Section: Miscellaneous

Original Research Article

A COMPARATIVE STUDY OF BRONCHOSCOPIC BIOPSY AND CT-GUIDED BIOPSY FOR DIAGNOSIS OF PERIPHERAL LUNG OPACITY IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Peripheral lung lesions (PPLs) pose diagnostic challenges which impact the overall patient management. Both CT-guided transthoracic biopsy and Flexible bronchoscopy- guided transbronchial lung biopsy (FOB-TBLB) are commonly used techniques, each with variable diagnostic accuracy and complications. The objective is to compare the diagnostic yield and complication rates between CT-guided transthoracic biopsy and FOB-TBLB techniques.

Materials and Methods: It is a prospective comparative study that included 140 patients with peripheral lung lesions, with 70 subjects in each group (CT-guided transthoracic biopsy and FOB-TBLB under C-arm guidance). Demographic data, smoking status, diagnostic yield, histopathological outcomes, complications and CT bronchus sign influence were analysed.

Results: Males and smokers predominated in both comparative groups, with the majority affected with the adenocarcinoma (50% & 40%) variant of lung malignancy. Comparison of diagnostic yield and safety profile between the CT-Guided and FOB- TBLB showed that the diagnostic accuracy (100%) is higher with the CT-guided approach, but carries the high procedure-related complications like pneumothorax and bleeding.

Conclusion: Even though the CT-guided approach has high accuracy, but carries a high risk for complications. FOB-TBLB becomes the safer initial approach and shows higher higher diagnostic yield in conjunction with C-arm guidance and in patients, particularly when a CT-Bronchus sign is present.

Keywords: CT- Computed Tomography, FOB- Flexible fiberoptic bronchoscopy, FOB-TBLB- Flexible fiberoptic bronchoscopy-guided Transbronchial Lung Biopsy, PPLs- Peripheral pulmonary lesions.

INTRODUCTION

Peripheral lung opacities (PPL) are a common presentation of both infective and neoplastic aetiology, typically located in the outer third of the lung, often posing a diagnostic challenge to treating physicians, as management is largely based on the established diagnosis. Historically, various methods have been adopted to obtain tissue samples for confirmation of diagnosis through histopathological studies. Among the various techniques, flexible fibreoptic endoscopy is widely used due to its safety and ability to sample airway tissues. But its diagnostic yield varies, especially in the peripheral lung opacities and the lesions that do not have any connection with the airway.[1] In contrast to this technique, Computed tomography (CT) guided transthoracic needle biopsy (TTNB) had the advantage of higher accuracy in the peripheral lung opacities but carried the procedure-related complications like bleeding and pneumothorax.[2,3]

The diagnostic success of these techniques depends on the location, size and presence of the CT bronchus sign.[4] As limited data comparing these techniques in the Indian subcontinent population, the present study aimed to evaluate the diagnostic yield, complications and factors influencing the successful tissue sampling between the two techniques of CT-guided TTNB and Bronchoscopy-guided transbronchial lung biopsy among patients with peripheral lung opacities.

Aim and Objectives

Aim

To compare the diagnostic efficacy of bronchoscopic biopsy and CT-guided transthoracic biopsy for the diagnosis of peripheral lung opacities.

Objectives

Primary Objectives

1. To assess the diagnostic yield of bronchoscopic biopsy in patients with peripheral lung opacity.
2. To assess the diagnostic yield of CT-guided transthoracic biopsy in patients with peripheral lung opacity.

Secondary Objective

To compare the overall diagnostic efficacy of bronchoscopic biopsy versus CT- guided transthoracic biopsy in the evaluation of peripheral lung opacity.

MATERIALS AND METHODS

Study Design and Setting: A prospective cross-sectional study was conducted at ESIC Medical College and Hospital, Hyderabad, from June 2022 to June 2024.

Sample Size: A total of 140 patients were included based on statistical calculations (n=70 per group).

Inclusion Criteria

- Adults (>18 years) with radiologically confirmed PPLs
- Patients with symptoms such as cough, hemoptysis, chest pain, or dyspnea
- Consent for participation

Exclusion Criteria

- Central lesions
- Severe hypoxemia
- Bleeding disorders
- Recent myocardial infarction (<3 weeks)
- Uncooperative patients
- Terminal illness
- Pleural disease

Procedures

Bronchoscopy-Guided Transbronchial Lung Biopsy (TBLB)

- Performed using a 6-mm Olympus bronchoscope.
- C-arm fluoroscopy guidance used to position biopsy forceps.
- Minimum of 3 biopsy samples obtained.

CT-Guided Transthoracic Needle Biopsy

- Performed using a 128-slice CT scanner.
- Coaxial needle technique with local anesthesia.
- Post-procedure CT used to detect pneumothorax or hemorrhage.

Outcome Measures

- Primary: Diagnostic yield (successful acquisition of diagnostic tissue)
- Secondary: Complications, association with CT bronchus sign, lesion size, location, smoking history, histological pattern.

Statistical Analysis

Data were analysed using chi-square and t-tests. $p \leq 0.05$ was considered significant.

RESULTS

In this study, 140 radiologically identified subjects with peripheral lung lesions were equally divided between CT-guided transthoracic biopsy(n=70) and flexible fibreoptic bronchoscopy-guided transbronchial lung biopsy (FOB-TBLB). Demographic variables like age, gender, BMI and habitual smoking were comparable between the two groups with no statistically significant difference. [Tables 1 & 2] Diagnostic success in the CT- guided biopsy group was strongly associated with the presence of the CT bronchus sign($P<0.001$), which suggests that pre-procedural multiplanar CT planning and other adjunctive techniques may enhance bronchoscopic yield. [Table 3] CT-guided biopsy showed higher diagnostic yield (100%) compared to FOB-TBLB (44.3%). [Table 4] In histologically confirmed cases majority were of malignancy (CT-guided 80%; FOB:87%), with adenocarcinoma being the most common subtype in both. [Table 5] Although the CT-guided biopsy demonstrated a superior diagnostic yield (100%), but was associated with high procedure-related complications, including pneumothorax (22.9%) and bleeding (27.1%). [Table 6]

Table 1: Comparison of demographics between the two groups

Variable	CT-guided (n=70)	FOB (n=70)	p-value
Age (years, mean ± SD)	57.87 ± 10.99	54.70 ± 11.92	0.104
Male sex, n (%)	48 (68.6)	51 (72.9)	0.355
Smokers, n (%)	37 (52.9)	44 (62.9)	0.231

Table 2: Comparison of BMI distribution between the two groups

BMI category	CT-guided biopsy (n=70)	FOB-TBLB (n=70)	p value
Underweight	8 (11.4%)	19 (27.1%)	0.109

Normal	40 (57.1%)	36 (51.4%)	
Overweight	17 (24.3%)	12 (17.1%)	
Obese	5 (7.1%)	3 (4.3%)	

Table 3: Lesion characteristics

Characteristic	CT-guided biopsy (n=70)	FOB-TBLB (n=70)	p value
Side of lesion			**0.680**
Right	45 (64.3%)	40 (57.1%)	
Left	22 (31.4%)	26 (37.1%)	
Bilateral	3 (4.3%)	4 (5.7%)	
Lobar distribution			0.517
Upper lobe	40 (57.1%)	45 (64.3%)	
Middle lobe	4 (5.7%)	3 (4.3%)	
Lower lobe	23 (32.9%)	18 (25.7%)	
Lingular / multiple lobes	3 (4.3%)	4 (5.8%)	
Lesion size			0.021*
< 3 cm	17 (24.3%)	7 (10.0%)	
≥ 3 cm	53 (75.7%)	63 (90.0%)	
CT bronchus sign	2 (2.9%)	49 (70%)	<0.001

Table 4: Diagnostic yield

Specimen obtained	CT Guided		FOB		P value
	number	Percentage (%)	Number	Percentage (%)	
Yes	70	100	31	44.3	<0.001*
No	0	0	39	55.7	

Table 5: Distribution of Histopathological diagnosis between the two groups

HPE diagnosis	Ct guided (%)	FOB (%)	P-Value
Adenocarcinoma	50	41.9	0.566
Squamous cell carcinoma	15.7	35.5	
Granulomatous inflammation	11.4	12.9	
Metastasis	4.3	6.5	
Carcinoid atypical	2.9	0	
Small cell carcinoma	5.7	3.2	
Fibrosis	2.9	0	
DIP	2.9	0	
Organizing Pneumonia	1.4	0	
Chronic inflammation	1.4	0	
Lymphohistocytic neoplasia	1.4	0	
Embryonal carcinoma	0	0	

Table 6: Comparison of complications between the two groups

Complication	CT-guided	FOB (%)	P-value
Pneumothorax	22.9	0	0.002
Bleeding	27.1	9.7	0.040

DISCUSSION

Peripheral pulmonary lesions (PPLs), due to their location and limited accessibility via bronchoscopy, pose a diagnostic challenge. In this study, although CT-guided transthoracic biopsy has shown a superior diagnostic yield, flexible Fibre optic bronchoscopy-guided lung biopsy (FOB-TBLB) performed under the guidance of C-arm fluoroscopy has offered a balance between diagnostic efficacy and safety, especially in resource-limited settings. Traditionally, the diagnostic yield of conventional bronchoscopy for PPLs has been modest and earlier investigations by Radke et al,[5] and Baaklini et al,[6] reported yields ranging from 35% to 63%, largely influenced by the size of the lesion and presence of a bronchial pathway. Further data from the AQuIRE study,[7] confirmed that the yield of the bronchoscopic technique is limited in the absence of guidance techniques, and these observations are consistent with practices routinely followed in many Indian centres where access to navigational bronchoscopy is restricted. C-arm fluoroscopy allows the real-time confirmation of biopsy tool position towards the lesion and improves bronchoscopic performance. In a study by Tsushima et al,[8] the bronchospy technique in combination with fluoroscopy-guided techniques demonstrated high diagnostic yield. De Roza et al. further showed that combining multiplanar CT planning with conventional bronchoscopy significantly enhances diagnostic yield.[1] In the present study, FOB-TBLB performed under C-arm guidance achieved a diagnostic yield of 44.3%, comparable to other fluoroscopy-assisted bronchoscopic studies and higher than yields historically reported for unguided bronchoscopy. In the current study there was strong association between the CT bronchus sign and the diagnostic success of bronchoscopy technique. The lesion, which demonstrated bronchial pathway on CT imaging were associated with high diagnostic

yield with FOB- TBLB. This finding was supported by the meta-analysis by Ali et al,[9] which showed that the presence of a CT bronchus sign substantially increases the likelihood of successful bronchoscopic diagnosis. Therefore, this study emphasises the careful pre- procedure radiological evaluation by computed tomography. In contrast to FOB-TBLB, CT-guided transthoracic biopsy demonstrated a consistent higher diagnostic yield, without being affected by the lesion characteristics. Previous studies by Yang et al, Wang et al and Kano et al have reported higher diagnostic yield up to 90%, findings that are consistent with 100% yield observed in the current study. However, its advantage was limited by the higher procedure-related complications like pneumothorax and bleeding.[10,11] It was in line with meta-analytic data and Indian studies reporting pneumothorax rates of approximately 20–25%.[12–14] FOB-TBLB under C-arm guidance demonstrated a favourable safety profile, with no pneumothorax and fewer bleeding events. This carries the clinical advantage in patients with limited pulmonary reserve or significant comorbidities. Overall, these findings support a stepwise diagnostic strategy in which C-arm–guided bronchoscopy serves as a safe and practical initial diagnostic approach for selected PPLs, reserving CT-guided biopsy for cases requiring definitive tissue diagnosis.[15]

CONCLUSION

FOB-TBLB, when compared to CT-guided transthoracic biopsy, is safer and provides an acceptable yield in selected cases, especially those with a positive CT bronchus sign and in cases biopsied under C-arm guidance. It may serve as an initial diagnostic approach when patient profile, safety concerns, or expertise favour a less invasive modality.

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