# Ultrasound-Guided Percutaneous Transthoracic Biopsy by Pulmonologists

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## ABSTRACT

*Background:* Ultrasound-guided transthoracic needle biopsy (USG-TTNB) is a simple and safe procedure carried out to obtain a tissue sample for confirmation of the diagnosis of various thoracic pathologies. These procedures are usually carried out by radiologists in our country. However, there is good efficacy and fewer complications even in the hands of chest physicians, as shown by many studies published abroad. Considering this, the study is carried out to evaluate outcomes of USG-TTNB by pulmonologists in Nepal.

*Objective:* To study the efficacy and complications associated with USG-guided transthoracic needle biopsies performed by pulmonologists.

*Methods:* Retrospective analysis of 77 patients undergoing USG-TTNB by pulmonologists at BPKIHS from November 2019 to November 2023 were analyzed. The efficacy of the procedure and the complication rate were derived. Efficacy was calculated as proportion of the patients who had undergone the biopsy and resulted in a clinically contributory specimen.

*Results:* Mean age: 62.5 ± 13.7 years; 63.6% female. Transthoracic Fine Needle Aspiration showed a diagnostic yield of 82.6 % of patients, whereas that of trucut biopsy was 86.7 % with a combined diagnostic yield of 94 %. Pneumothorax occurred in four (5.2 %) of patients, and hemothorax occurred in two (2.6 %) of patients.

*Conclusion:* USG-guided percutaneous transthoracic biopsy by a pulmonologist is a procedure with good diagnostic yield and a lower complication rate.

*Keywords:* Diagnostic yield; Pulmonologist; Transthoracic biopsy; USG;



## INTRODUCTION

Respiratory Diseases are the leading cause of death worldwide, be it neoplastic, infective, or inflammatory. According to the WHO, three out of the six most common causes of death were due to respiratory diseases. The majority of whose prevalence has increased since 2019[1]. This could be due to increased association with risk factors such as cigarette smoking, environmental conditions, or due to increased modality and advancement in diagnosing these conditions[1]. In Nepal, the condition is worse, with two of the three most common causes of death being due to respiratory disease; the majority of these causes were due to infectious and inflammatory conditions of the lung[2]. However, neoplastic conditions of the lung were not listed as common causes of death compared to world data. Probably, this suggests that still many of these cases are either not diagnosed or reported in our country.[2].

Many of the thoracic diseases require tissue diagnosis for confirmation, which could be arising from the pleura, the lung parenchyma or the mediastinum. There are numerous modalities for obtaining tissue samples out of which USG-guided biopsy are one of the easiest and safest techniques for peripheral thoracic lesion[3-5]. As ultrasonography is readily

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available in most of the health centers, and thus are performed readily throughout the world. But these procedures are performed only in limited centers in our country. These could be due to lack of training and expertise in the same. In most of these centers, these are mostly performed by radiologists. There are only sparse data of yield and complications of USG-guided biopsy in our country[3-9].

These are also performed by chest physicians in many countries with good yield and fewer complications. Considering the increased burden of respiratory disease and expertise in the field, we as pulmonologists are also performing USG-guided biopsy in our center. We would like to report the yield and complications of these procedures done by pulmonologists at our center, which is one of the largest teaching university hospitals situated in the eastern part of Nepal.

## METHODS

### Study Design and Setting

A retrospective hospital-based observational study was done in all patients who had undergone USG-guided percutaneous thoracic biopsy done by pulmonologists in the Bronchoscopy suite under the department of Pulmonary, Critical Care and Sleep Medicine, BPKIHS from November 2019 to November 2023 were included in the study. Ethical approval was obtained from the Institutional Review Committee (IRC-BPKIHS).

### Procedure Details:

After patient preparation and written consent, the target site was chosen according to maximum visualization of the lesion using a curved abdominal transducer or phased array probe. The most suitable patient position, as well as entry site, direction, and depth for the biopsy, were determined. Following this, cleaning and draping, 2% lidocaine was applied locally over the site. After which transducer was introduced through the chosen site to the target lesion, and then a semiautomated needle of 18-G needle with a 16-G coaxial needle was utilised to obtain multiple biopsy specimens.

Fine needle aspiration was also obtained using a 21-G needle following core biopsy sampling. Aspirate was made into a smear, fixed in 95% ethanol, and sent for cytological examination. Aspirates were also sent for other microbiological workup in clinically relevant cases. Post-procedure chest x-ray or lung US were routinely performed to diagnose possible complications. The following data were collected from the patients who have undergone the procedure.

1. Clinico-epidemiologic data
2. Site:Pleural/Lung parenchyma/Mediastinum/Chest Wall
3. Complications occurred during or after the procedure
4. Biopsy: Definite Benign/Definite Malignant/Suspicious of Malignancy/Non Diagnostic

Diagnostic yield was recorded as the proportion of biopsies that gave a clinically contributory specimen. Clinically contributory specimens were all the specimens that gave a diagnosis of either a) definite benign pathology, b) definite malignant pathology, or c) suspicious of malignancy/infective condition in clinically relevant cases reported by the pathologist in the specimen.

### Statistical Analysis

Descriptive statistics are used, which measure mean ± SD, and frequencies.

## RESULTS:

Retrospective data of 77 patients who underwent USG guided transthoracic biopsy were analyzed. Mean age of patient was 62.5±13.7 yrs. 28 (36.4%) were male and 49 (63.6 %) were female. Age range was 17-84 years with median age of 65 years (Table 1). Around 50% of population were greater than 65 years of age while 15% were below 50 years of age. 53% were former smoker while 12% were current smoker (Table 2).

Table 1: Patient Characteristics

| Variables | Value |
|---|---|
| Age (years) | 62.5±13.7 (range: 17-84) |
| Male: Female | 28 (36.4%) : 49 (63.6 %) |

Table 2: Risk factors among patients who underwent USG guided percutaneous transthoracic biopsy.

| Risk Factors | Frequency (n) | Percentage (%) |
|---|---|---|
| **Smoking** | | |
| Current Smoker | 11 | 14.3 |
| Former Smoker | 41 | 53.2 |
| Non-Smoker | 9 | 11.7 |
| **Alcohol** | 6 | 7.8 |

In the study of 77 patients who had an USG-guided percutaneous transthoracic biopsy, comorbidities were prevalent. The most common comorbidity was chronic obstructive pulmonary disease (COPD) which was in 19 patients (24.7%), followed by hypertension in 13 (16.9%), diabetes mellitus and heart disease (7.8%) in 6 patients each. Past tuberculosis was seen in 4 (5.2%) patients. Chronic liver disease (CLD) and pulmonary embolism were each in 1 (1.3%) patient (table 3). With the most pertinent comorbidities being COPD and past tuberculosis, it is not unreasonable to suggest that the burden of disease caused by respiratory diseases and

infectious diseases in Nepal had a bearing on diagnosis and complication rates. While no correlations were examined in this study.

Table 3. Comorbidities in patients who underwent USG guided percutaneous transthoracic biopsy

| Comorbidities | Frequency (%) |
|---|---|
| COPD | 19 (24.7%) |
| Hypertension | 13 (16.9%) |
| Diabetes Mellitus | 6 (7.8%) |
| Heart Disease | 6 (7.8 %) |
| Past Tuberculosis | 4 (5.2 %) |
| CLD | 1(1.3 %) |
| Pulmonary Embolism | 1 (1.3 %) |

57 % had lesion on Right side; 70 (90%) of biopsy were done from lung parenchyma, three (3.9 %) were from mediastinal and pleura; One (1.3 %) biopsy was done from chest wall. Average size of lesion was 7.2±3.2 cm. 70 (90.9%) sample were adequate following biopsy. Trucut biopsy was performed in 75 cases which contributed to diagnosis in 65 (86.7%) of cases. While USG guided FNAC was performed in 69 patients and contributed to diagnosis in 57 patients (82.6 %) of patients. Combining both trucut biopsy and FNA the yield increases to 94 % (Table 4).

Table 4: Diagnostic Yield

| Method | Diagnostic/Total (%) |
|---|---|
| FNA | 57/69 (82.6%) |
| Trucut biopsy | 65/75 (86.7%) |
| Combined | 72/77 (94%) |

Pneumothorax occurred in four (5.2 %) of patients, hemothorax occurred in two (2.6 %) of patients and one (1.6%) suffered from vasovagal shock and hemoptysis.

Of all pathological diagnosis made, most common was Squamous cell carcinoma seen in 28 (36.8%), Adenocarcinoma in 17 (22.1 %) of cases, Non-Small Cell Carcinoma NOS in 11 (14.3 %), Small Cell Carcinoma in eight (10.4 %) of cases, Large Cell Carcinoma and Ewings Sarcoma in one (1.3 % of cases) and finding suggestive of malignancy was seen in 2 (2.6%) of patients. Similar among benign causes Tuberculosis was seen in two (2.6%) patients and thymoma in two (2.6 %) patients while cryptococcosis was seen in one (1.3 %) patients (Table 5).

Table 5: Final Diagnosis in patients who underwent USG guided percutaneous transthoracic biopsy.

| Diagnosis | Frequency (n) | Percentage (%) |
|---|---|---|
| Adenocarcinoma | 17 | 22.1 |
| Squamous Cell Carcinoma | 28 | 36.8 |
| Non-Small Cell Carcinoma (NOS) | 11 | 14.3 |
| Small Cell Carcinoma | 8 | 10.4 |
| Large Cell Carcinoma | 1 | 1.3 |
| Ewings Sarcoma | 1 | 1.3 |
| Suggestive of Malignancy | 2 | 2.6 |
| Tuberculosis | 2 | 2.6 |
| Thymoma | 2 | 2.6 |
| Cryptococcosis | 1 | 1.3 |

## DISCUSSION:

There is probably underreporting or underdiagnosis of malignant cases in our country compared to world statistics, probably due to a lack of clinical expertise, technology, and despair related to its treatment, and even ignorance and illiteracy regarding the novel management techniques and practices. The scenario is more relatable with thoracic malignancy due to the dearth of specialties taking care of these patients. This motivates all of the Nepalese investigators to increase their study of thoracic diseases. Ultrasonography is a readily available, non-ionizing, and cost-effective technique for imaging purposes, as well as being utilized in many interventions. Considering this, reporting yield of USG guided percutaneous transthoracic biopsy, that too by pulmonologists, pave the way for increasing reporting of researchers related to thoracic lesions and also drive pulmonologists to carry out this procedure considering increased burden of thoracic diseases and their specialties after proper training with good instance from other countries with outstanding yield and fewer complications[3–9].

This is one of the first kind of study reporting the yield and complications of USG-guided percutaneous transthoracic biopsy that is done by pulmonologists in Nepal, which showed

overwhelming yield with minimal complications. However, there are studies from a tertiary care center in the capital city of Nepal reporting results of CT-guided thoracic lesions done by radiologists showing a yield greater than 90 % but with a fair amount of complications, which is likely considering the selection of cases in such procedure, needle transversing normal lung parenchyma, and smaller size of lesion[10,11]. Recently USG guided biopsy data in patients undergoing procedure in interventional radiology department was reported from tertiary care centre of Nepal with good yield and minimum complications[12].

Of 77 patients included in this study, 49 (63.6 %) were female, which is discordant with studies from other Asian Countries[6–8,13,14] but concordant with a study form Denmark[3]. This could be because in other Asian countries the male population is higher whereas in Nepal and Denmark the female population is higher than male, and the difference is more if we consider the eastern part, especially Dharan, and the population after 50 years of age. And another important cause would be due to male population living abroad is higher in the region where this study was conducted[1]5.

Transthoracic fine needle aspiration gave a clinically contributory specimen in 82.6% (57/69) of patients, which is concordant with a study from Denmark in malignant diseases and higher compared to a study from India[3,8]. Whereas diagnostic yield from trucut biopsy was 86.7% (65/75 patients), which was similar to result seen in similar studies from various countries[4,6,7,8].

Combined diagnostic yield of needle aspiration and trucut biopsy was 94 % in our centre, which can be seen in other studies as well, so wherever possible, both sampling techniques should be utilised to increase the diagnostic yield[8].

The most common complication that occurred during the procedure was pneumothorax in four patients, followed by hemothorax, which is comparable to other studies[3,6,7,8].

There were limitations in this study; it was a retrospective study, and there were no clear data on the number of needle punctures, the time required, or there was chance of missing data, especially regarding minor complications. The number of patients was also small, and it was a single-center study.

## CONCLUSION:

Besides its shortcomings, it indicates that USG-guided percutaneous transthoracic biopsy by a pulmonologist showed higher yield and fewer complications in our country as well. This study also suggests that combining fine needle aspiration and trucut biopsy in selected cases increases the diagnostic yield.

## AUTHOR'S CONTRIBUTION

All authors involved for Conception and Design of manuscript.

## FUNDING:

None

## ETHICAL CLEARANCE:

Study was conducted after ethical approval from Institutional Review Committee (IRC), BPKIHS, Dharan.

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