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Original article

The Role of Transthoracic Ultrasound-Guided Tru-Cut Biopsy in the Diagnosis of Peripheral Lung Lesions

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Abstract

Background: Peripheral lung lesions, often indicative of various diseases, require accurate diagnosis for appropriate management. Ultrasound (US)-guided tru-cut biopsy offers a minimally invasive method for diagnosing these lesions. **This study aims to** evaluate the role of US-guided tru-cut biopsy in diagnosing peripheral lung lesions. **Methods:** This prospective study included 60 patients with imaging-confirmed peripheral lung masses, admitted to Benha University Hospitals between January and December 2023. All patients underwent US-guided tru-cut biopsy using a 16-gauge needle. Clinical and imaging data were collected, and histopathological analysis was performed. **Results**: The most common lesion sites were the right lower lobe (26.7%) and left upper lobe (23.3%). Bronchogenic carcinoma was the most prevalent pathology (66.6%), followed by malignant metastatic papillary adenocarcinoma (16.7%). Lesions larger than 5 cm were observed in 61.7% of cases. Solid masses with smooth margins were found in 43.3%. Two core biopsies were obtained in 96.7%, with 3.3% requiring a single core due to complications. Re-biopsy was needed in 6.7% of cases. Hydro pneumothorax occurred in 3.3%, requiring chest tube insertion. A significant association was found between core size and the need for re-biopsy (p=0.003), and pleural effusion and lung collapse were linked to complications (p=0.010). **Conclusion:** US-guided tru-cut biopsy is an effective, minimally invasive method for diagnosing peripheral lung lesions with minimal complications. Larger studies are needed to confirm these findings and explore its broader application.

Keywords: Peripheral Lung Lesions; Ultrasound; Tru-Cut Biopsy; Bronchogenic Carcinoma; Prospective Study.

Introduction

Peripheral intrathoracic shadows are indicative of various diseases affecting the chest wall, pleura, lung, and mediastinum, including peripheral lung cancer, tuberculosis, pneumonia, and atelectasis (1). Transthoracic ultrasonography (US) is valuable for evaluating these lesions by allowing visualization, structural characterization, and aiding in differential diagnosis. US is especially beneficial for critically ill and bedridden patients due to its non-invasive, radiation-free, cost-effective, and bedside applicability, with the added advantage of repeatability for ongoing assessments (2, 3).

Peripheral pulmonary lesions, defined as lesions in direct contact with the chest wall without intervening aerated lung, display an echogenic texture and sharp borders due to a strong reflective interface with the aerated lung on US (4). The popularity of US in pulmonary diagnostics stems from its established safety and efficacy in multiple procedures, including locating thoracentesis sites, chest tube insertion, transthoracic fine needle aspiration, true-cut biopsy, pneumothorax diagnosis, and pleural fluid detection (5).

Peripheral pulmonary lesions have a broad differential diagnosis, including malignant, benign, and inflammatory types, with tissue diagnosis as the gold standard, often obtained via open lung biopsy, mediastinoscopy, or video-assisted thoracic surgery. Image-guided percutaneous transthoracic biopsy is now a widely accepted, safe, and minimally invasive method (6). US-guided true-cut core biopsy offers a less invasive approach with real-time guidance, low morbidity, and minimal complications, avoiding the need for general anesthesia (7). US-guided biopsies are preferred when lesions are visible in US; however, centrally located lesions or those without contact with the visceral pleura cannot be visualized due to air-induced reflection (8).

The purpose of this study is to determine the role of transthoracic US-guided tru-cut biopsy in the diagnosis of peripheral lung lesions.

Patients and methods

(Approval code: MD 18-12-2022)

Design and population

This Prospective study included 60 patients with with peripheral lung mass based on chest X-ray & CT scan admitted Radiology and Chest departments of Benha University Hospitals, during the period from January to December 2023. The study was done after being approved by the Research Ethics Committee, Faculty of Medicine, Benha University. An informed written consent was obtained from the patients. Every patient received an explanation of the purpose of the study and had a secret code number.

Inclusion criteria were adult patients of both sexes who had imaging-confirmed peripheral pulmonary lesions, and normal coagulation profiles, except for that patients were excluded.

Procedures

For all patients, pre-procedural steps included taking a comprehensive history (covering age, sex, smoking and occupational history, illness duration, medications like salicylates, antiplatelets, and anticoagulants, and any associated liver or kidney disease), conducting a thorough clinical examination, and performing bleeding profile and CBC tests to assess prothrombin time, concentration, and INR, thereby preventing post-procedural bleeding or hematoma and addressing any bleeding diathesis.

For the procedure, transthoracic ultrasonography was performed using LOGIQ P6 and LOGIQ P10 machines at Benha University Hospitals with a 3.5–5.0 MHz convex transducer and a 7.5–10 MHz linear transducer for detailed imaging. Patients were positioned supine, prone, or in lateral decubitus based on lesion location. The transducer was oriented to scan between ribs to avoid obstruction, allowing for efficient examination across multiple interspaces.

For the ultrasound-guided tru-cut biopsy of peripheral lung lesions, informed consent was obtained, and the patient was properly positioned. After handwashing and donning sterile attire, the puncture area was sterilized with povidone-iodine. Local anesthesia (1-2% lidocaine) was administered, first subcutaneously with a 25-gauge needle and then deeper with a 21-gauge needle near the rib margin. Using real-time ultrasound guidance, a 16-gauge semiautomatic cutting needle was inserted through the anesthetized tract to obtain tissue samples. Samples were then placed in 10% neutral buffered formalin, labeled, and sent for histopathological analysis.

Diagnostic thoracentesis was performed on 20 cases, with the patient positioned on the edge of the bed, head and arms resting on an examining table. The insertion area was sterilized, covered with a surgical drape, and numbed with local anesthesia. A needle was then inserted between two ribs at the back, and once reaching the pleural space, a fluid sample was collected using a syringe or suction bottle.

Post-procedural care involved monitoring all patients for four hours with close attention to vital signs. Additionally, a postero-anterior chest X-ray was performed to exclude the presence of pneumothorax following the procedure.

Statistical analysis

The collected data was revised, coded, and tabulated using the Statistical Package for Social Science (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). Data were presented and suitable analysis was performed based on the type of data obtained for each parameter. Descriptive statistics included the use of mean, standard deviation (± SD), median, and range for numerical data, while frequency and percentage were used for non-numerical data. The normality of data distribution was tested using the Kolmogorov-Smirnov test. Analytical statistics involved the use of the Chi-Square test to examine the relationship between two

qualitative variables, and the Fisher Exact or Monte-Carlo test when the expected count was less than 5 in more than 20% of cells. The Mann Whitney Test (U test) was applied to assess the statistical significance of differences in non-parametric variables between two study groups. A p value was considered significant if <0.05 at a 95% confidence interval.

Results

Most patients had no smoking history (78.3%) or past cancer history (90%). All patients underwent non-contrast CT scans, with 91.7% also receiving contrast-enhanced CT scans, while 8.3% did not due to contrast media allergy. The most common lesion sites were the right lower lobe (26.7%) and left upper lobe (23.3%), with 61.7% of lesions larger than 5 cm. Solid masses with smooth margins were the most prevalent CT feature (43.3%). Invasion of the chest wall was found in 8.3%, while pleural effusion and lung collapse were observed in 33.3% each. **Table 1**

Bronchogenic carcinoma was the most prevalent pathology (66.6%), followed by malignant metastatic papillary adenocarcinoma (16.7%), non-diagnostic (6.7%), round cell tumor (6.7%), and congested lung tissue (3.33%). The most common types of bronchogenic carcinoma were adenocarcinomas, including poorly differentiated (30%) and infiltrating adenocarcinoma (23.3%). Most patients did not have pleural effusions. The approach for US-guided tru-cut biopsy was determined by lesion site, with the right scapular line (26.7%) and right mid-clavicular line (23.3%) being the most common. The LOGIQ P10 machine provided good imaging quality with better acoustic views, and convex probes were preferred for better visualization. Most patients underwent two core biopsies (96.7%), while 3.3% had one core due to complications like hydropneumothorax or vasovagal attacks, which required procedure termination. A small percentage (6.7%) needed a re-biopsy, and 3.3% experienced hydropneumothorax that required chest tube insertion. **Table 2**

The distribution of different pathologies in relation to sites varies significantly p=0.001. This was attributed to significant difference in the distribution of poorly differentiated adenocarcinoma (p=0.001) and Congested lung tissue (p=0.008). **Table 3**

The significant p-value (p=0.004) indicate the diagnostic value of CT features in predicting lesion pathology. Infiltrating adenocarcinoma showed significant difference in CT features with highest association with Consolidative patch with air bronchograms (p<0.001). Malignant metastatic papillary adenocarcinoma showed significant difference in CT features with highest association with Heterogeneous mass with internal cystic breaking down (p=0.003). **Table 4**

A higher percentage of re-biopsies was observed when the core size was minimally representative, with a significant association between the number of cores taken and the need for re-biopsy (p = 0.003). Complications were more frequent in patients who

underwent biopsies with a convex probe, although no significant difference was found between convex and linear probes (p = 1.0). The presence of pleural effusion and lung collapse was significantly linked to complications, with all patients who had complications also showing pleural effusion and lung collapse (p = 0.010). Complications, including vasovagal attacks and hydropneumothorax, were associated with taking a single core, leading to the immediate termination of the procedure in some cases. A significant association was also found between the need for re-biopsy and the occurrence of complications (p = 0.019). **Table 5**

Case presentation

A 75-year-old male patient presented with persistent left lateral chest pain. CT findings showed a mass in the left upper lobe abutting the left main bronchus, with pleural invasion and internal cystic changes. TUS revealed a well-defined, heterogeneous, mainly hypoechoic lesion with pleural invasion. TUS-guided tru-cut biopsy provided two full core samples, and a post-procedure X-ray showed no pneumothorax. Laboratory analysis confirmed the lesion as malignant metastatic invasive papillary adenocarcinoma. **Figure 1**

A 50-year-old female patient presented with recent weight loss, easy fatigability, and severe left-sided chest pain. CT findings showed a left lower lobe posterior basal segment peripheral pulmonary mass. TUS revealed a well-defined hypoechoic lesion in the left lower zone. TUS-guided tru-cut biopsy provided two half core samples, and a post-procedure X-ray showed no pneumothorax. Laboratory analysis confirmed the lesion as minimally represented poorly differentiated adenocarcinoma. **Figure 2**

A 38-year-old male patient presented with right shoulder pain. CT findings revealed a right upper lobe apical segment pulmonary mass, with a consideration of a Pancoast tumor. TUS showed a well-defined heterogeneous lesion in the right upper zone. TUS-guided tru-cut biopsy provided two half core samples, and a post-procedure X-ray showed no pneumothorax. Laboratory analysis confirmed the lesion as minimally represented small cell carcinoma. **Figure 3**

A 52-year-old male smoker presented with progressive dyspnea and cough. CT imaging showed a left upper lobe apical-posterior segment mass lesion. TUS revealed a well-defined, heterogeneous, mainly hypoechoic lung lesion in the left middle zone, approached posteriorly. TUS-guided tru-cut biopsy obtained two full core samples, and a post-procedure X-ray showed no pneumothorax. Laboratory analysis confirmed the lesion as poorly differentiated adenocarcinoma. **Figure 4**

Table 1: Smoking history, known history of cancer, contrast and non-contrast enhanced CT scans, CT features, and associated CT findings in patients with peripheral lung lesions**.**

		Patients (n = 60)	
		No.	**%**
Positive		13	21.7
Negative		47	78.3
No		**54**	**90.0**
Cancer lung		**4**	**6.7**
Cancer larynx		**2**	**3.3**
Contrast enhanced CT	Yes	55	91.7
	No	5	8.3
Non-Contrast enhanced-CT	Yes	60	100
	No	0	0
Lesion's site	Right upper lobe	14	23.3
	Right middle lobe	6	10.0
	Right lower lobe	16	26.7
	Left upper lobe	14	23.3
	Left lower lobe	10	16.7
Lesion's size	3 cm	16	26.7
	4-5 cm	7	11.7
	> 5 cm	37	61.7
Number of lesions	Mean ± SD.	1.42 ± 1.01	
	Median	1.0	
	Min. – Max.	1.0 – 5.0	
CT patterns of the lesion	Consolidative patch with air bronchograms	4	6.7
	Heterogeneous mass with internal cystic breaking down	8	13.3
	Solid mass with smooth margins	26	43.3
	Solid mass with speculated margins	22	36.7
Invasion of chest wall	Yes	5	8.3
	No	55	91.7
Pleural effusion	Yes	20	33.3
	No	40	66.7
Lung collapse	Yes	20	33.3
	No	40	66.7

Table 2: Pathology of lesions, pleural effusion, approach of US-guided tru-cut needle biopsy, type of Table 2 : US machine and probe, number and size of cores, need for re-biopsy, and procedural-related complications in patients with peripheral lung lesions

		Patients (n = 60)	
		No.	**%**
Lesion	Infiltrating adenocarcinoma	14	23.3
	Malignant metastatic papillary adenocarcinoma	10	16.7
	Poorly differentiated adenocarcinoma	18	30.0
	Congested lung tissue	2	3.3
	Non diagnostic	4	6.7
	Non-small cell lung cancer	2	3.3
	Round cell neoplasm	4	6.7
	Small cell lung cancer	6	10.0
Pleural effusion	Exudate	12	20.0
	Malignant	6	10.0
	No pleural effusion	42	70.0
US guided tru-cut needle biopsy	Right mid clavicular line	14	23.3
	Right mid axillary line	6	10.0
	Right scapular line	16	26.7
	Left mid clavicular line	8	13.3
	Left mid axillary line	6	10.0
	Left scapular line	10	16.7
US Machine used	LOGIQ P6	20	33.3
	LOGIQ P10	40	66.6
Prob used	Convex	50	83.3
	Linear	10	16.7
Size of core	Adequate	52	86.7
	Minimally re-presentive	8	13.3
Number of cores	One	2	3.3
	Two	58	96.7
	Mean ± SD.	1.97 ± 0.18	
	Median	2.0	
	Min. – Max.	1.0 – 2.0	
Need for re-biopsy	No	56	
	Yes	4	
Complications	Hydropneumothorax	2	
	Vasovagal attack	2	
	No complications	56	

US – Ultrasonography, SD – Standard Deviation, Min. – Minimum, Max. – Maximum, LOGIQ P6 – A type of ultrasound machine, LOGIQ P10 – A type of ultrasound machine.

Table 3: Relation between lesion's site and pathology of the lesion

Site of the lesion		Right upper lobe n=14	Right middle lobe n=6	Right lower lobe n=16	Left upper lobe n=14	Left lower lobe n=10	Test (χ^2)	p
Pathology of the lesion	**Infiltrating adenocarcinoma**	6 (42.9%)	2 (33.3%)	2 (12.5%)	2 (14.3%)	2 (20.0%)	4.810	^{MC}0.289
	Malignant metastatic papillary adenocarcinoma	2 (14.3%)	0 (0.0%)	4 (25.0%)	4 (28.6%)	0 (0.0%)	4.734	^{MC}0.300
	Poorly differentiated adenocarcinoma	0 (0.0%)	2 (33.3%)	10 (62.5%)	2 (14.3%)	4 (40.0%)	16.65*	^{MC}0.001*
	Congested lung tissue	0 (0.0%)	2 (33.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	7.880*	^{MC}0.008*
	Non diagnostic	2 (14.3%)	0 (0.0%)	0 (0.0%)	2 (14.3%)	0 (0.0%)	3.857	^{MC}0.319
	Non-small cell lung cancer	2 (14.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.274	^{MC}0.262
	Round cell neoplasm	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (14.3%)	2 (20.0%)	5.266	^{MC}0.125
	Small cell lung cancer	2 (14.3%)	0 (0.0%)	0 (0.0%)	2 (14.3%)	2 (20.0%)	4.030	^{MC}0.362
	Test (p)	χ^2=42.444* ^{MC}p=0.001*						

χ^2: Chi Square test, MC: Monte Carlo, *: Significant when p value <0.05.

Table 4: Relation between CT features and pathology of the lesions

CT features of the lesion		Consolidative patch with air bronchograms n=4	Heterogeneous mass with internal cystic breaking down n=8	Solid mass with smooth margins n=26	Solid mass with speculated margins n=22	Test (χ^2)	p
Pathology of the lesion	**Infiltrating adenocarcinoma**	4(100.0%)	0(0.0%)	2(7.7%)	8(36.4%)	17.979	^{MC}<0.001*
	Malignant metastatic papillary adenocarcinoma	0(0.0%)	4(50.0%)	6(23.1%)	0(0.0%)	11.589	^{MC}0.003*
	Poorly differentiated adenocarcinoma	0(0.0%)	2(25.0%)	10(38.5%)	6(27.3%)	2.294	^{MC}0.502
	Congested lung tissue	0(0.0%)	0(0.0%)	2(7.7%)	0(0.0%)	2.461	^{MC}0.677
	Non diagnostic	0(0.0%)	0(0.0%)	2(7.7%)	2(9.1%)	0.839	^{MC}1.000
	Non-small cell lung cancer	0(0.0%)	0(0.0%)	0(0.0%)	2(9.1%)	3.144	^{MC}0.490
	Round cell neoplasm	0(0.0%)	0(0.0%)	2(7.7%)	2(9.1%)	0.839	^{MC}1.000
	Small cell lung cancer	0 (0.0%)	2 (25.0%)	2 (7.7%)	2 (9.1%)	2.330	^{MC}0.481
	Test (p)	χ^2=32.173* ^{MC}p=0.004*					

χ^2: Chi Square test, MC: Monte Carlo, *: Significant when p value <0.05.

Table 5: Relation between need for re-biopsy, type of prob used, associated findings among patients with peripheral lung lesions, number of cores, need for re-biopsy and complications

Number and size of cores		Need for re-biopsy No n = 56		Yes n = 4		Test	p
		No.	%	No.	%		
Size of core	Adequate	50	89.3	2	50.0	χ^2= 4.986	FE 0.082
	Minimally re-presentive	6	10.7	2	50.0		
Number of cores	One	0	0.0	2	50.0	χ^2= 28.966*	FE 0.003*
	Two	56	100.0	2	50.0		
Findings among patients with peripheral lung lesions		**Complications**					
Pleural effusion	No	40	71.4	0	0.0	χ^2= 8.571*	FE 0.010*
	Yes	16	28.6	4	100.0		
Lung collapse	No	40	71.4	0	0.0	χ^2= 8.571*	FE 0.010*
	Yes	16	28.6	4	100.0		
Type of prob used		**Complications**					
Convex		46	82.1	4	100.0	χ^2= 0.857	FE 1.0
Linear		10	17.9	0	0.0		
Number of cores		**Complications**					
One		0	0.0	2	50.0	χ^2= 28.966*	FE 0.003*
Two		56	100.0	2	50.0		
Need for re-biopsy		**Complications**					
No		54	96.4	2	50.0	χ^2= 12.934*	FE 0.019*
Yes		2	3.6	2	50.0		

χ2 – Chi-square, FE – Fisher Exact, p – Probability (value), *: Significant

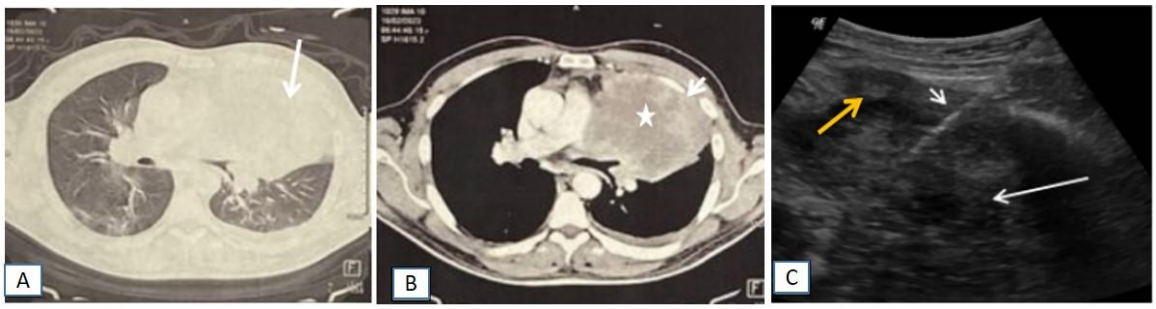

Figure 1: (A) CT lung window shows left upper lobe mass (long arrow) is seen abutting the left main bronchus. (B) Mediastinal window shows mass with internal cystic changes (star) and pleural invasion (short arrow). (C) TUS low frequency convex probe B-mode image shows heterogeneous hypoechoic lesion (long arrow) with loss of pleuropulmonary interface (yellow arrow) denoting pleural invasion. Tru-cut needle (short arrow) is seen within the lesion.

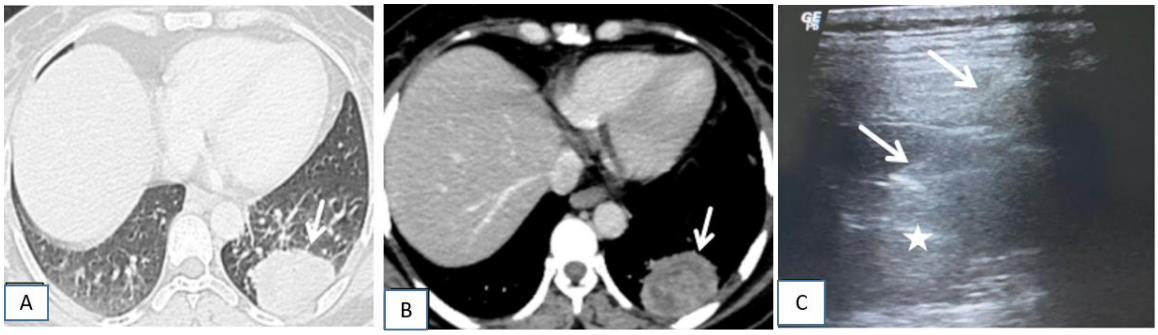

Figure 2: (A) CT lung window. (B) mediastinal window shows left lower lobe posterior basal segment peripheral mass lesion (arrow). (C) TUS high frequency liner probe B-mode image shows heterogeneous hypoechoic lesion (star). Tru-cut needle (arrows) is seen within the lesion**.**

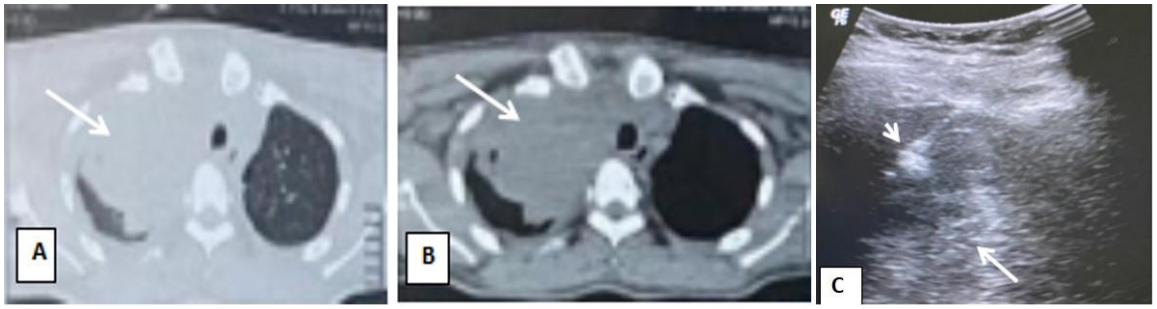

Figure 3: (A) CT lung window. (B) Mediastinal window shows right upper lobe apical segment mass lesion (arrow). (C) TUS low frequency convex probe B-mode image shows heterogeneous lesion (arrow). Tru-cut needle (arrowhead) is seen within the lesion.

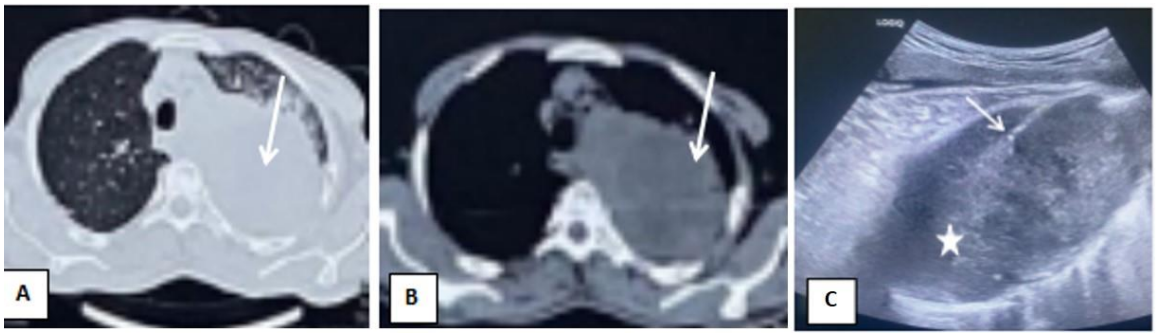

Figure 4: (A) CT lung window. (B) Mediastinal windows show left upper lobe apical-posterior segment peripheral subpleural masses (arrow). (C) TUS low frequency convex probe B-mode image shows heterogeneous hypoechoic lesion (star). Tru-cut needle (arrow) is seen within the lesion.

Discussion

The current study aimed to determine the role of transthoracic US-guided tru-cut biopsy in the diagnosis of peripheral lung lesions. This study was carried out on 60 patients with peripheral lung mass based on chest X-ray & CT scan from those patients attending at the Radiology or Chest Departments of Benha University Hospitals. They were 29 males and 31 females, their age ranged

between 44 and 80 years old with the mean age was 61.83 ± 10.64 years.

Concerning the size of the lesion, the current study showed that most lesions were greater than 5 cm in size (61.7%). While lesions sized from 4 to 5 cm accounted for 11.7%, and lesions sized of 3 cm accounted for 26.7%. In contrast the study some authors (9) noted that (42%) of lesions had a diameter of 1–2 cm and (57.6 %) of lesions had a diameter greater than or equal to 2 cm.

According to the site of pathology as defined by CT chest, the current study showed that the most common affected lobe was the right lower lobe (26.7%), followed by the right and left upper lobes (each was 23.3%) then the left lower lobe (16.7 %) and right middle lobe (10%). However, a study performed by Sweed and colleagues (10) showed that the most commonly affected lobe was the left upper lobe (30%), followed by the right upper lobe, right lower lobe, left lower lobe, and the middle lobe of the right lung in 23.3%, 16.7%, 10%, and 3.3%, respectively.

Radiologically, our study revealed 33.3% of patients had associated pleural effusion and (8.3%) had chest wall invasion. While the study of some authors (11) showed that (45%) had pleural effusion and (10%) had chest wall invasion.

Regarding histopathology analysis of Tru-Cut biopsy; the current study revealed that (66.6%) of diagnosed patients were bronchogenic carcinoma, followed by malignant metastatic papillary adenocarcinoma (16.7%). Then non diagnostic (6.7%) and round cell tumor (6.7%) as well as congested lung tissue (3.33%).

While in a published study (11) a 28.33% of diagnosed patients were bronchogenic carcinoma, followed by metastatic adenocarcinoma (21.67%) then malignant mesothelioma (16.67%), malignant lymphoma (8.33%), thymoma (5%), TB (5%), sarcoma (3.33%), neurofibroma (3.33%), organizing pneumonia (1.67%), fibrosis (1.67%), rhabdomyoma (1.67%), plasma cell tumor (1.67%), and schwannoma (1.67%).

As regard to the most common types of bronchogenic carcinoma among the studied patients; the current study showed that (30%) were poorly differentiated adenocarcinoma followed by (23.3%) infiltrating adenocarcinoma. Then (10%) small cell lung cancer and (3.33) non-small cell lung cancer. In contrast, a study by some authors (11) showed that the most common types of bronchogenic carcinoma among studied patients were squamous cell carcinoma and adenocarcinoma (30.2% each) followed by large cell carcinoma (28.3%) and small cell lung cancer (11.3%).

There were an agreement between our study and another study (12) concerning the most common type of malignancy that was adenocarcinoma with value of (58%) in our study and (30%) in their study.

Concerning the number of cores obtained to give adequate sampling, no need for re biopsy, our study noted that it was two cores in 56 cases (93.3%)

while the study by Ismaeil and co-workers (12) noted that the number of cores to obtain adequate sampling was two in 4 cases (22%), 3 cores in 5 cases (28%), 4 cores in 7 cases (39%) and 5cores in 2 (11%).

Regarding the sample adequacy, our stated noted that (86.7%) of samples were adequate and (13.3%) were minimally representative. While a study that was published recently (13) showed that (96.2%) were adequate and (3.8%) were minimally representative.

As regards the post procedural complications, in our study (6.6%) of patients developed complications while in study of some authors (14) there were no complications.

Our study included (6.6%) of patients developed complications of hydro pneumothorax and vasovagal attacks. Controversially, the study that was published recently (15) showed that (3.6%) of patients developed complications of hemoptysis and pneumothorax.

Interestingly, our study had several limitations the small sample size, which calls for larger studies to better understand the role of ultrasound in diagnosing peripheral lung lesions of various etiologies, the use of only a single type of 16-Gauge semiautomatic cutting needle, suggesting the need for future studies comparing different needle types in a larger cohort of patients, and the lack of a pathologist for on-the-spot cytology evaluation during the biopsy procedure.

Conclusion

US- guided Tru cut biopsy from peripheral lung lesions is an effective, minimally invasive procedure, does not require general anesthesia or sedation, supports procedures in real time and is associated with low morbidity, mortality and complication rates with a high rate of success

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