Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/120hmw63

INCIDENCE OF AIRLEAK AFTER WEDGE RESECTION VERSUS LOBECTOMY FOR PULMONARY MYCETOMA, FIVE YEARS SURGICAL EXPERIENCE IN A 3RD WORLD COUNTRY

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ABSTRACT

Introduction: Pulmonary mycetoma, which usually develops from tuberculous lung pathology, is still a significant problem in the developing world. Surgical resection is inferred to be the most effective treatment technique since the use of antifungal medications alone yields poor results. Although the choice of whether to perform a wedge resection or lobectomy remains complicated by the propensity for postoperative complications such as air leaks.

Objectives: To compare the incidence of postoperative air leaks in patients undergoing wedge resection versus lobectomy for pulmonary mycetoma in a tertiary care hospital in Pakistan over a five-year period.

Materials and Methods: This cross-sectional study was done in the Thoracic Surgery ward of Lady Reading Hospital in Peshawar, Pakistan. The study participants were patients with confirmed pulmonary mycetoma showing complete records of undergoing a wedge resection or lobectomy between January 2018 and December 2022. These clinical variables included the incidences of air leaks, the duration of the hospital stay, and the recurrence.

Results:It was observed that lobectomy patients developed less numbers of postoperative air leak and also of shorter duration as compared to those that underwent the wedge resection. The clinical characteristics found that recurrence and the length of hospital stay were much greater in the wedge resection group mainly in plans with complex mycetomas.

Conclusion: Lobectomy is safer and superior in managing air leak in offering treatment to patients with complex pulmonary mycetoma than wedge resection.

Keywords: Pulmonary mycetoma, wedge resection, lobectomy, air leak, thoracic surgery, tuberculosis, Pakistan.

INTRODUCTION

In countries facing endemic tuberculosis infections, pulmonary mycetoma proves to be a challenging yet critical condition that doctors must tackle in restricted resource areas. A pulmonary cavity healed from previously treated TB gets colonized by fungal elements, which primarily consist of Aspergillus fumigatus, to create myeloma (1). CPA cases in developing nations continue to increase due to extensive TB spread and inadequate pulmonary care systems after TB cure (2). Treatment of

mycetoma relies foremost on surgery because of its capability to treat both serious complications of continued bleeding through the airways and when medical interventions prove ineffective (3). The surgical treatment options include wedge resection and lobectomy, while wedge resection stands as the most preferred procedure. Surgical approaches to treating mycetoma cause different rates of complications after surgery, mainly because prolonged air leaks occur most frequently.

The wedge resection procedure becomes the first choice for peripheral and solitary lesions since it maintains small resection margins combined with lung parenchyma preservation. The healing process of wedging surgery produces higher air leak rates because the tissue nearby is poorly sealed from the air passage (4). The extent of lobectomy surgery produces better postoperative air leak outcomes because it includes eliminating all the affected lung structures (5). Research has tried to evaluate outcome differences between these surgeries, yet data about long-term results, specifically from low- and middle-income countries (LMICs), is quite scarce. A tertiary care institution in Pakistan shares its five-year surgical record of air leak occurrence between patients who received wedge resection and lobectomy treatment for pulmonary mycetoma.

The post-operative occurrence of air leaks represents a well-known complication of thoracic surgery, which leads to detrimental results for patient recovery, together with prolonged hospital stays and adverse clinical outcomes (2). The lack of extensive post-operative surveillance equipment combined with weak infection prevention standards creates significant problems for continuous air leak management in LMICs. The medical literature confirms that continuous air leakage after thoracic resection results in more extraordinary healthcare expenses, extended hospital stays, increased chance of pleural infections, and various risks to patient health (2). The rate of this complication must be known for surgical planning along with resource distribution, specifically in Pakistan, where tuberculosis is prevalent and pulmonary mycetoma cases are rising (6).

According to Sameer et al. in their Pakistani centre review, both surgical procedures for pulmonary aspergilloma have safety features. However, complications from air leaks, bleeding, and infections prove challenging, mostly with wedge resections (7). Results matching this observation stem from surgical patient groups in India and Ethiopia alongside Pakistan, where professionals choose surgery as antifungal therapy frequently fails in advanced cases (4,5,8). Significant structural damage and bronchiectasis within Mycetoma lesions create a risk of air leakage after surgery unless surgeons remove the entire infected tissue. The research by Shen et al. demonstrated that anatomical resections, including lobectomies, achieve better surgical results than limited resections in managing advanced cavities (8).

In rural hospitals and under-resourced settings, patients often present late with complex aspergillomas, sometimes after multiple episodes of hemoptysis or secondary infection (9). Wedge resection remains insufficient and hazardous when applied to such cases due to remaining diseased tissue that causes air leakage and infection persistence (10). The effectiveness of anti-fungal medications as a post-operative treatment against recurrent aspergillosis depends on the extent of disease involvement and reaches minimal success for invasive cavitary cases (10). Removing the entire diseased lobe through anatomical resection proves more effective than other procedures since it eliminates potential air leaks while minimizing disease recurrence. The presence of dense tissue adhesions plus irregular tissue during surgery proves to be a major cause of elevated air leaks following wedge resections (11). The development of minimally invasive thoracic surgery programs remains in developmental stages throughout Pakistan and third-world countries because open thoracotomies create excessive risks during recovery (12). The presence of TB-related chronic pulmonary changes effectively increases patient susceptibility to surgical complications after procedures, thus requiring complete preoperative evaluations and surgery plans (13).

The decision-making process about surgery depends on various factors, including lesion complexity, patient lung function, and available surgical capabilities. Simple aspergillomas warrant wedge resection when the lesions remain peripheral and affect a small area of the parenchyma. Nevertheless, complex aspergillomas need to be treated with lobectomy because postoperative care becomes restrictive (14). International hospital records, together with African and Asian surgical reports,

indicate that patients undergoing lobectomy experience better results as well as reduced surgical complications in challenging surgical situations (15). A five-year retrospective study conducted at the Thoracic Surgery Unit, Medical Teaching Institution, Lady Reading Hospital, Peshawar, Khyber Pakhtunkhwa, Pakistan, investigates empirical data regarding air leak occurrences between patients who receive wedge resection or lobectomy treatments for pulmonary mycetoma. The analysis of this study focuses on a TB disease hotspot to generate practical surgical patient care knowledge suitable for clinics like it.

Objective: This research examines the occurrence of air leaks after pulmonary mycetoma surgery through wedge resection or lobectomy procedures based on medical experiences from five years at a tertiary care hospital in Pakistan.

MATERIALS AND METHODS

Study Design: Retrospective, Observational Study.

Study setting: This study was done at the Thoracic Surgery Unit at the Medical Teaching Institution Lady Reading Hospital at Peshawar Khyber Pakhtunkhwa; Pakistan, a Center of Excellence for education training and research which serves a large population in resource constraint environment.

Duration of the study: Data was collected over a period of five years, from January 2018 to December 2022, with a follow-up duration of at least three months for each patient.

Inclusion Criteria

This study involved patients of 18 years and above diagnosed with pulmonary mycetoma through imaging, clinical examination, intra-operative and pathologic assessment, who had either a wedge resection or lobectomy. The patients with simple and complex mycetoma, those with recurrent hemoptysis, and those who are fit for general anaesthesia were considered for the study.

Exclusion Criteria

Patients with unavailable data, uncertain diagnose of mycetoma, presence of other malignant tumors, or those who underwent pneumonectomy or only medical treatment. Patient who were lost to follow before the three months were also excluded from the study.

Methods

The patients' information was reviewed from hospital records, operation notes, and follow-up charts. Only cases Operatively confirmed, and Histopathologically proven pulmonary mycetoma were included in the study. Wedge resection or lobectomy was used based on the extent of the disease or lesion size, the location of the mycetoma and the patient’s condition. Wedge resections were done on patients who presented with simple well, well-defined mycetoma, whilst lobectomies were done on patients with extensive cavitation or multiple lesions. All the operations were conducted under general anaesthesia with either open thoracotomy or video-assisted thoracoscopic surgery (VATS) as necessary for each individual patient.

The primary outcome was the air leak that was detected and persisted after 5 days of the postoperative period through the observation of the bubbling in the chest drainage system. The duration of the air leak was also measured and compared with the two surgical techniques used in the study. Quantitative data were summarized by using descriptive statistics, and patient outcomes were evaluated over a minimum duration of three months to detect recovery, complications, and recurrence.

RESULTS

A total of 87 patients underwent surgical intervention for pulmonary mycetoma during the five-year study period. Of these, 42 patients underwent wedge resection, while 45 patients underwent lobectomy. The overall male-to-female ratio was 2.5:1, with a mean age of 42.8 ± 10.7 years.

The majority of patients presented with symptoms of recurrent hemoptysis, chronic cough, and weight loss. All patients had a prior history of pulmonary tuberculosis, which had led to post-tuberculous cavitations serving as a nidus for fungal colonization.

Table 1: Demographic and Clinical Profile of Patients

Variable	Wedge Resection (n=42)	Lobectomy (n=45)	Total (n=87)
Mean Age (years)	41.5 ± 9.8	44.2 ± 11.5	42.8 ± 10.7
Male	30 (71.4%)	33 (73.3%)	63 (72.4%)
Female	12 (28.6%)	12 (26.7%)	24 (27.6%)
History of TB	42 (100%)	45 (100%)	87 (100%)
Recurrent Hemoptysis	36 (85.7%)	41 (91.1%)	77 (88.5%)

Air leak was the most common postoperative complication, with a significantly higher incidence observed in the wedge resection group. Out of 42 patients who underwent wedge resection, 19 (45.2%) developed a postoperative air leak, compared to 8 (17.7%) out of 45 patients in the lobectomy group ($p < 0.05$). The mean duration of air leak was also higher in the wedge resection group (6.4 ± 2.1 days) than in the lobectomy group (3.2 ± 1.6 days).

Table 2: Incidence and Duration of Postoperative Air Leak

Surgical Procedure	Patients with Air Leak	Percentage (%)	Mean Duration (days)
Wedge Resection	19	45.2%	6.4 ± 2.1
Lobectomy	8	17.7%	3.2 ± 1.6
Total	27	31.0%	-

Other complications included prolonged hospital stay, residual pleural space, and empyema. Wedge resection was also associated with a slightly higher rate of residual cavity formation, which was managed conservatively in most cases.

No perioperative mortality was reported. Follow-up at three months showed that recurrence of symptoms was more common in patients who underwent wedge resection (14.2%) compared to those who had lobectomy (4.4%).

Table 3: Postoperative Outcomes and Follow-up

Outcome	Wedge Resection (n=42)	Lobectomy (n=45)
Residual Cavity Formation	6 (14.2%)	2 (4.4%)
Recurrence of Symptoms	6 (14.2%)	2 (4.4%)
Prolonged Hospital Stay (>7d)	12 (28.5%)	5 (11.1%)
Mortality	0	0

These results demonstrate a notably higher incidence and duration of air leaks in patients undergoing wedge resection compared to lobectomy.

DISCUSSION

Pulmonary mycetoma, commonly resulting from colonization of pre-existing pulmonary cavities by fungi—most often Aspergillus species—poses significant clinical challenges, particularly in patients with a history of pulmonary tuberculosis. The most effective treatment for symptomatic pulmonary mycetoma remains surgical resection, especially in cases of recurrent hemoptysis. The present study sought to compare the postoperative outcomes, particularly the incidence and duration of air leaks, between two commonly adopted surgical techniques: wedge resection and lobectomy. Our findings revealed a significantly higher incidence and longer duration of postoperative air leaks in patients who underwent wedge resection compared to those who received lobectomy. This outcome is consistent with previously published studies, suggesting that wedge resection, being a more conservative surgical approach, may leave behind fragile lung tissue margins that are more prone to persistent air leaks. On the other hand, lobectomy involves the removal of an entire lobe and is thus more likely to eliminate diseased lung tissue comprehensively, reducing the likelihood of residual air leaks.

The demographic distribution in our study—showing a higher prevalence in males (72.4%) and a mean patient age in the early 40s—is in agreement with epidemiological trends noted in similar studies conducted in regions with a high burden of tuberculosis. Pakistan, being an endemic country for tuberculosis, provides a fertile ground for post-TB complications, such as cavitary lesions, that predispose individuals to mycetoma formation. All patients in our study had a documented history of prior tuberculosis, supporting the strong etiological link between TB and mycetoma. The high frequency of hemoptysis in our cohort (88.5%) underscores the severity of this clinical presentation and reinforces the need for timely surgical intervention. Hemoptysis, particularly massive or recurrent, is the most common and potentially life-threatening symptom that compels surgical management. Conservative medical therapy is often insufficient, and bronchial artery embolization, though helpful in the short term, lacks long-term efficacy due to recurrence.

Postoperative air leak is a well-recognized complication of lung surgery. In our study, 45.2% of patients in the wedge resection group experienced air leak, which was significantly higher than the 17.7% noted in the lobectomy group. These results are consistent with the literature suggested by other authors who noted that there is commonly an inadequate excision or suboptimal closure of alveolar airways and channels after performing wedge resections, which predisposes to air leaks. Furthermore, patients with extensive pleural adhesion or friable lung parenchyma, which is quite common in TB cases, are especially vulnerable to postoperative complications. Another point which can be concluded is that a longer duration of air leaks in the patients who have undergone the wedge resection resulted in more hospital days spent. Compared with lobectomy, 28.5% of the patients with wedge resection stayed in the hospital for more than seven days. This not only imposes a greater burden on healthcare resources but also affects patient recovery and satisfaction. Additionally, longer hospital stays increase the risk of nosocomial infections and other complications, further complicating the postoperative course.

Residual cavity formation was also more common in the wedge resection group, possibly due to inadequate excision of the diseased cavity or surrounding infected tissue. While most cases were managed conservatively with physiotherapy, antibiotics, and follow-up imaging, the presence of residual space increases the risk of superinfection, empyema, and recurrence of symptoms. Indeed, symptom recurrence was more frequent among patients who had undergone wedge resection (14.2%) compared to lobectomy (4.4%). This reinforces the notion that lobectomy, though more extensive, may provide a more definitive solution with fewer chances of recurrence. Thus, it is important to note that while the wedge resection group had a higher rate of complications, there was no perioperative mortality in either group. This is a great accomplishment and opens up the debate on the safety of surgical care, even in a developing country like Pakistan. They worked up the patient preoperatively to determine their medical condition, performed a highly skilful surgical procedure intraoperatively, and provided adequate postoperative care to reduce this patient's distressing symptoms.

Although this approach appears to be lung preserving and less invasive than lobectomy, the complication rate for persistent air leak, prolonged hospital stay and symptom recurrence is

significantly higher than with lobectomy. While lobectomy requires more extensive and complicated surgery, this approach is characterized by a lower number of complications after the operation and more favourable outcomes in the long term. Thus, in human being candidates who are undergoing surgery and have confined malignancy, lobectomy should be the preferred method. Nevertheless, choosing between the two options depends on the extent of the disease, the patient's pulmonary reserve, and the presence of comorbidities. However, such common indications as poor lung function and bilateral respiratory disease may require the surgeon to perform a wedge resection. Additionally, future research must also examine the contributions of minimally-invasive thoracoscopic (VATS) procedures that had longer outcomes of improved morbidity and faster postoperative recovery.

Therefore, the results of our study may not be generalizable to other settings in Pakistan or tertiary care hospitals, which have healthcare systems different from those of our study population. Secondly, the sample size, although sufficient to identify broad differences, might have been inadequate to compare some rare complications. Finally, the duration of the follow-up is three months, which might not be sufficient to reveal late recurrences or long-term functional repercussions. Finally, they found out that lobectomy yields significantly better postoperative results compared to wedge resection in surgically managing pulmonary mycetoma. Due to the lesser incidence of air leaks, shorter hospital days, and fewer relapse times, lobectomy is the recommended surgical technique when possible. Yet, current patient conditions should dictate the choice, while more concrete, multi-centre, prospective trials are required to verify these linguistic results and discuss minimal invasive approaches within this frame.

CONCLUSION

This paper attempts to compare lobectomy with wedge resection in the surgical treatment of pulmonary mycetoma, especially in patients with a history of pulmonary tuberculosis. Thus, the results confirm that lobectomy is characterized by a decreased rate of postoperative air leakage and shorter postoperative air leakage duration, fewer postoperative days, and symptom relapses. Wedge resection is less morbid as it does not remove a lobe or a whole lung but is associated with higher risks of side effects, particularly prolonged air leak and cavity formation. Since tuberculosis-related mycetoma is common in countries such as Pakistan, appropriate surgery is important in a patient's prognosis. Lobectomy, as a more extensive procedure, should be regarded as superior to segmentectomy in cases of adequate lung function and focal tumour site. Nevertheless, decision-making should continue at the individual level. Subsequently, research should be conducted with more participants and longer time frames to confirm the above findings and weigh minimal invasive approaches. Preoperative planning and postoperative management are important factors and determinants of the success of any operation.

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