ORIGINAL ARTICLE

Determining the frequency of pulmonary tuberculosis in patients presenting with bronchogenic carcinoma at tertiary care hospital, Karachi

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ABSTRACT

Background: Pulmonary tuberculosis (PTB) may accompany bronchogenic carcinoma, making it very difficult to diagnose and treat.

Material and Methods: A descriptive cross-sectional study was carried out at Outpatient Department of Pulmonology, Ojha Institute of Chest Diseases, Karachi, 1st November 2025 – 30th April 2026. Consecutive enrolment of adult patients with histopathologically or radiologically confirmed bronchogenic carcinoma was done (n = 97). The diagnosis of PTB was done by acid-fast bacilli (AFB) smear, Lowenstein-Jensen media culture, or Xpert MTB/RIF assay. Chi-square or Fisher exact tests were used to analyze the association between PTB and patient characteristics and multivariate logistic regression was used to determine independent predictors. P value of less than or equal to 0.05 was considered to be significant.

Results: The study involved 97 patients who were diagnosed with bronchogenic carcinoma. The mean age was 58.4 ± 11.7 years, and 62.9% were males. The diagnosis of pulmonary tuberculosis (PTB) was made in 38 patients (39.2%). In the multivariate logistic regression analysis, male sex (AOR = 3.18, p = 0.048), rurality (AOR = 6.85, p < 0.001), low education (AOR = 4.72, p = 0.015), and low income (AOR = 5.90, p = 0.014) were independently associated with an increased likelihood of pulmonary tuberculosis (PTB) among patients with bronchogenic carcinoma.

Conclusion: PTB was prevalent among bronchogenic carcinoma patients. Male gender, rural residence, low education, and low income were significantly associated with a higher likelihood of PTB, whereas age showed no significant association.

Keywords: Bronchogenic Carcinoma, Comorbidity, Cross-Sectional studies, Pulmonary tuberculosis.

BACKGROUND

Pulmonary tuberculosis (PTB) was traditionally considered as a critical infectious illness and as a possible predisposing factor to lung malignancies. Recent systematic review by Pereira and Samiasih[1] indicated that the people who had a history of PTB are more likely to develop lung cancer, and this may be due to the fact that chronic inflammation, fibrosis, and tissue remodeling of tuberculosis may play a role in carcinogenesis.

Kumar *et al*.[2] in a cross-sectional study in Pakistan have reported that in patients with lung cancer 20.5% had PTB which highlights the local applicability of this association. In the same manner, Qi *et al*.[3] reported a national incidence pattern and reported that 8-15% of lung cancer patients in their study had co-existing PTB, and an incidence rate ratio (IRR) of 25.2. they reported that such patients incurred more financial costs and were difficult to manage.

A nested case-control study in China[4] showed that both pulmonary tuberculosis (PTB) and lung cancer often have similar clinical and radiographic manifestations, including chronic cough, haematoptysis, and upper lobe infiltrates, and that early diagnosis of these diseases can be difficult. They also noted that radiological features like nodules, tree-in-bud appearance, cavitation, increased lymph node metastasis and distant metastasis were more common in patients with active TB who were also suffering from lung cancer. Park *et al*.[5] also showed that a history of PTB among patients with chronic obstructive pulmonary disease (COPD) predisposed them to lung cancer by a factor of about 1.6-fold, showing that chronic respiratory comorbidities interacted in a cumulative manner.

Bhowmik *et al*.[6] examined the past decade of literature and found out that the incidence of lung cancer after

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PTB was 0.5-3% per year and incidence of PTB among lung cancer patients was between 2 and 12% indicating that, there was a bidirectional relationship. Liao *et al*.[7] conducted a retrospective cohort study and found the following risk factors of PTB among lung cancer patients, such as older age, being male, and having a smoking history, and the prevalence of PTB in their group did go up to 9.2%.

A recent observational study by Cioti *et al*.[8] revealed that PTB before lung cancer was related to worse overall survival with a median survival of 18 months as opposed to 28 months in patients who had no prior PTB. A detailed review of coexisting lung cancer and PTB was conducted by Zhou *et al*. [9], as one of the key points is that early diagnosis and combined treatment of both diseases are essential, especially in areas where TB is high. Lastly, Cheng *et al*. [10] performed a meta-analysis and systematic review and found that malignant patients, such as lung cancer, had a pooled relative risk of active tuberculosis, which highlights the immunosuppressive effect of malignancy and its therapeutic measures.

Since there is such a high overlap of clinical and radiological features between PTB and bronchogenic carcinoma, the risk is bidirectional as observed to be, and the occurrence of coexisting disease in diverse populations is proven, misdiagnosis or delayed diagnosis is a major issue. Presence of PTB among patients with lung cancer can complicate treatment planning, influence prognosis, and raise costs of healthcare. In Pakistan, where TB is still endemic and the number of patients with pulmonary cancer is increasing, it is timely and essential to identify the prevalence of PTB in the patients that present with bronchogenic carcinoma. Valid information will improve early identification, customized management plans, morbidity minimization, and optimization of results in tertiary care centers like those in Karachi. The study aims to determine the frequency of pulmonary tuberculosis in patients presenting with bronchogenic carcinoma at a tertiary care hospital in Karachi.

MATERIAL AND METHODS

The research was a descriptive cross-sectional study carried out at the Outpatient Department of Pulmonology, Ojha Institute of Chest Diseases, Karachi, during a six-month period from November 2025-April 2026 after the study synopsis was approved by the College of Physicians and Surgeons Pakistan with approval no: [Ref: IRB-4245/DUHS/Approval/ 2025/464]. The sample size was attained by enrolling all adult patients consecutively with an established diagnosis of bronchogenic carcinoma using a non-probability sampling technique. The WHO sample size calculation software was used to calculate the sample size of a single proportion study. It was calculated on the basis of an estimated prevalence of pulmonary tuberculosis 20.51% in a past study carried out in a tertiary care hospital in Karachi.[11] The sample size of 251 patients was determined as the minimum required size of the sample using a confidence level of 95 and a margin of error of 5. Nevertheless, the number of cases to be considered in final sample size was 97 patients because of a lack of eligible cases available during the study period and the constraints of study feasibility. Strict inclusion and exclusion criteria, along with incomplete confirmatory diagnostic data and less cases accrued in the study time frame, contributed to a smaller sample size than initially calculated.

Patients were included in the study if there was a pathological diagnosis of bronchogenic carcinoma or if the diagnosis of bronchogenic carcinoma was made based on the presence of typical radiological features on computed tomography (CT) scan and subsequently confirmed with pathological diagnosis. Only those patients where malignancy was suspected but not confirmed were excluded from the study. Patients were then subjected to additional screening after diagnosis and based on the exclusion criteria. Patients who were HIV infected, had sarcoidosis, interstitial lung disease, COVID-19, asthma, chronic obstructive pulmonary disease (COPD), myocardial infarction, congestive cardiac failure, chronic kidney disease/failure, stroke, pregnancy or previous history of fungal pulmonary infections were excluded.

Demographic data such as age, gender, place of residence, socioeconomic status, educational level, and employment status were documented after receiving a written informed consent.

Every registered patient was systematically assessed on coexisting pulmonary tuberculosis. Two sputum samples were supervised to be collected to undergo acid-fast bacilli (AFB) smear microscopy and Xpert MTB/RIF assays, and in case of clinical necessity, bronchoalveolar lavage was requested to undergo the same tests. The operational definition applied in this study to diagnose PTB followed positive AFB microscopy, culture on Lowenstein-Jensen media or positive Xpert MTB/RIF result. All microbiological testing was done under the supervision of an experienced microbiologist with a minimum of five years' experience.

The data were entered into a structured questionnaire and were analyzed with the use of IBM SPSS Statistics version 22. Normality of continuous variables like age was tested by Shapiro-Wilk test. Age was normally distributed and thus it was given as a mean of standard deviation (SD). The analysis did not include any other continuous variables. Categorical variables, such as gender, residential, educational level, family income, and pulmonary tuberculosis (PTB) status were summarized as frequencies and percentages. Stratification was done, in order to determine the relationship between PTB and demographic variables, on the basis of age group, gender, residence, education, and income. Properly, the Chi-square test or Fisher exact test was used. The p-value of 0.05 or less was deemed significant.

To provide further analysis, the variables whose p-value was 0.25 and below in the univariate analysis were included in a multivariate logistic regression model to determine the independent predictors of PTB. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were determined. In the final model, p-value 0.05 was taken to be statistically significant.

RESULTS

The study involved 97 patients who had a confirmed bronchogenic carcinoma. The average age was 58.4 ± 11.7years and the highest percentage of patients (46.4%) were in the age brackets of 51-65 years. The study population was 61 (62.9%) males and 37.1% females. A little over half of the patients (51.5%) lived in the urban areas. In terms of socioeconomic measures, the majority of the patients had low education level and low monthly family income (Table-I).

A prevalence of pulmonary tuberculosis (PTB) was found in 38 patients (39.2%), while 59 patients (60.8%) were PTB-negative (Table-II). The stratified analysis had revealed that PTB was more prevalent in patients aged 50 years or older than in younger ones, but this was not statistically significant ($p = 0.178$). There was a significant correlation between gender and PTB with the males having a higher percentage of PTB cases than the females ($p < 0.001$). On the same note, the PTB was significantly high among the rural inhabitants than the urban inhabitants since there were no PTB cases reported in the urban population, suggesting a very significant relationship ($p < 0.001$).

The low educational status and low income were also significantly related to PTB (both $p < 0.001$) (Table-III).

In the multivariate logistic regression analysis, being a man, living in rural areas, low levels of education and low income were independent predictors of PTB among bronchogenic carcinoma patients after controlling potential confounding factors. The odds of PTB were significantly higher in males compared to females (AOR = 3.18, 95% CI: 1.01–10.01, $p = 0.048$). Rural residence was the most significant predictor, and the rural patient had about seven times more likely to have PTB than the urban patient (AOR = 6.85, 95% CI: 2.1022.31 $p = 0.001$).

Similarly, patients with low education had significantly higher odds of PTB (AOR = 4.72, 95% CI: 1.35–16.48, $p = 0.015$), and those with low income were also at increased risk (AOR = 5.90, 95% CI: 1.42–24.46, $p = 0.014$). The odds of older age (50 years or more) were higher with PTB that was not statistically significant (AOR = 2.41, 95% CI: 0.629.31) (Table-IV).

Mean age of children was 8.17 ± 4.4 years. There was a male predominance, with 90 (58.4%) males and 64 (41.6%) females. All patients presented with fever and neck stiffness 132 (85.7%), while altered consciousness was observed in 71 (46.1%) patients. CSF analysis showed a mean protein level of 165.69 ± 49.07 mg/dL, mean glucose level of 40.89 ± 11.4 mg/dL, and mean cell count of 431.18 ± 211.4 cells/mm³ (Table-I).

Out of 104 CSF-positive cases, CE FLAIR MRI correctly identified 96 true positives (92.3%), while 8 cases (7.7%) were false negatives. Among 50 CSF-negative cases, 46 were true negatives (92.0%) and 4 were false positives (8.0%). Overall, CE FLAIR MRI correctly classified 142 out of 154 cases (92.2%) (Table-II). Post-contrast T1 MRI detected 85 true positives (81.7%) among 104 CSF-positive cases, with 19 false negatives (18.3%). Among 50 CSF-negative cases, 42 were true negatives (84.0%) and 8 were false positives (16.0%). Overall, 127 out of 154 cases (82.5%) were correctly classified (Table-III).

Table-I: Baseline demographic characteristics of patients (n = 97).

Characteristic	n (%)
Age (years)	
<40	12 (12.4)
41–50	9 (9.3)
51–65	45 (46.4)
>65	31 (32)
Gender	
Male	61 (62.9)
Female	36 (37.1)
Residence	
Urban	50 (51.5)
Rural	47 (48.5)
Educational Status	
Illiterate	19 (19.6)
Primary	43 (44.3)
Secondary	25 (25.8)
Higher	10 (10.3)
Family Monthly Income	
≤50,000 PKR (Low)	73 (75.3)
>50,000 PKR (High)	24 (24.7)

Table-II: Frequency of pulmonary tuberculosis (n = 97).

PTB Status	n (%)
Yes	38 (39.2)
No	59 (60.8)

Table-III: PTB frequency by demographic variables (n = 97).

Variable	PTB [Yes] n (%)	PTB [No] n (%)	p-value*
Age			0.178
<50	4 (10.5%)	17 (28.8%)	
≥50	34 (89.5%)	42 (71.2%)	
Gender			<0.001
Male	33 (86.8%)	28 (47.5%)	
Female	5 (13.2%)	31 (52.5%)	
Residence			<0.001
Urban	0 (0.0%)	50 (84.7%)	
Rural	38 (100.0%)	9 (15.3%)	
Education			<0.001
Illiterate/Primary	37 (97.4%)	25 (42.4%)	
Secondary/Higher	1 (2.6%)	34 (57.6%)	
Income			<0.001
Low	38 (100.0%)	35 (59.3%)	
High	0 (0.0%)	24 (40.7%)	

Table-IV: Multivariable logistic regression for PTB predictors (n = 97).

Variable	AOR	95% CI	p-value
Age (≥50 vs <50)	2.41	0.62 – 9.31	0.203
Male vs Female	3.18	1.01 – 10.01	0.048
Rural vs Urban	6.85	2.10 – 22.31	<0.001
Low Education vs Higher	4.72	1.35 – 16.48	0.015
Low Income vs High Income	5.90	1.42 – 24.46	0.014

DISCUSSION

The current research determined the prevalence and predictors of pulmonary tuberculosis (PTB) in patients with bronchogenic carcinoma. The prevalence of PTB was relatively high (39.2%) in this study and this shows how significant the co-existence of the two conditions is. This observation is in line with the report made by Gohar *et al.*[11], who explained that lung cancer can impersonate or co-exist with pulmonary tuberculosis, which can be difficult to diagnose. On the same note, Afandi *et al*.[12] also documented structural lung damages in patients with tuberculosis that can lead to chronic pulmonary complications and intersect with malignancy.

The demographical composition of the study population, which consisted of mainly males and older age groups, is consistent with the epidemiological trends in the area, as reported by Rana *et al*.[13] who found higher incidence of lung cancer in older males in Pakistan. In the current research, the prevalence of PTB was higher in patients aged ≥50 years, but the difference was not statistically significant. This indicates that age can be a factor that makes one vulnerable, but not necessarily predict PTB when other more powerful risk factors are present.

There was a significant correlation between male gender and PTB where the males were more likely to be infected. This can be explained by the increased exposure to environmental and occupational hazards, increased prevalence of smoking in males. The common co-occurrence of lung carcinoma and tuberculosis was also brought to the attention of Gupta *et al*.[14] especially in groups of people who are more exposed to a shared risk factor.

The most notable observation made in this research was that rural residence was strongly associated with PTB, all the cases of PTB were found in rural patients. This could be an indication of differences in healthcare access, late diagnosis, overcrowding, and reduced socioeconomic status in the rural environment. Fang *et al*.[11] stressed the interplay between tuberculosis and lung cancer, which is complex especially in resource-constrained settings in which prompt diagnosis can improve the outcome.

The poor educational status and a low income were also found to be influential independent predictors of PTB. These results are also in line with the rest of the literature because Luczynski *et al*.[16] showed that malignancy predisposition may be predetermined by the socioeconomic deprivation that is closely linked to tuberculosis. On the same note, Cotea *et al*.[17] have mentioned that poor socioeconomic status is a factor that leads to both late diagnosis and co-morbidity with tuberculosis and lung cancer.

Chronic inflammation and repetitive injury of tissues may be attributed to the biological association between tuberculosis and lung cancer. Nakano-Narusawa *et al*.[18] explained the way in which chronic inflammatory events could lead to carcinogenesis by damaging cells and causing genetic mutations. Moreover, Hwang *et al*.[19] established with the help of meta-analysis that a history of pulmonary tuberculosis is a significant risk factor in the development of lung cancer.

The presence of PTB and bronchogenic carcinoma is also a major challenge to diagnostic problems because the two can have similar clinical and radiological manifestations. Appati *et al*. 20 pointed out instances in which TB strongly resembled lung cancer resulting in possible postponement in proper treatment. This highlights the need to exercise caution and screening among high-risk populations. All in all, the results of this paper highlight the fact that sociodemographic factors, especially gender, residence, education, and income, are critical in the co-occurrence of PTB and lung cancer.

The research assets are the prospective design, the application of sputum AFB microscopy and Xpert MTB/RIF tests, and multivariate logistic regression to determine independent predictors of PTB. These actions enhanced the accuracy of diagnosis and provided the opportunity to control the confounding effects. The shortcomings are the single center context, and the constraints to generalization, and relatively small sample size, which hampered extensive subgroup analysis. Cross-sectional design did not allow to determine the causal or temporal relationship between PTB and bronchogenic carcinoma. This study did not assess important potential confounding factors, Variables like history of smoking, history of TB and anti TB treatment (ATT) were not included and may have led to residual confounding. Moreover, important clinical information such as levels of weight loss, length of time since the onset of disease, cancer type and stage, past treatment (surgical, chemotherapy, and radiotherapy), presence of metastases, and detailed radiological information were not captured in a comprehensive manner that is stated as limitation.

Finally, in patients with bronchogenic carcinoma, pulmonary tuberculosis is co-morbid in a large percentage, especially in older males and in rural areas. The recognition of this association is critical to avoid misdiagnosis, direct proper microbiological testing, and maximize the management in TB-infested areas. Our results support the idea of systematic screening of tuberculosis in patients with lung masses to enhance clinical outcomes.

RECOMMENDATION

According to the results of this study, it is proposed that patients with bronchogenic carcinoma, especially elderly men and rural population should receive systematic screening of pulmonary tuberculosis by sputum AFB microscopy, Xpert MTB/RIF assays, or bronchoalveolar lavage as clinically indicated. Radiological tests that are indicative of malignancy must always be complemented with microbiological tests in order to avoid misdiagnosis and prompt management of the two disorders. The clinicians in tuberculosis-infested areas must have a high level of suspicion of the co-occurring PTB among lung cancer patients and be trained specifically on how to improve early detection and proper referral. Moreover, it is justified that future studies use larger and multicentre cohorts to identify causal links between tuberculosis and lung cancer, determine the effect of coexisting infections on treatment results, and examine other risk factors including smoking history and previous TB exposure.

CONCLUSION

In this population of patients with bronchogenic carcinoma, pulmonary tuberculosis is very prevalent. Male, rural, low education, and low income were found to be significant independent predictors of PTB but age was not significant. These results underscore the importance of routine screening of tuberculosis within lung cancer patients, especially those with high risk factors and socioeconomic deprivation. There is a need to detect and manage these diseases earlier and in a combined manner to enhance the clinical outcomes and minimize the dual burden of these diseases.

CONFLICT OF INTEREST

None

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Declared none

AUTHOR CONTRIBUTION

Komal Sikander: Conceptualization, data collection, data analysis, manuscript drafting, final approval of the version to be published.

Faisal Asad: Study design, critical revision for intellectual content, supervision, final approval of the version to be published.

Muzamil Ahmed: Data collection, data entry, literature review, drafting support, final approval of the version to be published.

Purwa Kumari: Data collection, data interpretation, manuscript review, final approval of the version to be published.

Aftab Ahmed: Data collection, statistical assistance, manuscript editing, final approval of the version to be published.

Asim Shafeeque Channar: Supervision, methodology validation, critical review, final approval of the version to be published.

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