

The Role of Percutaneous Transthoracic Core Needle Biopsy on Diagnostic of Central and Peripheral Lung Nodule/Mass using Chest CT Scan and Chest Ultrasound Guidance

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Keywords: Core biopsy, Percutaneous, Transthoracic

Abstract: Percutaneous transthoracic core needle biopsy is a technique using a longer sized needle and hooks allowing tissue for histopathological examination on certain indications (lesion size over 8 mm or transthoracic needle aspiration (TTNA) is not representative). The aim of this study was to analyze the role of core biopsy size 14G (the largest size available in Indonesia) with a co-axially needle on diagnostic of central and peripheral lung nodule/mass with the use of chest CT scan and chest ultrasound guidance. This is a retrospective study of 58 patients with peripheral lung nodule/mass from the year 2014 to 2019.

1 INTRODUCTION

Core needle biopsy has become the dominant method in obtaining tissue samples from pulmonary lesions to make a pathological diagnosis (Zhou *et al.*, 2013). The development of imaging methods especially computed tomography (CT) has contributed to more accurate localization of lung lesions. It has contributed to making this procedure universally well-known and performed on a large scale. The procedure has actually become a viable alternative to other diagnostic procedures such as sputum cytology, bronchoscopy, and thoracotomy, with a high quality of material sampling collected for analysis (Beckh, Bleskei, and Lessnau, 2002; Junqueira *et al.*, 1990).

The guided biopsy with computed tomography has been widely accepted as an effective and safe procedure for a specific diagnosis (Guimarães *et al.*, 2009; Yu *et al.*, 2002).

Another imaging development for lung lesion is an ultrasound (US). Sonogram has been described as a useful tool in characterizing unspecified pleural or subpleural pulmonary lesions, when there is no lung aeration in between (Sartori *et al.*, 2007). In addition, US can be used as a safe and effective method to guide the biopsy of masses in the chest wall (Schubert *et al.*, 2005). The main advantage of this imaging modality is that the US allows real-time monitoring of procedures and can be done at the patient's bedside, without using radiation.

Transthoracic core needle biopsy is indicated to determine nodules or pulmonary masses tissue. Core biopsy is a technique similar to transthoracic needle aspiration (TTNA) using a longer and bigger size needle with a cutting needle so it can obtain tissue for histopathology examination based on certain indications (tumor size is more 8 mm or yield TTNA is not representative).

While core biopsy size 14-18 G was used for the first time in the early 1980s. It has been shown that only 40-50% of small peripheral thoracic lesions are malignant. Using percutaneous biopsy, surgery or thoracoscopy can be avoided in 64% of patients (Liao *et al.*, 2000).

Core biopsy was performed with image guidance, including chest CT and US. Some previously published articles for CT guided biopsy have described their role as modalities effective guidelines for diagnosing intrathoracic lesions (Liang *et al.*, 2014).

In this study, our aim was to describe the sample characteristics and the accuracy of transthoracic biopsy cores using US or CT guidelines to diagnose lung lesions.

2 METHODS

The researchers collected retrospectively cases of biopsy procedures that had been conducted by

researchers from 2014 to 2019 at Columbia Asia Hospital Medan and Malahayati Islamic Hospital Medan, Indonesia. A total of 58 patients consisted of 12 women and 46 men aged 19 to 79 years old was enrolled.

By using chest radiographs or chest CT scan we determined if there were nodules or masses in the lung. All patients were then informed of which procedures they should receive and all subjects consented for the procedures to be performed.

Of the 58 core biopsy actions, two guides were selected, imaging CT scan or US guide. Forty-three patients were guided using chest CT scan and 15 patients used US guide. If the lesions were located near the chest wall or peripherally and the size was more than 2 cm, it will be guided with the US. But if the lesion was less than 2 cm and located in the deeper or center, it was done with the CT scan guidance.

We marked the site of insertion of the core biopsy needle. We infiltrated the local anesthesia lidocaine from the skin through the parietal pleura using a 26G needle syringe. Then we inserted the coaxially needle as the core biopsy cutting needle cannula catheter to obtain the tissues. Each specimen was immediately put into a container containing 10% formalin and sent to the pathology department for further examination.

At the end of the procedure, all patients were monitored for signs and symptoms of complications, such as hemoptysis and pneumothorax.

3 RESULTS

During this period, a total of 58 core biopsy actions were carried out. Of those, 43 were guided using CT scan and 15 patients were guided with the US. Table 1 describes the baseline characteristics of patients.

Table 1: Characteristics of patients underwent core biopsy randomized to US guidance or CT guidance.

Characteristics	US-guided (n=15)	CT-guided (n=43)
Mean age (years)	53,28 ± 14,63 years	
Age (years)		
16-35	3 (19.8%)	9 (20.8%)
36-55	6 (39.9%)	17 (39.4%)
56-75	6 (40.0%)	17 (39.4%)
Sex		
Male	12 (80.0%)	34 (79.0%)
Female	2 (13.3%)	10 (23.0%)

Histopathology diagnosis is described in table 2, and the complications of the procedures are stated in table 3. There were 3 pneumothorax complications (6.9%) that occurred with an area of pneumothorax <20% but there was no requirement to place intercostal chest tube placement, and 1 (1.7%) hemoptysis complication was reported.

Table 2: Final histopathology diagnosis.

Histopathology Classification	US-guided (n=15)	CT-guided (n=43)
Adenocarcinoma	8 (53.0%)	10 (23.0%)
Squamous cell ca	4 (26.0%)	11 (25.0%)
Large cell ca	1 (6.6%)	2 (4.6%)
Adenosquamous	1 (6.6%)	0
Small cell lung carcinoma	0	3 (6.9%)
Oat Cell	0	1 (2.3%)
Yolk sac	0	2 (4.6%)
Mature teratoma	0	1 (2.3%)
NHL	1 (6.6%)	0
Lung fibrosarcoma	0	1 (2.3%)
Non specific inflammatory process	0	2 (4.6%)
Pulmonary TB	1 (6.6%)	4 (9.3%)
Pneumonia	0	1 (2.3%)
Fibrotic Mass	0	2 (4.6%)
Plasmacytoma	0	1 (2.3%)
Cryptococcus	0	1 (2.3%)
Loss Connective Tissue	0	1 (2.3%)

Table 3: Complication core biopsy

Complication	US-guided (n=15)	CT-guided (n=43)
Pneumothorax <20%	0	3 (9.3%)
Hemoptysis	0	1 (2.3%)

4 DISCUSSION

Transthoracic core needle biopsy is an alternative intervention when bronchoscopy is not available. A percutaneous pulmonary biopsy is a safe and accurate procedure for the diagnosis of focal thoracic lesions. A study conducted by Liang *et al.* (2014) showed that CT-guided biopsy cores with cytology evaluation had a low and adequate atypical level. Pulmonary core biopsy can provide a more accurate tumor classification and specific diagnosis for non-neoplastic lesions. Adequate networks are often available for molecular studies.

The rate of complication of biopsy of pneumothorax core needles is compatible with fine needle aspiration. Pneumothorax and mild bleeding are the common complications of core biopsy. Liang *et al.* (2014) reported pneumothorax incidence at 31.4%. Beslic *et al.* (2012) compared the rates of complications in percutaneous fine needle aspiration biopsy guided by CT and core needle biopsy and discovered that pneumothorax was detected in 9.7% of patients with a fine needle biopsy and 31.5% in patients with core biopsy. However, other authors reported varying rates of pneumothorax ranging from less than 10% to more than 60% in fine needle aspiration and core biopsy (Minot *et al.*, 2012). In our institution, CT-scan and US were immediately performed post-procedure in all patients and broad criteria for the pneumothorax was used from the Light study (Light, 1990).

The limitation of our study is that the authors did not report the size of radiological lesions, TNM grading, and pain score.

5 CONCLUSION

The percutaneous core needle biopsy procedure guided by CT and US showed high accuracy of results, 79.3% of the lesions obtained histopathologically were malignant lesions.

In all cases studied, there was no report from the pathologists of an inadequate sample or unavailability of tissue. Although the needle used is a large type of needle (size 14G) and it is the largest needle available in Indonesia but the complications of pneumothorax turned out to be low (6,9 %). Pneumothorax is a common complication and has been reported to occur in 50% of events. In our report, there were no additional intervention procedures like simple aspiration or chest tube insertion needed.

Our study shows that CT biopsy with CT or US guidelines is a safe procedure and is generally well tolerated. Some patients may experience significant and lasting pain and therefore must receive detailed information regarding this procedure.

FUNDING

No grant support or funding from public institutions or private enterprises was received for this research.

ACKNOWLEDGMENTS

The researcher would like to thank Columbia Asia Hospital and Universitas Sumatera Utara Hospital which have allowed the retrieval of medical history data.

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