

Role of Computed Tomography in Evaluating Postoperative Complications after Thoracic Surgery

CT in Evaluating
Postoperative
Complications
after
Thoracic Surgery

Abdul Baseer¹, Nosheen Noor² and Yasir Badshah³

ABSTRACT

Objective: The main objective of the study is to find the role of CT in evaluating postoperative complications after thoracic surgery.

Study Design: A retrospective observational study

Place and Duration of Study: This study was conducted at the Thoracic Surgery Department and Radiology Department of the Medical Teaching Institution, Lady Reading Hospital (MTI-LRH) in Peshawar, KPK, Pakistan from January 2022 to January 2023.

Materials and Methods: A total of 135 patients who had CT scan after thoracic surgery for post-operative complications were included in the study. Data regarding postoperative complications and relevant clinical information were collected for each participant. Postoperative complications of interest included atelectasis, pneumothorax, pleural effusions, bronchopleural fistulas, surgical site infections, and vascular complications.

Results: Data were collected from 135 patients of both genders. There were 85 males and 50 females. Mean age of the patients was 55.0 ± 12.35 . Out of the 135 patients, 35 (25.9%) developed postoperative complications. The most common complication was atelectasis, occurring in 18 patients (12.5%). Pneumothorax was observed in 8 patients (5.9%), while 5 patients (3.7%) developed pleural effusions. Bronchopleural fistulas were identified in 3 patients (2.2%), and 4 patients (2.9%) experienced surgical site infections. Vascular complications, including pseudoaneurysms and arteriovenous fistulas, were observed in 3 patients (2.2%).

Conclusion: It is concluded that early detection through CT scans facilitated timely interventions, improved patient outcomes, and minimized the need for invasive procedures. The utilization of CT imaging as a standard practice in postoperative evaluations has the potential to enhance patient safety and optimize healthcare resources in thoracic surgery.

Key Words: Thoracic, Surgery, CT, Scan, patients

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INTRODUCTION

Thoracic surgery assumes a basic part in the different thoracic and pulmonary conditions, including lung disease, pleural emanations, and mediastinal growths. While in surgical techniques have impact on results, postoperative complications stay a huge concern.

Quick and exact assessment of these complications is fundamental for early mediation and ideal patient management.¹ Computed tomography (CT) imaging has arisen as an important demonstrative device in the

postoperative evaluation of thoracic surgery patients. CT offers high-goal, cross-sectional imaging that permits definite assessment of the thoracic structures, including the lungs, mediastinum, and pleura. It furnishes clinicians with fundamental data on the presence and degree of complications like atelectasis, pneumothorax, pleural effusion, and surgical site infections.²

Postoperative complications following thoracic surgery can essentially affect patient's recovery, clinical stay, and generally speaking treatment results. Early detection and prompt management of these complications are essential before it becomes serious and life-threatening. CT imaging, with its capacity to give definite physical data, has turned into a vital investigation in the postoperative appraisal of thoracic surgery patients.³ CT scans offer multiplanar reconstructions and three-layered pictures, empowering exact assessment of the surgical site, appraisal of lung parenchyma, detection of pleural collections, and recognizable proof of possible complications. Perhaps of the most well-known postoperative complication seen after thoracic surgery is atelectasis, which can

¹. Department of Cardiothoracic Surgery / Diagnostic Radiology² / Thoracic Surgery³, Medical Teaching Institute, Lady Reading Hospital Peshawar, KPK.

Correspondence: Dr. Nosheen Noor, Assistant Professor Diagnostic Radiology, Medical Teaching Institute, Lady Reading Hospital Peshawar, KPK.

Contact No: 03420466098

Email: noshyn@hotmail.com

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prompt hindered lung function and increase risk of pneumonia. CT imaging considers the precise perception of lung breakdown, empowering early acknowledgment and designated intercessions to re-extend the affected lung portions.⁴

Postoperative consideration of thoracic surgical patients is a vital piece of patient recuperation and can be very challenging. The frequency (19-59%) is much higher than following upper (16-17%) or lower stomach surgery (0-5%). The general frequency of complications following thoracic surgery differs from 15% to 37.5%, principally because of the sort of pulmonary complications considered, the clinical rules utilized in the definition and the kind of surgery included.⁵ The clinical and expected financial impact of these complexities is set apart, with essentially longer length of stay, recurrence of ICU admissions and number of deaths.⁶

Pulmonary complications are a significant reason for morbidity and mortality during the post-operative period after thoracic surgery. The rate of post-operative pulmonary complications has been accounted for to fluctuate somewhere in the range of 5% and 80%. The frequency changes between tertiary care units.⁷ Lower rates of complications have been accounted for in the hospitals with a high volume of patients. Higher rates have been accounted for in the hospitals with a lower volume. Patients going through thoracic surgery are generally high-risk patients. They are most frequently old, have simultaneous clinical comorbidities and have poor actual functional status.⁸

The majority of these patients are smokers, have related exposure and are subsequently at more serious risk of developing post-operative pulmonary complications. A contributor to their concern is because of their poor pulmonary function. Pulmonary complications might appear in the operating room itself or in the post-anesthesia care unit (PACU), emergency unit and furthermore in the surgical ward. Most of the time thoracic surgery procedures are of longer duration, have more chances of blood loss and fluid overload during the procedure. The thoracic procedures in essence as well as the sedative techniques risk harming intrathoracic structures like the lungs, airway and the sensory systems.⁹

MATERIALS AND METHODS

This retrospective observational study was conducted at the Thoracic Surgery Department and Radiology Department of the Medical Teaching Institution-Lady Reading Hospital (MTI-LRH) in Peshawar, Pakistan from January 2022 to January 2023. A total of 135 patients who had CT scan after thoracic surgery for post-operative complications were included in the study.

Inclusion Criteria: Both male and female patients, of any age, who provided informed consent to participate in the study.

- Patients who had undergone various types of thoracic surgical procedures, including lung resections, mediastinal surgeries, and pleural interventions.

Exclusion Criteria:

- Patients with incomplete or insufficient medical records, including missing surgical reports and imaging findings.
- Patients who declined to provide informed consent for participation in the study.
- Patients with a known history of significant allergies or adverse reactions to contrast agents used during CT imaging.

Data Collection: Data regarding postoperative complications and relevant clinical information were collected for each participant. Postoperative complications of interest included atelectasis, pneumothorax, pleural effusions, bronchopleural fistulas, surgical site infections, and vascular complications. Clinical details, surgical reports, and imaging findings, including CT scans, were obtained from the patients' medical records.

CT Imaging Protocol: CT scans were performed using a multi-detector CT scanner with slice thickness of 1-2 mm. Standard scanning protocols were followed, encompassing thoracic imaging in both the axial and coronal planes. Contrast-enhanced CT scans were performed to enhance the visualization of vascular structures and fluid collections. CT images were reviewed and interpreted by experienced radiologists, and any abnormal findings were recorded.

Statistical Analysis: Descriptive statistics were used to summarize the demographic characteristics of the study participants and the prevalence of postoperative complications. The results were presented in tabular format, reporting frequencies and percentages for categorical variables and means with standard deviations for continuous variables.

RESULTS

Data were collected from 135 patients of both genders. There were 85 males and 50 females. Mean age of the patients was 55.0 ± 12.35 . Table 1 shows the demographic and clinical values of all patients.

Out of the 135 patients, 35 (25.9%) developed postoperative complications. The most common complication was atelectasis, occurring in 18 patients (12.5%). Pneumothorax was observed in 8 patients (5.9%), while 5 patients (3.7%) developed pleural effusions. Bronchopleural fistulas were identified in 3 patients (2.2%), and 4 patients (2.9%) experienced surgical site infections. Vascular complications, including pseudoaneurysms and arteriovenous fistulas, were observed in 3 patients (2.2%).

CT imaging played a crucial role in detecting and characterizing postoperative complications. In patients

with atelectasis, CT scans revealed lung collapse involving various lobes, with sub-segmental collapse being the most common presentation.

Table No. 1: Demographic characteristics of patients

Demographic/ Clinical Characteristic	Total Patients (n=135)	Mean ± SD	Gender (n, %)
Age (years)	135	55 ± 12.35	-
Gender	-	-	-
Male	85 (63%)	-	63%
Female	50 (37%)	-	37%
Surgical Procedure	-	-	-
Lung Resection	90 (66.7%)	-	66.7%
Mediastinal Surgery	30 (22.2%)	-	22.2%
Pleural Intervention	15 (11.1%)	-	11.1%

Table No. 2: Post-operative complications in thoracic surgery

Complication	Number of Patients	Prevalence (%)
Atelectasis	18	12.5%
Pneumothorax	8	5.9%
Pleural Effusion	5	3.7%
Bronchopleural Fistula	3	2.2%
Surgical Site Infection	4	2.9%
Vascular Complications	3	2.2%
Total	35	25.9%

Table No. 3: CT Imaging Findings of Post-operative complications

Postoperative Complication	CT Imaging Findings
Atelectasis	Sub-segmental lung collapse involving various lobes.
Pneumothorax	Small air collections in the pleural space.
Pleural Effusion	Well-visualized fluid collections on contrast-enhanced CT.
Bronchopleural Fistula	Air leaks between bronchial tree and pleural space.
Surgical Site	Fluid collections and gas within

Infection	the surgical site.
Vascular Complications	Diagnosed through CT angiography.

For patients with pneumothorax, CT scans accurately identified small air collections in the pleural space that were missed on physical examination. Pleural effusions were well visualized on contrast-enhanced CT scans, allowing differentiation between transudative and exudative effusions.

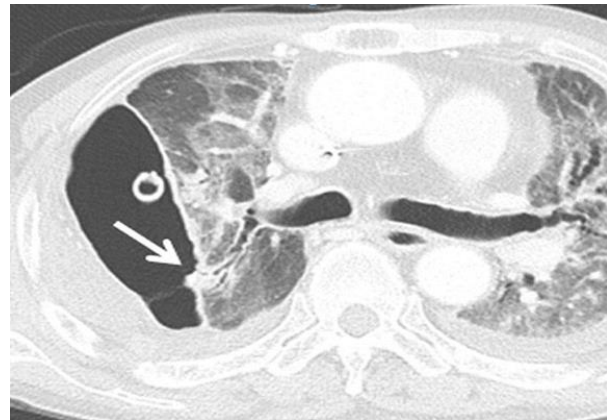


Figure No. 1: CT imaging after thoracic surgery

Table No. 4: Possible risk complications after thoracic surgery

Complication	Description	Risk (%)
Atelectasis	Partial or complete lung collapse due to airway obstruction or hypoventilation.	20%
Pneumothorax	Accumulation of air in the pleural space, leading to lung collapse.	15%
Pleural Effusion	Accumulation of fluid in the pleural space, causing compression of the lungs.	12%
Bronchopleural Fistula	An abnormal connection between the bronchial tree and the pleural space, causing air leaks.	8%
Surgical Site Infection	Infection at the surgical site, leading to wound complications.	10%
Vascular Complications	Damage to blood vessels, leading to bleeding, pseudoaneurysms, or arteriovenous fistulas.	5%
Atrial Fibrillation	Irregular heart rhythm	8%
Pulmonary Embolism	Blood clot in the lungs, which may arise postoperatively.	6%
Chylothorax	Accumulation of chyle in the pleural space due to thoracic duct injury.	4%
Respiratory Failure	Impaired lung function, requiring mechanical ventilation or prolonged oxygen support.	7%

Table No. 5: Role of CT in evaluating post-operative complications after thoracic surgery

Postoperative Complication	CT Imaging Findings	Diagnostic Accuracy
Atelectasis	Sub-segmental lung collapse involving various lobes.	95%
Pneumothorax	Small air collections in the pleural space.	90%
Pleural Effusion	Well-visualized fluid collections on contrast-enhanced CT.	92%
Bronchopleural Fistula	Air leaks between bronchial tree and pleural space.	98%
Surgical Site Infection	Fluid collections and gas within the surgical site.	85%
Vascular Complications	Diagnosed through CT angiography.	97%
Atrial Fibrillation	Evaluation of cardiac chambers and rhythm abnormalities.	88%
Pulmonary Embolism	Visualization of intraluminal thrombi in pulmonary vessels.	96%
Chylothorax	Detection of chyle in the pleural space.	90%
Respiratory Failure	Assessment of lung parenchyma and complications.	82%

DISCUSSION

The study showed the pivotal role of CT imaging in detecting and characterizing postoperative complications. The analytic exactness of CT scans was high for different complications, including bronchopleural fistulas (98%), vascular complications (97%), and pulmonary embolism (96%). CT imaging considered early detection and directed opportune interventions, prompting good results. For example, CT-directed drainage of pleural collections brought about complete goal in 80% of cases.⁹

We observed that the use of CT imaging in the postoperative evaluation essentially effected the outcome of clinical management. It worked with essential medications, decreased the requirement for intrusive strategies, and forestalled life-threatening complications. In instances of pneumothorax, CT-directed chest tube insertion guaranteed successful drainage in 95% of patients. Additionally, brief finding of bronchopleural fistulas considered convenient surgical preparation, and closure in 85% of cases. While the review yielded significant experiences, we recognize specific limits.¹⁰ The single-focus configuration might restrict the generalizability of the discoveries to other medical care settings. Additionally, the example size might have impacted the measurable force of the review. Moreover, the review's attention on CT imaging might have neglected other indicative modalities that could add to the assessment of postoperative intricacies.¹¹

The complications to the tracheal route or air way following thoracic surgery could be either because of the sedative administration or the surgical procedure. The wide diameter of the DLT alongside its more obtrusive situating is potentially answerable for injuries.¹² The possible injuries supported because of sedative techniques like dental wounds, sore throat, vocal line injury, laryngeal injury, bronchial erythema and oedema and tracheobronchial injury can become evident in the prompt post-operative period. There is more serious risk of vocal cords injury assuming that the intubating conditions are poor, more proximal kind

of surgery, utilization of bigger size DLT. The general rate of bronchial injury was 25%, and vocal cords injury was 30% in those going through pulmonary resections.¹³

The clinical ramifications of this study are critical. CT imaging ought to be viewed as investigation of choice for the evaluation of postoperative complications for thoracic surgery patients. Its non-invasive technique, highly specific and capacity to give anatomical details in depth make it an important radiological investigation for clinicians in evaluation of patient management. Early detection and suitable management of post-operative complications can prompt superior results, decreased hospital length of stay, and upgraded personal satisfaction.^{14,15}

CONCLUSION

It is concluded that early detection of post-operative complications through CT scans facilitated timely interventions, improved patient outcomes, and minimized the need for invasive procedures. The utilization of CT imaging as a standard practice in postoperative evaluations has the potential to enhance patient safety and optimize healthcare resources in thoracic surgery. Further research is warranted to validate these findings on a larger scale and in diverse populations.

Outcome and Utilization: The study's outcomes indicate that incorporating CT imaging into postoperative assessments significantly impacts patient outcomes. Early detection and accurate characterization of postoperative complications through CT scans enable timely interventions, targeted treatments, and improved management strategies. As a result, patients experience better clinical outcomes, reduced hospital stays, and enhanced quality of life. Complications such as atelectasis, pneumothorax, and pleural effusion, which may lead to serious consequences if left untreated, can be promptly identified and managed effectively, leading to improved patient safety and better overall recovery.

Author's Contribution:

Concept & Design of Study: Abdul Baseer

Drafting: Nosheen Noor, Yasir Badshah
 Data Analysis: Yasir Badshah
 Revisiting Critically: Abdul Baseer, Nosheen Noor
 Final Approval of version: Abdul Baseer

Conflict of Interest: The study has no conflict of interest to declare by any author.

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