Section: Pathology

Original Research Article

ROLE OF RAPID ON-SITE EVALUATION OF TRANSBRONCHIAL NEEDLE ASPIRATES IN IMPROVING THE ADEQUACY OF SAMPLES AND DIAGNOSIS OF PULMONARY AND MEDIASTINAL DISEASES IN A TERTIARY CARE HOSPITAL OF NORTH INDIA: A RETROSPECTIVE STUDY

Bharti Sharma[1], Ritesh K Sheorain[2]

[1]*Specialist, Department of Pathology, Pt. BD Sharma PGIMS, Rohtak, India.*
[2]*Specialist, Department of Pathology, Pt. BD Sharma PGIMS, Rohtak, India.*

Received *: 25/07/2026*
Received in revised form *: 20/08/2026*
Accepted *: 04/09/2026*

Corresponding Author:
Dr. Bharti Sharma,
Specialist, Department of Pathology, Pt. Neki Ram Sharma Government Medical college, Bhiwani, India.
Email: bhartisharma405@gmail.com

DOI: 10.70034/ijmedph.2026.3.681

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (3); 4350-4354

ABSTRACT

Background: Objective: Lung cancer remains the leading cause of cancer-related mortality worldwide and is among the most commonly diagnosed malignancies. Conventional transbronchial needle aspiration (c-TBNA) is an established technique for staging bronchogenic carcinoma and evaluating hilar and mediastinal lymphadenopathy. This study assessed the added value of rapid on-site evaluation (ROSE) when combined with c-TBNA for improving diagnostic performance, specimen adequacy, and procedural efficiency in a tertiary care hospital in Northern India. **Aim:** To evaluate the added value of Real-time cytopathology of transbronchial needle aspirates in diagnosis of thoracic disorders.

Materials and Methods: This retrospective study was conducted in the Department of Pathology over a 12-month period from January to December 2021. Cases in which c-TBNA was performed with concurrent ROSE for mediastinal or pulmonary lesions were retrieved from institutional records. Histopathology was taken as the reference standard, and cases without corresponding histopathological confirmation were excluded. Data analysis was performed using SPSS version 20, and statistical tests included sensitivity, specificity, chi-square test, and unpaired t test as applicable.

Results: A total of 50 patients were included in the analysis, comprising 37 males (74%) and 13 females (26%), with a mean age of 56.16 years. Smoking history was present in 32 patients (64%), and most smokers were male. Radiologically, mediastinal lymphadenopathy was the predominant presentation. The most common sampling site was station 7 (48%), followed by station 4 (22%). Adequate sampling was obtained on the first needle pass in 40 cases (80%), while 8 cases (16%) required a second pass.

ROSE-assisted c-TBNA showed a diagnostic yield of 100% for malignant neoplasms, 83.3% for suspicious for malignancy, 87.5% for inflammatory lesions, and 50% for granulomatous lesions. Overall diagnostic yield increased to 89.74% after the introduction of ROSE, compared with 75.3% before its use.

Conclusion: ROSE is a valuable, safe, and cost-effective adjunct to c-TBNA.

Clinical significance: It improves sample adequacy, reduces the need for repeat procedures, and enhances the overall diagnostic utility of conventional needle aspiration in pulmonary and mediastinal lesions.

Keywords: Conventional transbronchial needle aspirate, Real-time cytopathology and thoracic disorders.

INTRODUCTION

Malignant tumors of the lung remain a major global health burden, ranking among the most frequently diagnosed cancers and the leading cause of cancer-related death.[1,2] Accurate staging is essential because treatment planning and prognosis depend largely on the extent of disease and the presence of mediastinal or distant spread. Among all staging steps, assessment of mediastinal lymph nodes is particularly important and often technically challenging. Over time, several methods have been used to evaluate mediastinal disease, including imaging-based techniques such as computed tomography and positron emission tomography, as well as invasive procedures like mediastinoscopy, video-assisted thoracoscopic surgery, and traditional bronchoscopic sampling. Endobronchial ultrasound-guided fine-needle aspiration (EBUS-FNA) later improved the evaluation of hilar and mediastinal lymphadenopathy in non-small cell lung cancer. [3] Although highly accurate and minimally invasive, its cost and dependence on specialized equipment limit routine access in many resource-constrained settings.[4]

Conventional transbronchial needle aspiration remains an important bronchoscopic technique for sampling peribronchial and mediastinal lesions. In this procedure, a needle is advanced through the bronchoscope to penetrate the tracheobronchial wall and obtain tissue from adjacent structures. c-TBNA is widely recognized as a safe, specific, and cost-effective method for diagnosing and staging thoracic lesions.[5] c-TBNA has a specificity of more than 95%, however, its sensitivity varies considerably across studies, largely because of differences in operator experience, lesion characteristics, and sampling adequacy. For this reason, early use of c-TBNA is recommended when imaging suggests thoracic involvement.[6,7] Real-time cytopathology adds an immediate cytological assessment of aspirated material and helps determine whether the sample is adequate. By providing instant feedback to the bronchoscopist, ROSE can reduce the need for repeat passes, lower procedure-related discomfort, and decrease the likelihood of repeat bronchoscopy. It is usually performed by a cytopathologist or trained cytotechnologist working in coordination with the interventional team. ROSE also improves sample triage. In addition to confirming adequacy, it helps preserve material for cell block preparation, microbiological studies, flow cytometry, and molecular testing when needed.[8] This is especially useful in thoracic oncology, where small samples often need to support multiple downstream diagnostic and predictive tests. By enabling timely decisions at the bedside or near the procedure suite, ROSE can improve diagnostic efficiency and reduce unnecessary invasive procedures.[9] The growing role of targeted therapy has further increased the importance of preserving limited cytological material for ancillary studies. In this context, ROSE supports better allocation of specimens and can strengthen the diagnostic performance of c-TBNA.[10,11] In diagnosis of lung lesions, cytology and histology are comparable and, in many studies, cytology even outperformed biopsy in lung tumor diagnosis. Its value is further improved with ROSE. ROSE gives the opportunities to pulmonologist, radiologist and cytopathologist to work together which results in increasing diagnostic usefulness of cytology for lung lesions.[11]

There are some studies which showed that comparable diagnostic yields achieved with both c-TBNA and EBUS-TBNA when ROSE was performed by an experienced operator in both cases.[12] There are studies which have proved that when c-TBNA combined with ROSE the diagnostic yield became much better as compared to c-TBNA without ROSE.[13] As ROSE is increasing the diagnostic yields of cytological materials now FNA procedures for lesions and masses in deep-seated or difficult-to-access sites, should be combined with ROSE and should be considered central to patient care.[14]

Aim: To assess the added diagnostic value of ROSE when combined with conventional transbronchial needle aspiration in the evaluation of pulmonary and mediastinal diseases.

MATERIALS AND METHODS

Study Design and Cohort Selection

This retrospective study was conducted in the Department of Pathology over a period of one year, from January 2021 to December 2021. Hospital records were reviewed to identify all patients with pulmonary or mediastinal lesions who underwent c-TBNA along with simultaneous ROSE. The collected information included demographic details, clinical history, radiological findings before the procedure, and final pathological diagnosis.

Inclusion and Exclusion Criteria

For analysis, cytological findings from ROSE were compared with the corresponding histopathological diagnosis. Only cases with available histopathological confirmation were included in the final analysis. Cases without a matching tissue diagnosis or definitive surgical pathology follow-up were excluded. Histopathology was considered the reference standard for assessment of diagnostic performance.

Procedural Protocol and Statistical Analysis

Aspirated material obtained by c-TBNA was examined immediately at the procedure site using rapid staining methods to assess adequacy, cellularity, and diagnostic morphology. The recorded data were coded, tabulated, and analyzed systematically. Statistical analysis was performed using SPSS version 20. Descriptive results were expressed as percentages and proportions, and

inferential analysis included chi-square test and unpaired t test, wherever applicable.

RESULTS

Cohort Demographics and Clinical Characteristics are shown in [Table 1]. The study included 50 patients, of whom 37 were male (74%) and 13 were female (26%). The mean age was 56.16 years, and the largest proportion of patients belonged to the 61–70-year age group. Smoking history was present in 32 patients (64%), while 18 patients (36%) were non-smokers. Among smokers, 31 (96.8%) were male and 1 (3.12%) was female.

Table 1: Patients characteristics

Characteristics	Data %	Absolute Value
1. Total no. of patients		50
2. Sex distribution		
male	74%	37
Female	26%	13
3. Maximum patients age group		61-70 years
4. Mean age		56.16 years
5. Smoking history		
smokers	64%	32
Non-smokers	36%	18
6. Sex distribution (Smokers)		
Male	96.8%	31
Female	3.12%	1
7. Radiological findings		
Mediastinal lymphadenopathy (LAP)	30%	15
Mediastinal mass	28%	14
Lung consolidation	20%	10
Hilar lymphadenopathy	8%	4
Lung mass	6%	3
Consolidation & mediastinal mass	4%	2
Lung mass & mediastinal LAP	2%	1
Normal CECT	2%	1
8. c-TBNA aspiration site		
Station 7	48%	
Station 4	22%	
Station 2	10%	
Station 11	2%	
9. No. of aspiration needle passed for adequate sample		
1 pass	80%	40
2 passes	16%	8
3 passes	4%	2

Mediastinal lymphadenopathy was the most common radiological finding. The most frequently sampled site was station 7, accounting for 48% of procedures, followed by station 4 at 22%, station 2 at 10%, and station 11 at 2%. An adequate sample was obtained on the first needle pass in 40 cases (80%). Two passes were required in 8 cases (16%), and three passes in 2 cases (4%).

ROSE-assisted c-TBNA showed a diagnostic yield [Table 2 & 3] of 100% for definite malignant lesions (21 of 21 cases), 83.3% for suspected malignant lesions (5 of 6 cases), 87.5% for inflammatory lesions (7 of 8 cases), and 50% for granulomatous lesions (2 of 4 cases).

Table 2: ROSE sensitivity and diagnostic yield

ROSE sensitivity for	
Malignant cases	100%
Inflammatory lesions	87.5%
Granulomatous lesions	50%
Normal finding cases	100%
Over all diagnostic yield of ROSE	89.74%
Diagnostic yield before ROSE	75.3%

Table 3: Diagnostic ROSE for different lesions

Diagnoses	Hp diagnoses	Rose diagnoses	Diagnostic yield
1. Malignancy –Definitive -Suspected	21 6	21 5	100% 83.30%
2. Granulomatous	4	2	50%
3. Inflammatory	8	7	87.50%
4. Normal	11	8	72.70%

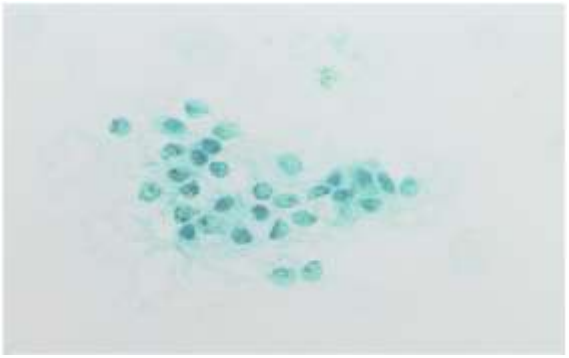

Figure 1: Toluidine blue stained photomicrograph of adenocarcinoma cytology on ROSE (400 X)

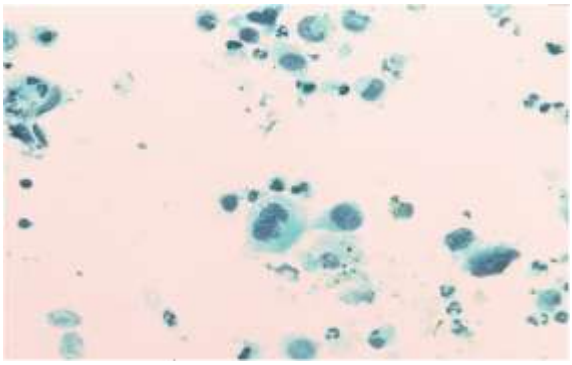

Figure 2: Toluidine blue stained photomicrograph of squamous cell carcinoma cytology on ROSE (400 X)

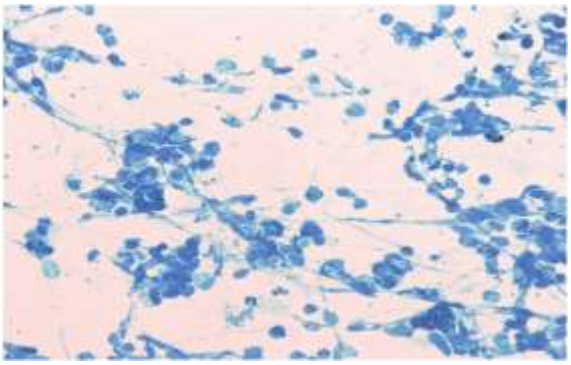

Figure 3: Toluidine blue stained photomicrograph of small cell carcinoma lung cytology on ROSE (400 X)

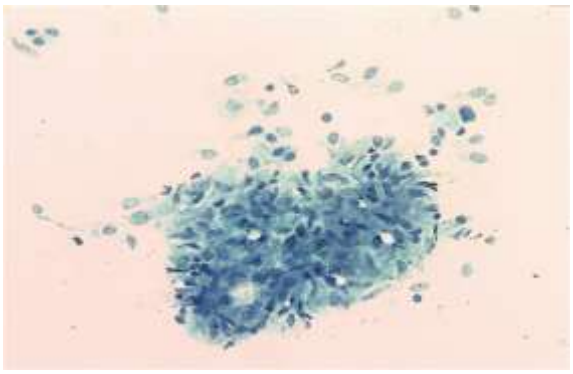

Figure 4: Toluidine blue stained photomicrograph of granuloma cytology on ROSE (200X)

[Figure 1,2,3 & 4]. Overall, ROSE achieved a diagnostic yield of 89.74% (35 of 39 histopathologically confirmed cases). This was higher than the pre-ROSE institutional yield of 75.3% in 81 earlier c-TBNA cases [Table 4].

Table 4: Over all Diagnostic yield of ROSE

	Cases diagnostic on ROSE	Cases diagnostic on HP	Diagnostic yield
Total Cases	35	39	89.74%

DISCUSSION

ROSE provides immediate assessment of specimen adequacy and cellular detail during c-TBNA, which helps guide further sampling in real time. In our study, first-pass adequacy was better than that reported in several previous series, likely because experienced cytopathologists and interventional pulmonologists were present during sampling. This close coordination probably contributed to the improved overall performance.

The higher diagnostic yield in our study may also be related to the frequent sampling of station 7, which is technically easier to access than some other mediastinal stations. In addition, on-site feedback allowed additional passes to be taken immediately when needed, reducing the chance of inadequate material. These factors together likely explain the improvement over historical institutional data.

For malignant lesions, the study showed excellent sensitivity and a negative predictive value of 100%, although specificity and positive predictive value were somewhat lower than in some reports. This difference may reflect the difficulty of distinguishing reactive, atypical, and inflammatory cells from malignant cells on rapid smears alone. Such overlap is a known limitation of morphology-based on-site assessment.

The sensitivity for granulomatous lesions was only 50%, which is consistent with the difficulty of recognizing sparse granulomas on rapid screening. In some cases, epithelioid cells may be sparse or may resemble bronchial or spindle-shaped cells, leading to diagnostic uncertainty. This highlights the need for careful interpretation and experience in cytological assessment, especially in granulomatous disease.

CONCLUSION

ROSE is a safe, efficient, and cost-effective adjunct to c-TBNA. It improves sample adequacy, reduces the need for repeated needle passes, shortens procedure time, and enhances overall diagnostic

yield. It also helps preserve material for better triage and further testing when required. At the same time, some limitations remain. Cytological subtyping of malignancy was possible in only 33.3% of cases, and granulomatous lesions were correctly identified in only 50% of cases. Although a negative on-site impression is reassuring, ROSE still depends heavily on cytomorphological expertise and careful interpretation of look-alike patterns.

Clinical significance

ROSE has reduced the procedural adverse events associated with repeated procedure. It assists in diagnostic workup and improves the diagnostic success rate and sensitivity of c-TBNA samples.

REFERENCES

1. Malvezzi M, Bertuccio P, Rosso T, Rota1 M, Levi F, Vecchia C, et al. European cancer mortality predictions for the year 2015: does lung cancer have the highest death rate in EU women? Ann Oncol 2015;26(4):779–86.
2. Torre LA, Bray F, Siegel RL, Ferlay J, Lortet-Tieulent J, Jemal A. Global cancer statistics, 2012. CA Cancer J Clin 2015;65:87–108.
3. Hamilton H, Pellicier J, Bernstein M, Dimashkieh H, Yang J. Endobronchial ultrasound-guided Transbronchial fine needle aspiration: advantages and potential pitfalls. Pathol Lab Med Int 2015;7:83–93.
4. Shannon JJ, Bude RO, Orens JB, Becker FS, Whyte RI, Rubin JM, et al. Endobronchial ultrasound-guided needle aspiration of mediastinal adenopathy. Am J Respir Crit Care Med 1996;153:1424–30.
5. Bilaceroglu S, Chhajed P. Transbronchial needle aspiration: A diagnostic tool in routine bronchoscopy. J Assoc Physicians India 2005;53:797–802.
6. Schenk DA, Chambers SL, Derdak S, Komadina KH, Pickard JS, Strollo PJ, et al. Comparison of the Wang 19-gauge and 22-gauge needles in the mediastinal staging of lung cancer. Am Rev Respir Dis 1993;147:1251-8.
7. Huang JA, Browning R, Wang KP. Counterpoint: Should endobronchial ultrasound guide every transbronchial needle aspiration of lymph nodes? No. Chest 2013;144:734-7.
8. Bruno P, Ricci A, Esposito MC, Scozzi D, Tabbi L, Sposato B, et al. Efficacy and cost effectiveness of rapid on site examination (ROSE) in management of patients with mediastinal lymphadenopathies. Eur Rev Med Pharmacol Sci 2013;17(11):1517–22.
9. Wohlschläger J, Darwiche K, Ting S, Hager T, Freitag L, Schmid KW, et al. Rapid on-site evaluation (ROSE) in cytological diagnostics of pulmonary and mediastinal diseases. Pathologe 2012;33:308-15.
10. Trisolini R, Cancellieri A, Tinelli C, Paioli D, Scudeller L, Casadei GP, et al. Rapid on-site evaluation of transbronchial aspirates in the diagnosis of hilar and mediastinal adenopathy: A randomized trial. Chest 2011;139:395-401.
11. Yarmus L, Van der Kloot T, Lechtzin N, Napier M, Dressel D, Feller-Kopman D. A randomized prospective trial of the utility of rapid on-site evaluation of transbronchial needle aspirate specimens. J Bronchology Interv Pulmonol 2011;18:121-7.
12. Madan K, Mohan A, Ayub II, Jain D, Hadda V, Khilnani GC, et al. Initial experience with endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) from a tuberculosis endemic population. J Bronchology Interv Pulmonol 2014;21:208–14.
13. Walia R, Madan K, Mohan A, Jain D, Hadda V, Khilnani GC, et al. Diagnostic utility of conventional transbronchial needle aspiration without rapid on-site evaluation in patients with lung cancer. Lung India 2014;31:208-11.
14. Da Cunha Santos G, Ko HM, Saieg MA, Geddie WR. ‘‘The Petals and thorns’’ of ROSE (rapid on-site evaluation). Cancer Cytopathol 2013;121(1):4-8.