

# The Gulf Journal of Oncology



Indexed By PubMed and Medline Database

Issue 47, January 2025  
ISSN No. 2078-2101



The Official Journal of the Gulf Federation For Cancer Control

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# Yield and Safety of Ultrasound Guided Tru Cut Biopsy

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## Abstract

**Background:** Thoracic lesions can result from malignant, benign, and inflammatory conditions. They affect lung parenchyma, pleura, or mediastinum, and often require biopsy for a definitive diagnosis.

**Objectives:** We aimed to assess the safety and diagnostic yield of ultrasound-guided tru-cut needle biopsy performed by pulmonologists.

**Patients and Methods:** We conducted a prospective study among 45 patients undergoing ultrasound-guided tru-cut biopsies for diagnosing thoracic lesions. Data on patient demographics and procedure results were collected using a predesigned clinical data collection sheet.

**Results:** In this group of patients, ultrasound-guided biopsy performed by pulmonologists yielded adequate tissue samples and achieved an accurate diagnosis in 94.4% (42) of the cases. Malignant lesions were identified in 66.7% (30) of the patients. In most patients, 86.7% (39), there were no complications, and we recorded no procedure-related mortalities.

**Conclusion:** Our results indicated that ultrasound-guided tru-cut biopsy performed by pulmonologists yielded excellent diagnostic results and was a safe technique for diagnosing thoracic lesions.

**Keywords:** Benign, Biopsy, Malignant, Mediastinal, Pleural, Sudan, Thoracic

## Introduction

Computed tomography (CT) guided lung biopsy has long been the standard for histological diagnosis of thoracic lesions, but its use is restricted to interventional radiologists. An alternative, ultrasound (US) guided biopsy of thoracic lesions, conducted in clinics by pulmonologists, is gaining popularity. This method offers real-time imaging and multiplanar views and avoids radiation exposure.<sup>(1)</sup> With the rise of lung cancer, smaller peripheral pulmonary nodules have become more common, posing a diagnostic challenge. Sputum cytology and flexible bronchoscopy, traditional diagnostic methods for peripheral lesions, often yield low results.<sup>(2)</sup> Fluoroscopy, CT scans, and US-guided biopsy have become crucial for diagnosing peripheral pulmonary lesions.<sup>(3)</sup> Thoracic lesions encompass a broad spectrum, including malignant, benign, and inflammatory conditions, and are frequently encountered in clinical practice. These lesions in the lung parenchyma, pleura, or mediastinum require thorough evaluation for proper treatment. Diagnosis depends not solely on imaging.<sup>(4)</sup> Thoracic lesions present diverse clinical and radiographic features, necessitating biopsy for definitive diagnosis and subsequent treatment.<sup>(5)</sup> Tissue histopathology and culture,

obtained through open lung biopsy, mediastinoscopy, or video-assisted thoracoscopic surgery (VATS), remain the gold standard for investigating these lesions.<sup>(6)</sup> However, surgical biopsy carries significant morbidity. CT-guided biopsy, another transthoracic biopsy method, is hindered by cost, radiation exposure, patient transport, and availability issues.<sup>(7)</sup> Ultrasound (US) has emerged as a safe, accurate, portable, and cost-effective alternative, avoiding radiation exposure.<sup>(8)</sup> Its use in pulmonology has expanded to assess various parenchymal and pleural diseases.<sup>(9)</sup> US-guided sampling enhances diagnostic accuracy, allowing precise fine needle aspirations and tissue core biopsies.<sup>(10)</sup> Pulmonologists utilize US guidance for biopsies to analyze thoracic diseases, including pleural thickenings, pulmonary lesions near the pleura, mediastinal tumours,

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and chest wall lesions.<sup>(11)</sup> Ultrasound has become pivotal in diagnosing various lung diseases, extending from pleural fluid evaluation to pneumonia, pneumothorax, atelectasis, interstitial lung disease, pulmonary oedema, and pulmonary mass lesions.<sup>(12)</sup> Studies have shown that physician pulmonologists, familiar with ultrasound-guided procedures like thoracentesis, can perform tru-cut biopsies with comparable diagnostic yields to those of radiologists performing CT-guided procedures, and this not only saves patients' time but also aids in early diagnosis.<sup>(13)</sup> The safety of Ultrasound-Guided Tru-Cut Biopsy was also affirmed by other authors, like Mohammed Al Ameen AL Bagir, whose study in Sudan between April 2011 and October 2012 showed that ultrasound-guided biopsy of thoracic lesions had a diagnostic yield of 95.7%. Immediate complications were haemoptysis in two cases and chest pain in one, affirming the safety of the procedure.<sup>(14)</sup> Similarly, authors Muhammad Hussain, Muhammad Ashraf, and Kamran Khalid Chima conducted a study in Lahore, Pakistan, from March 2013 to 2015, where 50 patients underwent tru-cut biopsies performed by pulmonologists. Minor haemoptysis occurred in two patients (4%) and resolved spontaneously, while procedural pain occurred in 20% of cases, and they concluded that US-guided tru-cut biopsy was a safe procedure with good diagnostic yield when performed by pulmonologists.<sup>(15)</sup> In a study conducted at Tanta University Hospital in Egypt, 50 patients had ultrasound-guided biopsies, 28% (14) of the lesions were benign, 60% (30) were malignant, and 12% (6) of cases were undiagnosed. The procedure-related complications included pneumothorax in 2 cases (4%) and pulmonary hemorrhage in two (4%) cases.<sup>(16)</sup> Olivera et al. studied 147 procedures; lesions were in the lung in 45% (67) of the cases, chest wall in 37% (54), anterior mediastinum in 9% (14), and pleura in 8% (12/147). The overall diagnostic success rate was 90.5%, and specimen adequacy was 91.2%. Diagnostic success was highest for mediastinal lesions (92.9%) and lowest for pleural lesions (75%). Minor complications occurred in only 2.7% (4) of the cases.<sup>(17)</sup> In a study done by Tikkaoski et al. in Finland in 200 patients, the success rate was 92%. Very few complications were reported for small pneumothorax in 5 patients and haemoptysis in 3 patients, and no patient required treatment.<sup>(18)</sup> Thoracic lesions, with their varied differential diagnoses, are common challenges in clinical practice. They may be in the lung parenchyma, pleura, or mediastinum, presenting with diverse clinical and radiographic features, necessitating biopsy for definitive diagnosis and treatment. This study aims to evaluate the yield and safety of ultrasound-guided tru-cut needle biopsy performed by pulmonologists.

## Patients and Methods

### Study Design and Setting

This is a prospective, hospital-based study carried out in the AL-Shaab teaching hospital, the main specialized chest hospital in Khartoum, Sudan.

### Study Participants

The study included all adult male and female patients who presented with thoracic lesions during the study period and agreed to participate in the study and on whom a tru cut ultrasound-guided biopsy could be performed. It excluded patients with serious comorbidities, coagulation disorders, and patients who refused to participate in the study.

### Data collection

Structured questionnaires were used during face-to-face interviews of patients to collect clinical history and sociodemographic characteristics. We recorded imaging and laboratory results in a predesigned clinical data collection sheet.

### Investigations

Every patient was evaluated with CXR and spiral CT chest with contrast beforehand. A senior radiologist interpreted the images.

### Tru-Cut Biopsy Technique

A multidisciplinary team was involved in the procedure, including a pulmonologist, an interventional radiologist, a pulmonology registrar, a laboratory consultant, and a nurse. Every eligible patient gave their informed consent; the skin was prepared in a sterile fashion, and 1% lidocaine hydrochloride was administered with a sterile syringe to anaesthetize skin and subcutaneous tissue, and then a Doppler US-guided tru-cut biopsy was performed by a pulmonologist. We kept Patients for a 2-hour observation period after the procedure, recorded all procedure-related events for every participant in his sheet, and sent biopsies for histopathology.

### Statistical Analysis

We analysed using a statistical software package (SPSS for Macintosh, version 27; IBM SPSS, Inc., Armonk, NY, USA). The descriptive statistics will be calculated and presented in frequency tables and graphs. We compared categorical variables using the Chi-square test, and  $P < 0.05$  will be considered statistically significant.

### Ethical Consideration

The IRB at Al-Shaab Teaching Hospital approved the study. The study team members informed all participants about their rights throughout the study and obtained written informed consent.

## Results

### Demographic characteristics

A total of 45 patients participated in this study. Of these, 33 (73%) were males. The mean age of participants was  $49 \pm 13.42$  years.

### Site of Lesions

Chest computed tomography scan (CT) confirmed that lesions were in the pleura in 21 cases (46.7%), pulmonary in 20 cases (44.4%) and mediastinal in 4 cases (8.9%) (Figure 1).

### Diagnostic Success

The biopsy was adequate and revealed an accurate diagnosis in 94.4% (42) of the patients; however, in 6.6% (n=3) of the patients, the pleural biopsy was inadequate for histopathology. Therefore, the accuracy is 100% in detecting lung and mediastinal lesions and about 85.7% in detecting pleural lesions.

### Nature of Lesions

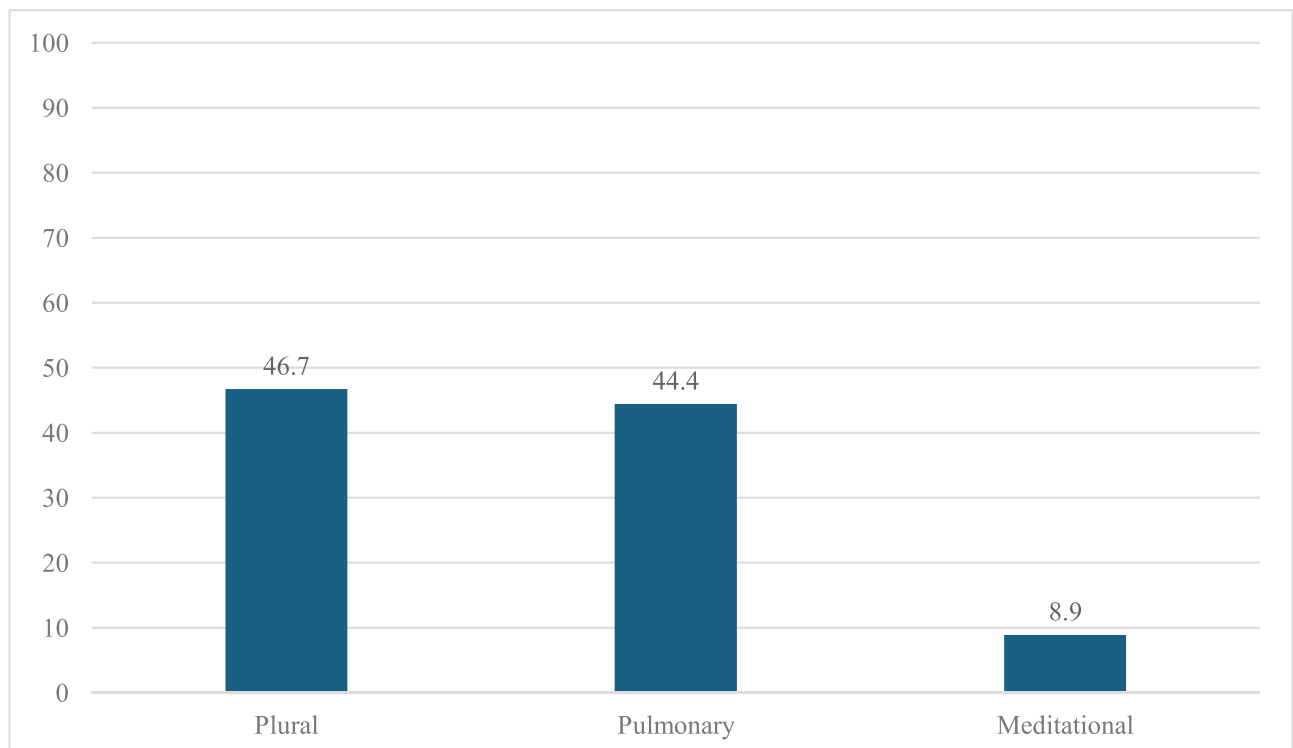
Lesions were malignant in 66.7% (30) of the patients and benign in 26.7% (12). Regarding malignant lesions, 53.3% (n=16) were in the lungs, 33.3% (n=10) in the pleura, and 13.3% (n=4) in the mediastinum (Figure 2). Furthermore, of the twelve benign lesions, 66.7% (n=8) were in the pleura, 33.3% (n=4) were in the lungs, and none of the mediastinal lesions were benign (Figure 2).

### Safety of procedure

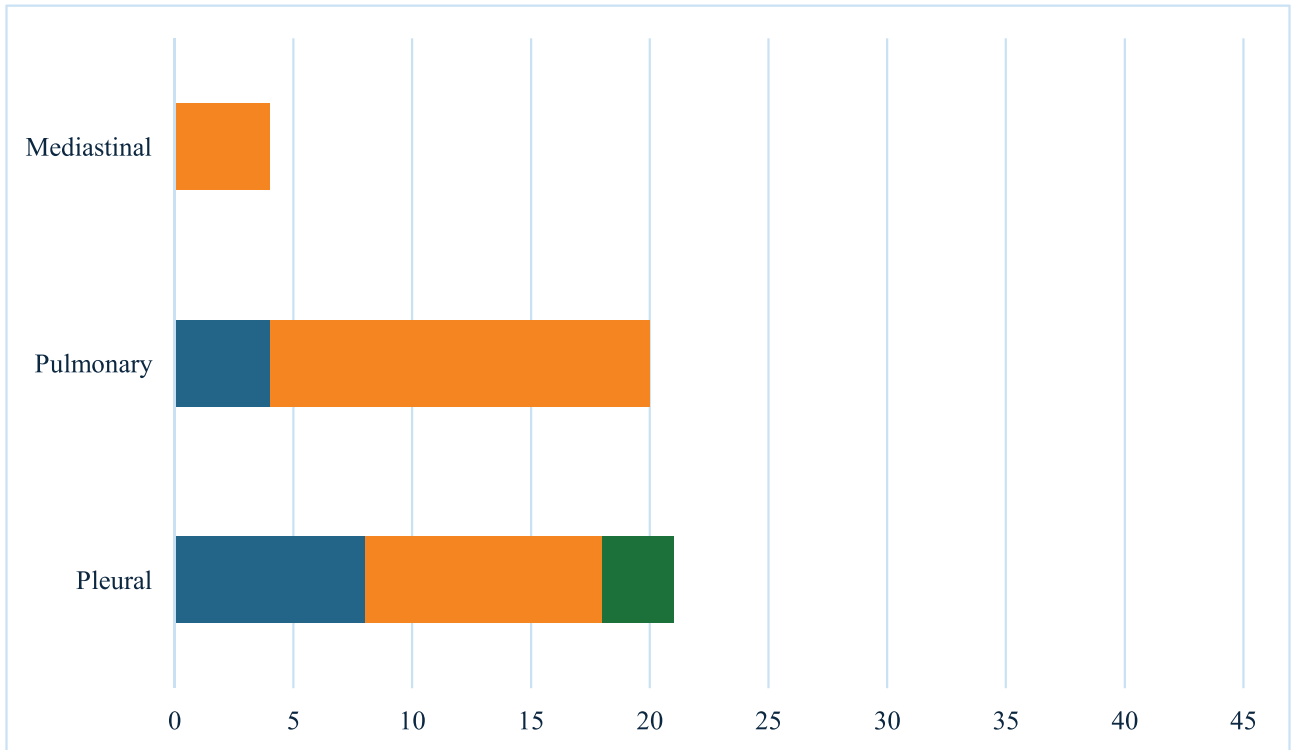
We noted minor haemoptysis after the procedure in only three patients (6.7%), which stopped spontaneously. Mild local hematoma at the biopsy site was observed in one patient (2.2%) (controlled with local pressure). Small pneumothorax was observed only in 2 patients (4.4%) (treated conservatively), while 39 (86.7%) of the procedures had no complications (Figure 3).

## Discussion

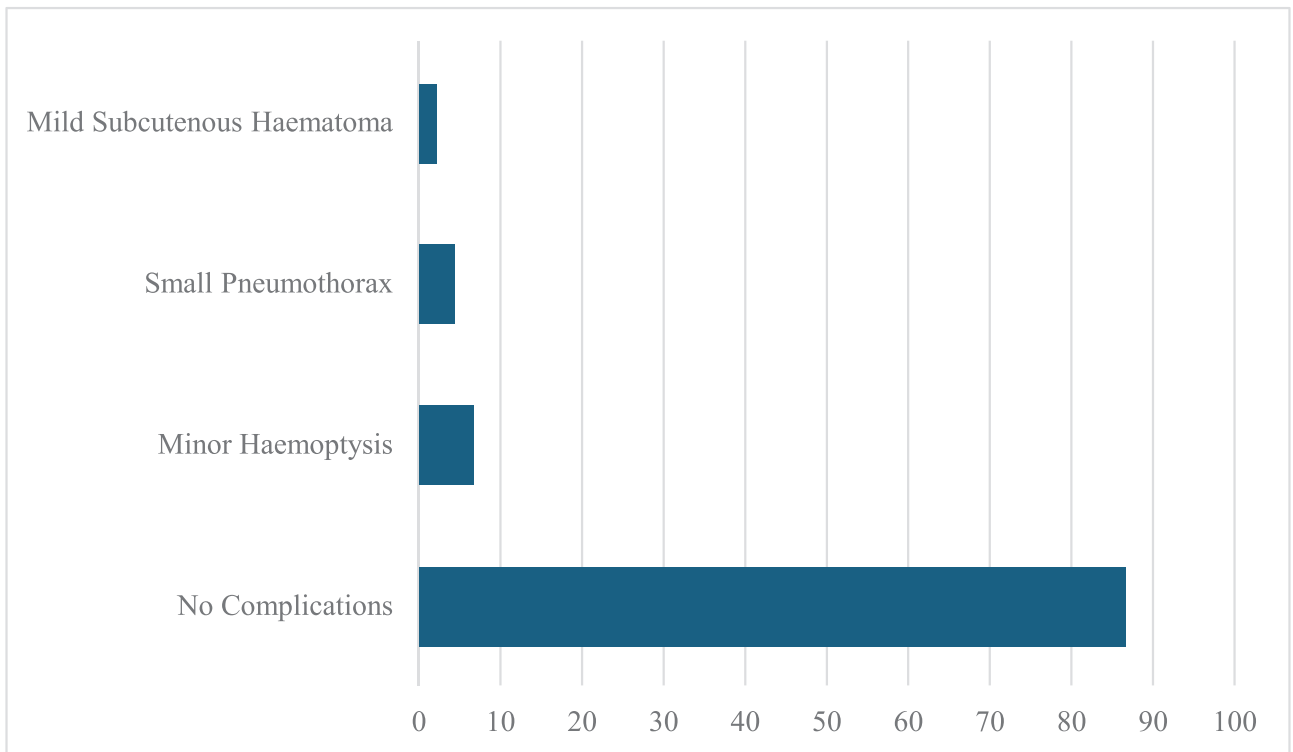
Computed tomography (CT) guided lung biopsy has long been the gold standard for the definitive diagnosis of thoracic lesions; however, it's performed only by interventional radiologists. An alternative, ultrasound (US) guided biopsy of thoracic lesions, conducted in clinics by physician pulmonologists, is gaining popularity.<sup>(1)</sup> Studies have shown that physician pulmonologists, familiar with simple ultrasound-guided procedures like thoracentesis, can perform ultrasound-guided tru-cut biopsies of thoracic lesions with comparable diagnostic yields to radiologists performing CT-guided thoracic biopsies.<sup>(13,14)</sup> This study aims to evaluate the safety and diagnostic yield of ultrasound-guided tru-cut needle biopsy performed by pulmonologists for diagnosing thoracic lesions. This study involved 45 patients with an average age of  $49 \pm 13.42$  years. Chest computed tomography scans (CT) confirmed that lesions were pleural in 21 cases (46.7%), pulmonary in 20 cases (44.4%), and mediastinal in only 4 cases (8.9%). In our tertiary hospital setting, biopsy provided an



**Figure 1.** Distribution of lesions by site



**Figure 2:** Histopathology According to Site of Lesion



**Figure 3:** Procedure Related Complications

accurate diagnosis in 94.4% (42) of the patients, while in 6.6% (3) of the patients, pleural biopsy was inadequate for histopathology processing. Similar high diagnostic success rates were reported in studies by Hussain et al.<sup>(15)</sup> El-Sharawy et al. in Egypt,<sup>(16)</sup> Portela-Oliveira et al. in Canada,<sup>(17)</sup> and Tikkakoski et al. in Finland.<sup>(18)</sup>

Among the study patients, 66.7% (30) had malignant lesions and 26.7% (12) had benign lesions. This distribution is consistent with findings from studies by Hussain et al. and El-Sharawy et al.<sup>(15,16)</sup>, indicating that our results align with regional and international data. Regarding the safety of the procedure, minor haemoptysis occurred in 6.7%

(3) of the patients, mild local hematoma at the biopsy site in 2.2% (1) of the patients, and small pneumothorax was in 4.4% (2) of the patients. However, 86.7% (39) of the procedures passed without complications. These findings support the safety of the procedure as reported by El Ameen et al.,<sup>(14)</sup> Hussain et al.,<sup>(15)</sup> El-Sharawy et al.,<sup>(16)</sup> Portela-Oliveira et al.,<sup>(17)</sup> and Tikkakoski et al.<sup>(18)</sup>

Our study is the first done in our setting in Sudan, and the current study findings will provide insight into the diagnostic yield, safety, and practice of ultrasound-guided biopsy. The study included only 45 patients with thoracic lesions presenting at one tertiary hospital in Khartoum, and thus, it may have limited generalizability to other settings in the country. We recommend repeating this study at a larger scale that involves many patients and allows more statistical analysis.

## Conclusion

The majority of ultrasound-guided tru-cut biopsies performed by pulmonologists in this study had adequate samples and excellent diagnostic results, with a low number of complications and no procedure-related mortality. The results of this study support the recommendation that ultrasound-guided tru-cut biopsy performed by pulmonologists is useful for diagnosing thoracic lesions in resource-constrained settings.

## Funding and Conflict of Interest

The authors declare no conflict of interest and have not received any funds for this study.

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