



Age and Sex Distribution of Bronchoscopic Biopsy Diagnoses in Patients Undergoing Diagnostic Bronchoscopy: A Single-Centre Observational Study.

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Abstract

Background: Bronchoscopy is an important diagnostic procedure for the evaluation of patients with suspected pulmonary malignancy and selected granulomatous lung diseases. The diagnostic spectrum obtained from bronchoscopic specimens may vary according to patient characteristics, including age and sex. Evaluation of these patterns can provide useful information regarding the clinical profile of patients undergoing diagnostic bronchoscopy. Aim: To evaluate the age- and sex-wise distribution of diagnostic findings among patients undergoing diagnostic bronchoscopy and to describe the distribution of granulomatous inflammation, small cell lung carcinoma (SCLC), non-small cell lung carcinoma (NSCLC) and inconclusive specimens across different age groups. **Materials and Methods:** This single-centre observational study included 100 patients who underwent diagnostic bronchoscopy. Patients were categorised into three age groups: <40 years, 40–60 years and >60 years. Bronchoscopic diagnostic findings were classified as granulomatous inflammation, SCLC, NSCLC or inconclusive. Categorical variables were expressed as frequencies and percentages. The distribution of diagnoses according to age and sex was evaluated descriptively. **Results:** Of the 100 patients, 78 (78.0%) were males and 22 (22.0%) were females. The majority of patients were aged >60 years (64, 64.0%), followed by 40–60 years (30, 30.0%) and <40 years (6, 6.0%). NSCLC was the most frequent diagnostic category, observed in 42 (42.0%) patients, followed by SCLC in 20 (20.0%), granulomatous inflammation in 16 (16.0%) and inconclusive specimens in 22 (22.0%). Malignant diagnoses accounted for 62 (62.0%) cases. The proportion of malignant diagnoses increased with age, with no malignant diagnosis observed in the <40-year group in the underlying distribution. Among patients aged >60 years, malignant diagnoses constituted the majority of bronchoscopic diagnoses. NSCLC showed a marked male predominance. **Conclusion:** In this single-centre bronchoscopic series, malignant diagnoses, particularly NSCLC, constituted the predominant diagnostic category and were concentrated among older patients. The findings highlight the importance of age and sex distribution when interpreting bronchoscopic diagnostic patterns. Larger prospective studies incorporating clinical, radiological and procedural characteristics are required to evaluate factors associated with diagnostic yield and inconclusive specimens.

Keywords: Bronchoscopy; Granulomatous inflammation; Lung neoplasms; non-small cell lung carcinoma; Small cell lung carcinoma.



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INTRODUCTION

Flexible bronchoscopy is an established diagnostic procedure in respiratory medicine and is routinely used for the evaluation of patients with suspected pulmonary malignancy, infectious diseases and other bronchopulmonary disorders. It permits direct visualisation of the tracheobronchial tree and enables acquisition of diagnostic material through bronchial washings, brushings, endobronchial biopsy, transbronchial biopsy, bronchoalveolar lavage and needle-based sampling techniques [1]. The Indian guidelines for diagnostic flexible bronchoscopy emphasise appropriate patient selection and the use of suitable sampling techniques according to the clinical and radiological characteristics of the suspected lesion [1].

Bronchoscopy plays an important role in establishing the diagnosis of suspected lung cancer, particularly when histopathological or cytological confirmation is required. The diagnostic yield of bronchoscopy is influenced by several factors, including lesion location, size, bronchoscopic visibility and the sampling modality employed [2,3]. Different bronchoscopic techniques have variable diagnostic performance, and the use of complementary sampling methods may improve the probability of obtaining a definitive diagnosis [3]. Studies evaluating bronchoscopy for peripheral pulmonary

lesions have also demonstrated that diagnostic yield and procedure-related outcomes may vary according to lesion and procedural characteristics [4]. Therefore, an inconclusive bronchoscopic specimen should not be considered equivalent to exclusion of malignancy and should be interpreted in conjunction with clinical and radiological findings.

Lung cancer comprises distinct histological entities with important differences in biological behaviour, treatment and prognosis. The distinction between small cell lung carcinoma (SCLC) and non-small cell lung carcinoma (NSCLC) remains clinically important in the initial diagnostic evaluation of suspected lung cancer [5]. Contemporary classification of thoracic tumours has further evolved to incorporate histomorphological, immunohistochemical and molecular characteristics, thereby increasing the importance of obtaining adequate diagnostic tissue for accurate tumour classification and subsequent management [6,7]. In addition to malignant lesions, bronchoscopic specimens may demonstrate granulomatous inflammation, which may represent infectious or non-infectious disease and requires appropriate correlation with clinical, radiological and microbiological findings [1,8].

The demographic profile of patients undergoing diagnostic bronchoscopy may provide useful information regarding the diagnostic spectrum encountered in routine clinical practice. In particular, evaluation of age and sex distribution may help describe the demographic pattern of malignant and non-malignant bronchoscopic diagnoses within an institution. However, the distribution observed in a bronchoscopy cohort should be interpreted as an institutional diagnostic pattern rather than as an estimate of disease incidence or population-level risk. Therefore, the present study was undertaken to evaluate the age- and sex-wise distribution of bronchoscopic diagnoses among patients undergoing diagnostic bronchoscopy at a single centre, with particular emphasis on granulomatous inflammation, SCLC, NSCLC and inconclusive specimens.

MATERIALS AND METHODS

Study Design and Study Population

This was a single-centre observational study conducted over a period of 12 months. A total of 100 patients undergoing diagnostic bronchoscopy were included in the study. The study aimed to evaluate the age- and sex-wise distribution of bronchoscopic diagnoses, including granulomatous inflammation, small cell lung carcinoma (SCLC), non-small cell lung carcinoma (NSCLC) and inconclusive specimens. Patients were categorised into three age groups: less than 40 years, 40–60 years and more than 60 years.

Data Collection and Diagnostic Classification

Demographic and diagnostic data were collected from the available clinical and histopathological records of the included patients. The variables analysed included age group, sex and bronchoscopic diagnostic category. The diagnoses were classified into four categories: granulomatous inflammation, SCLC, NSCLC and inconclusive specimens. Malignant diagnoses comprised SCLC and NSCLC. Specimens for which a definitive diagnosis was not established were classified as inconclusive. The diagnostic findings were subsequently analysed according to age group and sex.

Statistical Analysis and Ethical Considerations

The collected data were entered and analysed using Statistical Package for the Social Sciences (SPSS), version 25.0. Categorical variables were expressed as frequencies and percentages. The distribution of diagnostic categories was assessed across the predefined age groups and between males and females. The proportion of malignant diagnoses was calculated by combining SCLC and NSCLC cases. Results were presented in tabular form for ease of interpretation. Ethical approval details, including the name of the Institutional Ethics Committee and approval number, should be incorporated according to the actual approval obtained for the study. Patient confidentiality was maintained during data handling, and informed consent or waiver requirements should be reported in accordance with the applicable institutional guidelines.

RESULTS

Overall diagnostic distribution

The provisional dataset suggests that NSCLC was the most frequent diagnostic category, followed by inconclusive specimens, SCLC and granulomatous inflammation.

Table 1. Distribution of bronchoscopic diagnoses according to sex (provisional, n=100)

Diagnostic category	Male, n (%)	Female, n (%)	Total, n (%)
Granulomatous inflammation	6 (7.7)	10 (45.5)	16 (16.0)
SCLC	16 (20.5)	4 (18.2)	20 (20.0)
NSCLC	40 (51.3)	2 (9.1)	42 (42.0)
Inconclusive	16 (20.5)	6 (27.3)	22 (22.0)
Total	78 (100)	22 (100)	100 (100)

Table 1 shows that NSCLC was the most frequent diagnosis, accounting for 42% of the study population, followed by inconclusive biopsy findings (22%), SCLC (20%), and granulomatous inflammation (16%). Among males, NSCLC was the predominant diagnosis, whereas granulomatous inflammation was the most frequent category among females.

Table 2. Age-wise and sex-wise distribution of patients (N = 100)

Age group (years)	Male, n (%)	Female, n (%)	Total, n (%)
Below 40 years	2 (2.6)	4 (18.2)	6 (6.0)
40–60 years	20 (25.6)	10 (45.5)	30 (30.0)
Above 60	56 (71.8)	8 (36.4)	64 (64.0)
Total	78 (100.0)	22 (100.0)	100 (100.0)

As shown in Table 2, most patients were aged above 60 years (64%), followed by those aged 40–60 years (30%). Only 6% of patients were below 40 years of age. The majority of male patients belonged to the above-60-year age group, while the largest proportion of female patients was in the 40–60-year age group.

Table 3. Distribution of bronchoscopic diagnoses across age groups (N = 100)

Diagnosis	Below 40 years, n (%)	40–60 years, n (%)	Above 60 years, n (%)	Total, n (%)
Granulomatous inflammation	6 (100.0)	6 (20.0)	4 (6.3)	16 (16.0)
SCLC	0 (0.0)	4 (13.3)	16 (25.0)	20 (20.0)
NSCLC	0 (0.0)	12 (40.0)	30 (46.9)	42 (42.0)
Inconclusive biopsy	0 (0.0)	8 (26.7)	14 (21.9)	22 (22.0)
Total	6 (100.0)	30 (100.0)	64 (100.0)	100 (100.0)

Table 3 demonstrates variation in diagnostic patterns across age groups. All patients below 40 years were classified as having granulomatous inflammation in this provisional dataset. Among patients aged 40–60 years, NSCLC was the most frequent diagnosis (40%), followed by inconclusive biopsy findings (26.7%). In patients above 60 years, NSCLC was the predominant diagnosis (46.9%), followed by SCLC (25%) and inconclusive biopsy findings (21.9%).

Table 4. Distribution of malignant and non-malignant or inconclusive findings by age group (N = 100)

Age group (years)	Malignant diagnosis, n (%)	Granulomatous inflammation, n (%)	Inconclusive biopsy, n (%)
Below 40	0 (0.0)	6 (100.0)	0 (0.0)
40–60	16 (53.3)	6 (20.0)	8 (26.7)
Above 60	46 (71.9)	4 (6.3)	14 (21.9)
Total	62 (62.0)	16 (16.0)	22 (22.0)

Table 4 shows that malignant diagnoses accounted for 62% of the provisional study population. The proportion of malignant diagnoses was higher in the above-60-year age group (71.9%) than in the 40–60-year age group (53.3%). No malignant diagnosis was recorded in the below-40-year group in this provisional dataset. Granulomatous inflammation was more frequent among younger patients, while inconclusive biopsy findings occurred across the older age groups.

DISCUSSION

Age and Sex Distribution

In the provisional dataset, 78% of patients were male and 22% were female. Patients aged above 60 years constituted the largest age group (64%), followed by those aged 40–60 years (30%). This pattern suggests that the study population was predominantly older and male. Such a distribution may be encountered in bronchoscopy populations investigated for suspected lung malignancy, although the proportions can vary according to referral patterns, smoking exposure, occupational risks, and the indications for bronchoscopy.

The predominance of older patients is clinically relevant because the likelihood of lung cancer generally increases with advancing age. However, age and sex distributions alone cannot establish the risk of malignancy in a population. Interpretation should also consider the clinical and radiological indications for bronchoscopy, smoking history, comorbidities, and the selection criteria used for patient recruitment. Therefore, these demographic findings should be interpreted as characteristics of the study population rather than estimates of disease prevalence in the general population.

Diagnostic Spectrum of Bronchoscopic Biopsy Specimens

In the provisional results, NSCLC was the most frequent diagnosis, accounting for 42% of cases, while SCLC accounted for 20%. Together, these categories represented 62% of the study population. Granulomatous inflammation was identified in 16% of cases, whereas 22% had inconclusive biopsy findings.

The predominance of malignant diagnoses may reflect the clinical selection of patients referred for bronchoscopy because of suspected lung cancer. However, the proportion of malignancy in this study should not be interpreted as the prevalence of lung cancer in the community, since patients undergoing diagnostic bronchoscopy constitute a selected clinical population. The observed diagnostic spectrum may vary according to radiological findings, lesion location, clinical suspicion, referral practices, and the bronchoscopic sampling technique employed.

The distinction between SCLC and NSCLC is important because these malignancies differ in histopathological characteristics, biological behaviour, and treatment approaches. Histopathological examination of bronchoscopic specimens can provide essential diagnostic information and guide further investigations and management. The World Health Organization classification of thoracic tumours also emphasises the importance of appropriate histological classification of lung neoplasms [6,7].

Association Between Age and Malignant Diagnoses

The provisional analysis showed that malignant diagnoses accounted for 53.3% of patients aged 40–60 years and 71.9% of patients above 60 years. NSCLC was the most frequent diagnosis in both of these age groups. In contrast, all patients below 40 years were classified as having granulomatous inflammation in the provisional dataset.

This pattern is consistent with the general clinical understanding that lung malignancy is more frequently encountered in older adults. Nevertheless, the absence of malignant diagnoses in the youngest age group should be interpreted cautiously because this group contained only six patients in the provisional analysis. A small subgroup can produce unstable percentages, and these findings cannot establish that malignancy is absent among younger patients.

The relationship between age and malignant diagnosis should ideally be evaluated using the verified patient-level data and an appropriate statistical test. If the objective is to assess an association between age category and diagnostic outcome, a chi-square test may be used when its assumptions are satisfied; Fisher's exact test may be preferable when expected cell counts are small. Effect estimates and p-values should be reported only after analysis of the actual dataset.

Inconclusive Biopsy Findings and Diagnostic Yield

Inconclusive biopsy findings accounted for 22% of cases in the provisional results. This is an important consideration because a biopsy that does not establish a specific diagnosis does not necessarily exclude malignancy or another underlying disease. The interpretation of a nondiagnostic specimen should take into account the clinical presentation, radiological appearance, lesion accessibility, and adequacy of the collected tissue.

In a multicentre registry study of 581 patients undergoing bronchoscopy for peripheral lung lesions, Ost et al. reported a diagnostic result in 53.7% of patients. Diagnostic yield varied according to sampling methods and lesion characteristics, and the use of peripheral transbronchial needle aspiration was associated with improved yield [9]. These findings highlight that the diagnostic performance of bronchoscopy depends on more than the procedure itself; the lesion being investigated and the sampling technique also influence the likelihood of obtaining a definitive diagnosis.

The proportion of inconclusive specimens in the present study cannot be directly compared with the diagnostic yield reported by Ost et al. because the study populations, lesion characteristics, sampling techniques, and definitions of diagnostic success may differ. Nevertheless, both findings emphasise the need to interpret inconclusive specimens carefully and to consider further investigation when clinical suspicion remains high.

Strengths and Limitations

A strength of the proposed study is its focus on the age-wise and sex-wise distribution of bronchoscopic biopsy diagnoses within a defined single-centre population. Presenting the diagnostic spectrum across age categories may help identify patterns that warrant further evaluation in larger studies.

Several limitations should be acknowledged. First, the single-centre design and sample size of 100 patients may limit the generalisability of the findings. Second, the diagnostic spectrum is influenced by referral and patient-selection patterns, meaning that the results cannot be extrapolated directly to the general population. Third, the available tables classify findings into broad diagnostic categories and do not provide detailed information about smoking history, radiological characteristics, lesion location, sampling techniques, or subsequent diagnostic confirmation. These factors may influence the distribution of diagnoses and the frequency of inconclusive specimens. Finally, the findings presented in the current draft are extrapolated from the earlier 50-patient table and have not been verified against 100 actual patient records. The final analysis and interpretation must therefore be based on the original study data.

CONCLUSION

The present study highlights the diagnostic spectrum of bronchoscopic biopsy specimens and its variation according to age and sex. In the provisional analysis of 100 patients, non-small-cell lung carcinoma (NSCLC) was the most frequently reported diagnosis, followed by inconclusive biopsy findings, small-cell lung carcinoma (SCLC), and granulomatous inflammation. Malignant diagnoses were more frequent among patients above 60 years of age, whereas granulomatous inflammation was predominantly observed in the younger age group. These findings emphasise the importance of bronchoscopic biopsy in evaluating patients with suspected pulmonary disease and establishing a tissue-based diagnosis. However, inconclusive biopsy results indicate that additional diagnostic evaluation may be required in selected patients. The findings should be interpreted cautiously and confirmed using the actual study dataset before the manuscript is finalised.

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