Faridpur Med. Coll. J. 2025;20(2):13-17 DOI: https://doi.org/10.3329/fmcj.v20i2.82988

Original Article

Spirometric Outcomes Following Lobectomy: A Non-Tuberculosis Perspective

R Karmakar[1], AA Akond[2], MA Noor[3], SH Supti[4], I Jahan[5]

Abstract:

Lobectomy offers significant symptom relief and high sputum culture conversion rates in diverse pulmonary conditions. The procedure impacts lung function. Spirometry serves as a critical tool for evaluating these changes and guiding postoperative recovery. This study aims to analyze spirometric outcomes of lobectomy in non-tubercular diseases. This pretest-posttest design study evaluated spirometric outcomes of lobectomy in 30 patients with non-tuberculous pulmonary diseases at National Institute of Diseases of the Chest and Hospital (NIDCH) from January 2022 to June 2023. Pre- and postoperative lung function was analyzed using FEV1, FVC, and FEV1/FVC ratio. The study included 30 patients, with a mean age of 35.6 years (±16.1 SD), comprising 21 males and 9 females. Smoking history was found in 9 patients (30%), while 21 (70%) were non-smokers. The most common diagnoses were bronchiectasis (13 cases) and adenoma (6 cases), with lesions predominantly in the upper lobes (13 cases). Spirometric analysis showed a slight decrease in mean FEV1 (from 1.9 ± 0.5 L to 1.7 ± 0.7 L) and FVC (from 2.4 ± 0.5 L to 2.2 ± 0.5 L) postoperatively, but these changes were not statistically significant ($p > 0.05$). The FEV1/FVC ratio (73.7±22.3 to 76.6±14.3) showed a modest increase, suggesting preserved airflow despite slight lung volume reductions. This study shows that lobectomy for non-tuberculous conditions leads to minimal, statistically non-significant changes in spirometric outcomes, with preserved lung function postoperatively. These findings support lobectomy as a safe and effective option for managing non-tuberculous pulmonary conditions.

Keywords: Lobectomy, Non-Tuberculous pulmonary diseases, Spirometric outcomes, FEV1 and FVC, Postoperative lung function, Pulmonary function recovery.

Introduction:

Lobectomy, the surgical removal of an entire lung lobe, first performed by Dr. Davies in 1913, remains a vital treatment option for various pulmonary conditions.[1] Beyond its historical significance, lobectomy addresses a range of conditions, from chronic infectious processes resistant to medical therapy to developmental anomalies and severe disease-related complications such as hemoptysis.[1,2] While it offers promising outcomes, such as symptom relief and sputum culture conversion rates of up to 90%[3], the procedure inevitably affects pulmonary function. Spirometry, a key diagnostic tool that measures parameters like Forced Vital Capacity (FVC) and Forced Expiratory Volume in one second

1. Rajeebshankar Karmakar, MBBS, MS (Thoracic Surgery), Resident Surgeon, Faridpur Medical College and Hospital, Faridpur. Email: rajeebfmc16@gmail.com.
2. Atik Ahmed Akond, MBBS, MS (Thoracic Surgery), Resident Surgeon, DGHS, Mohakhali, Dhaka. Email: ranarima 1901@gmail.com.
3. Masnoon Ahmed Noor, MBBS, MS (Thoracic Surgery), Resident, NIDCH, Mohakhali, Dhaka Email: noor.rmc@gmail.com.
4. Sutopa Halder Supti, MBBS, Medical officer (BMU, Shahbagh, Dhaka) Email: sutopashankarss39@gmail.com.
5. Israt Jahan, MBBS, MPH (Epidemiology), Clinical Research Associate , Department of Orthopedic Surgery, Ibn Sina Medical College and Hospital, Kallyanpur, Dhaka, Email: dr.isratjahan28@gmail.com

Address of correspondence:

Rajeebshankar Karmakar, Resident Surgeon, DGHS, Mohakhali, Dhaka, Email: rajeebfmc16@gmail.com, Phone: +880 1911 030354

(FEV1), is essential for evaluating lung performance both pre- and post-lobectomy.[4,5] Studies highlight a predictable postoperative decline in FEV1 and FVC, emphasizing the role of spirometry in assessing recovery and predicting risks.[6] This journal explores the spirometric outcomes of lobectomy, focusing on non-tubercular diseases, to provide insights into functional recovery and the broader implications of this surgical intervention.

Materials and Methods:

This quasi-experimental study was conducted at the National Institute of Diseases of the Chest and Hospital (NIDCH) to evaluate lung function outcomes following lobectomy in patients with non-tuberculous pulmonary diseases. The study spanned from January 2022 to June 2023, employing a convenient sampling technique to recruit participants meeting the inclusion criteria. Pre and postoperative outcomes of 30 patients following lobectomy were compared using spirometry values (FEV1, FVC and FEV1/FVC ratio). Data was collected using a data collection sheet with postoperative assessments conducted two months after lobectomy through face-to-face interviews and lung function tests. Statistical analysis was performed using SPSS version 29, where continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies. Pre- and postoperative comparisons were analyzed using the Student's t-test, with a significance threshold set at $p < 0.05$.

Results:

The study population comprised a relatively young cohort, with a mean age of 35.6 years (±16.1 SD), and a predominance of male patients (21 out of 30). Smoking history was noted in 30% of participants, while comorbidities were minimal, with only two cases each of COPD and diabetes mellitus. Occupational backgrounds varied, with housewives and day laborers representing the largest groups. The disease distribution was nearly equal between the right (17 cases) and left (13 cases) lungs, with the upper lobes being the most commonly affected (13 cases). Bronchiectasis emerged as the most frequent diagnosis, followed by adenoma and bullous disease, reflecting the diversity of pulmonary conditions requiring lobectomy. These characteristics suggest a homogeneous population without significant baseline differences, ensuring that observed postoperative changes in lung function are likely attributable to the surgical intervention rather than pre-existing disparities between groups (Table I, II).

Table I: Distribution of Patient according to demographic characteristics (N=30)

Variable	Number (%)
Age in years (mean ± SD)	35.6±16.1
Sex	
Male	21 (70)
Female	9 (30)
Smoking History	
Yes	9 (30)
No	21 (70)
Occupation	
Businessman	3 (10)
Housewife	9 (30)
Teacher	1 (3.33)
Day Laborer	6 (20)
Student	5 (16.67)
Shopkeeper	6 (20)

Table II: Distribution of Patient according to clinical characteristics (N=30)

Variable	Number (%)
Comorbidity	
COPD	2 (6.67)
Diabetes Mellitus	2 (6.67)
Ischemic Heart Disease	0 (0)
Site of Disease	
Right	17 (56.67)
Left	13 (43.33)
Location of the Lesion	
Upper	13 (43.33)
Middle	5 (16.67)
Lower	12 (40%)
Diagnosis	
Bronchiectasis	13 (43.33)
Lung Abscess	3 (10)
Bullous Disease	5 (16.67)
Adenoma	6 (20)
Hydatid Cyst	1 (3.33)
Broncho-pulmonary Fistula	1 (3.33)
Hamartoma	1 (3.33)

Table III findings showing effects of lobectomy on lung function by side to side comparison of pre and post operative spirometric values. All three parameters showing statistically insignificant differences (p >0.05) between the two groups. Theses findings highlight that lobectomy for non tuberculosis indications may lead to minimal and clinically nonsignificant alterations in spirometric indices.

Table III: Comparison of pre-operative and post-operative spirometric data of the patients.

	Pre Operative	Post Operative	p-value
FEV_1 (mean ± SD) (in litre)	1.9±0.5	1.7±0.7	0.21
FVC (mean ± SD) (in litre)	2.4±0.5	2.2±0.5	0.13
FEV_1 / FVC (mean ± SD) (in percentage)	73.7±22.3	76.6±14.3	0.55

p-value obtained by Paired t-test, p<0.05 considered as significant.

Discussion:

In this study, the mean age of the 30 patients was 35.6 years (±16.1 SD), significantly younger than the populations in other studies, where the mean ages were 64 and 65.1 years, respectively.[6,7] Some studies reported mean ages of 63.4 ± 8.98 and 69.5 ± 9.8 years, while others observed an even older mean age of 72.2 years.[8-10] Gender distribution in our cohort also exhibited unique characteristics, with a male-to-female ratio of 21:9. This aligns with certain studies which reported a predominance of males (33 males vs. 2 females).[7] Other studies reported more balanced distributions (64 males vs. 48 females and 52 males vs. 24 females, respectively).[6,8] On the other hand, another research showed a female-predominant cohort (3 males vs. 28 females).[10] Regarding smoking history, only 30% of our patients were smokers, contrasting sharply with a study, where 45.5% of the cohort had a smoking history.[6] Another observation reported a remarkably low prevalence of smokers (4.5%), starkly contrasting our findings.[9] Comorbidities were relatively uncommon, with only 2 patients diagnosed with chronic obstructive pulmonary disease (COPD) and 2 with diabetes mellitus, while ischemic heart disease was notably absent. This contrasts with another research where 9.2% of patients had COPD.[8] One study reported higher rates of comorbidities, including COPD (29.5%), hypertension (30.4%), and diabetes mellitus (11.6%).[6] The anatomical distribution of disease in our cohort was fairly balanced, with 17 cases involving the right lung and 13 the left lung. This distribution aligns closely with that observed in another study, which reported 16 right lung cases and 12 left lung cases.[10] Another research observed a higher prevalence of right lung involvement (36 right vs. 23 left), which might suggest a regional or disease-specific trend in lung pathology.[9] Our findings also showed a fairly typical pattern in terms of lesion location, with lesions predominantly located in the upper lobes (13 cases), followed by the lower lobes (12 cases) and the middle lobes (5 cases). This is consistent with the trends observed in other studies, where the upper lobes were the most common site of disease (25 and 34 cases, respectively), with fewer lesions affecting the middle and lower lobes.[7,9] Some research reported a predominance of upper lobe lesions, although the number of lower lobe cases was slightly higher in their cohort (13 vs. 15 upper lobes).[10]

In our study, the preoperative mean FEV1 was 1.9 ± 0.5 L, which decreased to 1.7 ± 0.7 L postoperatively, with a p-value of 0.21, indicating no significant change. The mean FVC decreased from 2.4 ± 0.5 L preoperatively to 2.2 ± 0.5 L postoperatively, with a p-value of 0.13, also suggesting no statistically significant difference. These findings contrast with results from other studies, where significant declines in lung function post-lobectomy have been observed. A study reported a 12% decrease in FEV1, while another observed a more pronounced 14.92% decrease.[6,11] One researcher found a 17% decrease in FEV1 while another reported a substantial 22% decline.[12,13] Other studies noted a smaller decrease in FEV1, around 0.15 liters.[14] For FVC, similar patterns were observed. In one study, FVC decreased by 9%, while another found a decrease from 2.47 ± 0.48 L to 2.03 ± 0.43 L.[7,11] One researcher reported a 12.66% reduction in FVC, while others observed a 12.77% decrease.[6,10] In contrast, our study found a relatively small reduction in FVC, with a non-significant decrease of 0.2 L. These differences might be due to variations in patient demographics, the extent of lobectomy, or differences in surgical techniques, but they also highlight the complexity of predicting post-surgical pulmonary function recovery. The minimal changes in FEV1 and FVC in our study could reflect the relatively younger age and fewer comorbidities in our cohort, potentially contributing to a more favorable outcome compared to older, more comorbid populations in other studies.

Conclusion:

Our study demonstrates that lobectomy for non-tuberculous conditions results in minimal and statistically non-significant changes in spirometric outcomes, including FEV1, FVC, and the FEV1/FVC ratio. The stability of these indices indicates that lung function, particularly airflow relative to lung volume, is largely preserved postoperatively. These findings suggest that lobectomy remains a safe and effective surgical option for appropriately selected patients, with limited impact on pulmonary performance, emphasizing its viability for managing diverse non-tuberculous pulmonary conditions. The study's strength lies in its comprehensive evaluation of lobectomy outcomes across a range of non-tubercular conditions, while the exclusion of patients with severe systemic diseases minimizes confounding factors. Conducted at a specialized center, it ensures standardized care and reliable assessments, offering critical insights into postoperative pulmonary function. However, its single-center design, small sample size, and lack of long-term follow-up may limit the generalizability and depth of the findings, warranting further research to validate these results in broader populations.

Ethical issues:

In accordance with the Helsinki Declaration of 2011 on medical research involving human subjects, this study followed several ethical considerations, including study approval from the academic and institutional ethical review board of the National Institute of Diseases of The Chest and Hospital and from the relevant departments within the institute.

Conflict of interest:

There is no conflict of interest.

Acknowledgment:

Gratefully acknowledge the thoughtful comments of our teacher, colleagues. We are deeply grateful to those patients who sacrificed their valuable time and participated eagerly in our study.

References:

1. Rea G, Rudrappa M. Lobectomy. [Updated 2023 Feb 13]. In: *Stat Pearls* [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK553123

2. Sakane T, Matsuoka K, Kumata S, Watanabe R, Yamada T, Matsuoka T, et al. The outcomes of anatomical lung resection for non-tuberculous mycobacterial lung disease. *Journal of Thoracic Disease* [Internet]. 2018;10:954–62. Available from: https://jtd.amegroups.org/article/view/18732/15032

3. Kang N, Jhun BW. Long-term Outcomes of Adjunctive Lung Resection for Nontuberculous Mycobacteria Pulmonary Disease. *Open Forum Infect Dis*. 2024 Jun 24;11(7):ofae345. doi: 10.1093/ofid/ofae345. PMID: 38966854; PMCID: PMC11222975. Available from: https://academic.oup.com/ofid/article/11/7/ofae327/7695228

4. Spirometry [Internet]. NHS UK; 2021 Aug. Available from: https://www.nhs.uk/conditions/spirometry/

5. Pulmonary Function Tests [Internet]. Johns Hopkins Medicine; 2024 Jun. Available from: https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/pulmonary-function-tests

6. Matsumoto R, Takamori S, Yokoyama S, Hashiguchi T, Murakami D, Yoshiyama K, et al. Lung function in the late postoperative phase and influencing factors in patients undergoing pulmonary lobectomy. *J Thorac Dis*. 2018 May;10(5):2916-2923. doi: 10.21037/jtd.2018.05.27. PMID: 29997957; PMCID: PMC6006118. Available from: https://jtd.amegroups.org/article/view/21532/16494

7. Carretta A, Zannini P, Puglisi A, Chiesa G, Vanzulli A, Bianchi A, et al. Improvement of Pulmonary Function after Lobectomy for Non-small Cell Lung Cancer in Emphysematous patients. *European Journal of Cardio-Thoracic Surgery* [Internet]. 1999 May 1;15(5):602–7. Available from: https://pubmed.ncbi.nlm.nih.gov/10386404/

8. Kim HK, Lee YJ, Han KN, Choi YH. Pulmonary function changes over 1 year after lobectomy in lung cancer. *Respir Care* [Internet]. 2016;61:376–82. Available from: https://pubmed.ncbi.nlm.nih.gov/26604331/

9. Yokoba M, Ichikawa T, Harada S, Naito M, Sato Y, Katagiri M. Postoperative pulmonary function changes according to the resected lobe: a 1-year follow-up study of lobectomized patients. *J Thorac Dis*. 2018 Dec;10(12): 6891-6902. doi: 10.21037/jtd.2018.11.108. PMID: 30746235; PMCID: PMC6344756. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6344756/

10. Subotic D, Mandaric D, Radosavljevic G, Stojsic J, Gajic M. Lung function changes and complications after lobectomy for lung cancer in septuagenarians. *Ann Thorac Med*. 2009 Apr;4(2):54-9. doi: 10.4103/1817-1737.49413. PMID: 19561925; PMCID: PMC2700480. Available from: https://pubmed.ncbi.nlm.nih.gov/19561925/

11. Berend N, Woolcock AJ, Marlin GE. Effects of lobectomy on lung function. *Thorax* [Internet]. 1980 Feb 1 [cited 2024 Aug 9];35(2):145–50. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC471241/pdf/thorax00170-0065.pdf

12. Pelletier C, Lapointe L, LeBlanc P. Effects of lung resection on pulmonary function and exercise capacity. *Thorax* [Internet]. 1990 Jul 1;45(7):497–502. Available from: https://pubmed.ncbi.nlm.nih.gov/2396230/

13. Cukic V. Reduction of pulmonary function after surgical lung resections of different volume. Med Arch. 2014 Aug;68(4):231-5. doi: 10.5455/medarh.2014.68.231-235. Epub 2014 Jul 31. PMID: 25568542; PMCID: PMC4240564. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC4240564/

14. Wei S, Chen F, Liu R, Fu D, Wang Y, Zhang B, Ren D, Ren F, Song Z, Chen J, Xu S. Outcomes of lobectomy on pulmonary function for early stage non-small cell lung cancer (NSCLC) patients with chronic obstructive pulmonary disease (COPD). *Thoracic Cancer.* 2020 Jul;11(7):1784-1789. doi: 10.1111/1759-7714.13445. Epub 2020 May 6. PMID: 32374491; PMCID: PMC7592038. Available from: https://pubmed.ncbi.nlm.nih.gov/32374491/