.17-0.56, p<0.001).

Adjusted odds ratios from multivariate analysis. Reference line at OR=1.0

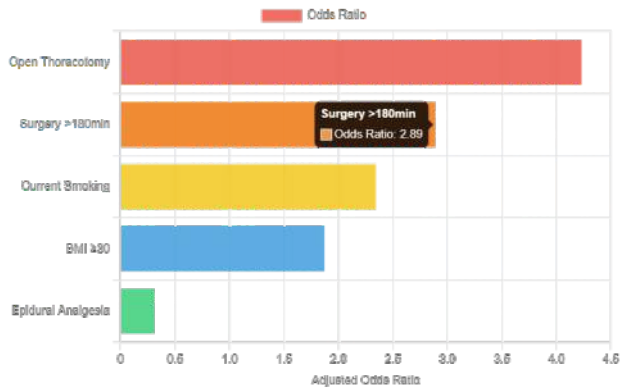

Figure 3: *Independent Predictors of Severe Pain (Odds Ratios)*

Analgesia Effectiveness: Epidural patients had significantly lower VAS at all timepoints: 24h (4.2±1.7 vs 6.8 ±1.9, p<0.001), 48h (3.1±1.5 vs 5.4±1.9, p<0.001), and 72h (2.5±1.4 vs 4.2±1.8, p<0.001) compared to systemic opioids. Paravertebral blocks showed intermediate efficacy (24h VAS: 5.1±1.8).

Clinical Outcomes: Poor pain control (VAS≥ 7) was associated with higher respiratory complications (28.3% vs 12.1%, p<0.001), longer hospital stay (8.4±2.3 vs 5.6±1.8 days, p<0.001), and delayed mobilization (42.8 ±12.6 vs 28.4±9.2 hours, p<0.001). Patient satisfaction was significantly lower with poor pain control (39.7% vs 82.7% high satisfaction, p<0.001).

Discussion

This comprehensive study of 284 thoracic surgery patients provides critical insights into postoperative pain in a Pakistani tertiary care setting. The 68.3% prevalence of moderate to severe pain at 24 hours aligns with international literature (40-80%) but indicates significant undertreatment requiring urgent attention[1,2].

Open thoracotomy emerged as the strongest predictor (OR=4.23), consistent with extensive literature demonstrating pain advantages of minimally invasive approaches through reduced chest wall trauma and eliminated rib spreading.[9] However, VATS is not feasible for all cases, particularly complex resections or emergencies. For open procedures, muscle-sparing techniques, careful rib retraction, and prophylactic intercostal nerve blocks should be standard practice.[4,5]

Prolonged surgery (>180 minutes, OR=2.89) reflects greater complexity and tissue manipulation, while current smoking (OR=2.34) likely involves altered pain processing from chronic nicotine exposure and increased respiratory symptoms exacerbating incisional pain.[3] Preoperative smoking cessation programs could improve outcomes. Obesity (BMI≥30, OR=1.87) may involve altered analgesic pharmacokinetics and increased inflammatory mediators, suggesting need for weight-based dosing and preferential use of regional techniques.[3]

Epidural analgesia demonstrated remarkable efficacy, reducing severe pain risk by 69% with a clinically meaningful 2.6-point VAS reduction. Beyond pain scores, epidural facilitated earlier mobilization and reduced respiratory complications—critical outcomes in thoracic surgery.[5,12] However, only 43.7% received epidural due to contraindications, technical challenges, and resource limitations. Paravertebral blocks offer safer alternatives when epidural is contraindicated.

The association between poor pain control and adverse outcomes—2.3-fold higher respiratory complications, 2.8-day longer hospital stay, 14.4-hour delayed mobilization—demonstrates that pain management directly impacts clinical recovery and healthcare costs, not merely patient comfort. Respiratory complications likely result from inadequate coughing and deep breathing due to pain.

Our findings align with international literature while providing Pakistani context. Khan et al. (2022) highlighted similar South Asian challenges including resource constraints reflected in our 43.7% epidural utilization. The study by Hussain et al. (2019) in Pakistani patients

reported comparable epidural benefits (67% pain reduction).

Study limitations include cross-sectional design limiting causal inference, single-center setting potentially limiting generalizability, lack of chronic pain assessment, and absence of detailed cost-effectiveness analysis. Future research should include randomized controlled trials comparing analgesic strategies, longitudinal chronic pain studies, implementation science research on protocol adoption barriers, and economic evaluations.

Clinical Recommendations: Based on our findings, we recommend: (1) risk stratification identifying high-risk patients (open approach, smokers, obese, prolonged surgery) for enhanced protocols; (2) standardized multimodal analgesia combining regional techniques, non-opioid analgesics, and adjuvants; (3) expanded regional anesthesia utilization with appropriate training; (4) preoperative optimization including smoking cessation; (5) VATS expansion where feasible; (6) continuous quality improvement with regular pain audits; and (7) acute pain service development ensuring 24-hour expertise.

Conclusion:

Postoperative pain affects two-thirds of thoracic surgery patients, with open thoracotomy, prolonged surgery, smoking, and obesity as independent predictors. Epidural analgesia significantly reduces pain severity and improves clinical outcomes including reduced complications, earlier mobilization, and shorter hospitalization. Implementing risk-stratified, multimodal pain protocols emphasizing regional anesthesia can substantially improve thoracic surgery outcomes in Pakistani healthcare settings. Despite resource challenges, the clinical and economic benefits justify sustained efforts to optimize pain management.

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Ethical Approval: The IRB/EC approved this study via letter no. IRB/2025/1565/SIMS dated March 26, 2025.

Conflict of Interest: None

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Authors' Contribution

AAT: Conception.

MSN: Design of the work.

ZS: Data acquisition, analysis, or interpretation.

AAT, ZS: Draft the work.

MSN: Review critically for important intellectual content.

All authors approve the version to be published. All authors agree to be accountable for all aspects of the work.

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