THE DIAGNOSTIC YIELD OF CORE NEEDLE US-GUIDED TRANSTHORACIC LUNG BIOPSY IN THE DIAGNOSIS OF PERIPHERAL LUNG LESIONS COMPARED TO FLEXIBLE BRONCHOSCOPY A SINGLE CENTER STUDY FROM TRIPOLI-LIBYA

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ABSTRACT

Safe and effective diagnostic modalities are needed for the assessment of peripheral lung lesions. Ultrasound (US) guidance for trans thoracic lung biopsy (TTLB) is safer, quicker, and less expensive than guidance by CT or fluoroscopy, and unlike flexible bronchoscopy (FB); TTLB allows the operator to biopsy the lesions without relying on central airway anatomy to reach the target. This is a descriptive prospective study to evaluate the diagnostic yield of core needle US-guided TTLB in the diagnosis of peripheral lung lesions compared to FB.

Patients with peripheral lung lesions referred to the respiratory clinic at Tripoli Central Hospital during the period from July 2005 to December 2014 were evaluated. They were subjected to history taking, clinical and radiological examination. Flexible bronchoscopic (FB) examination was performed with or without transbronchial biopsy (TBB). When the FB was negative or the biopsy was inconclusive or needed to be confirmed, core needle US-guided transthoracic lung biopsy (TTLB) was performed. 8 patients were considered clinically fit for FB and directly underwent TTLB. None of these patients had INR >1.5, platelets < 100,000/ml, forced expiratory volume (FEV1) <35% of predicted, pulmonary hypertension, severe respiratory failure, sever, emphysema, or previous pneumectomy. Samples taken from suspicious sites were sent for histopathological examination.

The 91 consecutive patients were involved in the study, 76 (83.5%) were males and (15%) were females, their mean age was 63.8 ±17.9 (SD) (range 16-91 years). In 83 patients FB was performed, out of them 65 had transbronchial biopsy (TBB). TBB histopathology results gave a clear diagnosis in 28/83 patients (33.7%). The 91 patients underwent TTLB and a tissue diagnosis was obtained in 81 (89%) patients. 64/91 patients (69.2%) had malignant lesions and 17 patients (18.7%) had benign ones. In the remaining 10 (1.1%) patients the result was inadequate or inconclusive. The diagnostic yield of TTLB in the 38 patients who had normal FB findings was 92.1%; 22/38 had malignant and 13/38 had benign lesions. Malignant lung lesions were significantly associated with older age. Squamous cell lung cancer was detected in 17/91 patients (18.7%), adenocarcinoma in 15/91(16.5%) and small cell carcinoma 14/91 (15.4%) patients. No serious complication was reported except for a pneumothorax that necessitated chest tube insertion in one patient (1.2%). The diagnostic yield of TBB in this study was low (33.7%). The yield of US-guided TTLB was high (89%) and was higher (92.1%) in the patients with negative FB findings. Overall 69.2% of the studied patients had malignant lung lesions that were significantly associated with older age, and squamous cell cancer was the most frequent diagnosis.

KEY WORDS: Peripheral lung lesions, Ultrasound-guided transthoracic lung biopsy, Core needle biopsy.

INTRODUCTION

In the evaluation of a patient with suspected lung lesions, it is important to decide on the optimal site and modality for the tissue biopsy[(1)]. Lung samples may be obtained by transbronchial lung biopsy (TBLB), computed tomography (CT)-guided, video-assisted thoracoscopic, or surgical biopsy[(2)]. For patients with symptoms suggestive of airways involvement such as, increasing cough or hemoptysis with or without radiographic finding of central lesions; flexible bronchoscopy (FB) is preferred diagnostic procedure[(3)]. The principal advantages of FB include an extensive view of the tracheobronchial tree, no requirement for general anesthesia and low complication rate[(4-6)]. The overall diagnostic yield of FB varies depending on the size, location and extent of the lung lesion. In addition to the nature of underlying lung disease, the results of TBLB also depend on the experience and technical skills of the bronchoscopic operator[(7)]. Patients with negative bronchoscopy require more concerted effort to achieve a timely diagnosis and treatment[(8, 9)].

US-guided TTLB is a well-established technique capable of providing sufficient tissue for histopathologic diagnosis of lung lesions. It is safe, quick, and less expensive[(10,11)] and according to the BET Guidelines 2003[(2)]; it should be used when possible. Like TBLB, the results of TTLB depend on the experience and technical skills of the physicians performing the procedure who should have excellent knowledge of pleural and thoracic anatomy and good judgment in interpreting the ultrasound images. The biopsy can be taken by either fine needle aspiration (FNAB) for cytological examination or core needle biopsy (CNB) for histological examination. The diagnostic yield of both FNAB and CNB are reported to be high, though, CNB is superior in benign lesions[(12,13)]. According to the BET Guidelines

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2003; the decision on the type of needle used depends on the operator experience, available cytological support, and the position of the lesion**.**

The aim of this study is to evaluate the diagnostic yield of TTLB performed at the respiratory clinic in Tripoli Central Hospital and to compare it with the FB yield.

MATERIALS AND METHODS

Prior chest imaging (when available) was reviewed and CT scan chest was performed to evaluate and localize the pathology site. Patients with any of the following were excluded; INR > 1.5, PTT > 40, Platelets < 100,000/ml, Forced expiratory volume (FEV_1) <35% of predicted, pulmonary hypertension, severe respiratory failure, or sever emphysema. FB was performed in 83 patients, out of them 65 had transbronchial biopsy (TBB). The TTLB was performed jointly by a senior consultant physician with outstanding experience in US and a senior respiratory physician using an Aloka US unit (Tokyo, Japan) model SSD 4000 with Doppler and 3.5- MHz small-sector convex probe. A dedicated cytopathologist was not available, so CNB was chosen using True-cut needle (18G - 20G). Samples obtained were placed in formalin and sent for histopathologic examination. At the end of the procedure, the patient was examined by auscultation for the presence of pneumothorax and an erect chest X-ray was performed 1 hour after the biopsy. Most of the biopsies were performed on inpatients.

Data analysis:

It was performed using the SPSS software (Statistical Package for the Social Sciences, version 16.0 (SPSS Inc, Chicago, Ill, USA). Continuous variables are demonstrated as means (±SD), and categorical variables as numbers and percentages. Categorical variables were analyzed by chi-square test and student's t-test for continuous variables. P values less than 0.05 were considered significant.

RESULTS

As shown in (table 1); the study included 91 consecutive patients, 76 of them (83.5%) were males and (15%) were females, their mean age was 63.8 ±17.9 (SD) (range 16-91 years). The radiological diagnosis was cavitating lesions in 10 patients, opacities in 43 & mass lesions in 36 patients. FB was performed in 83 patients and showed; visible endobronchial growth in 35 patients (42.2%), endobronchial narrowing in 12 patients (14.4%), and normal findings in 38 patients (45.8%) patients. In 65 out of the 83 patients TBLB samples were taken. The TBLB histopathology results gave a clear diagnosis in only 28/83 patients (33.7%); 24 patients (28.9%) had malignant lesions and 4 (4.8%) patients had benign ones. All of the studied patients underwent TTLB and a tissue diagnosis was obtained in 81 (89%); malignant lesions in 64/91 patients (69.2%) and benign lesions in 17 patients (18.7%). In the other 10(%) patients the result was inadequate or inconclusive.

(Table1) Summary of radiologic, FB, TBB, & TTLB findings of the 91 studied patients

Parameter	Percentage or mean
Age	63.8±17.9, (range 16-91 years
Gender (males)	76/91 (83.5%)
Radiological diagnosis	
Cavitating lesion	10/ 91(11%)
Opacity	43/ 91(47.2%)
Mass	36/ 91(39.6%)
FB	83/91(91.2%)
Visible endo-bronchial growth	35/83 (42.2%)
Narrowing	12/83(14.4%),
Normal	38/83 (45.8%)
FB visual yield	47/83 (56.6%)
Transbronchial biopsy(TBLB)	
Tissue diagnosis	28/83 (**33.7%)**
negative or inconclusive	37/83 (44.6%)
not performed	18/83 (21.7%)
Total FB diagnosis yield	**28/83 (33.7%)**
Transthoracic lung biopsy (TTLB)	91/91 (100%)
Tissue diagnosis	81/91 (89%)
Malignant lesions	64/91(69.2%)
Benign lesions	17/91 (18.7%)
Inconclusive	10/91(11%)
TTLB diagnostic yield	**81/91(89%)**

Percentage or mean ±SD

(Table 2) shows the TTLB results of the 38 patients who had normal FB findings; 22/38 (57.9%) had malignant lesions, and 13 (34.2%) had benign lesion with a total diagnostic yield of 35/38 (92.1%).

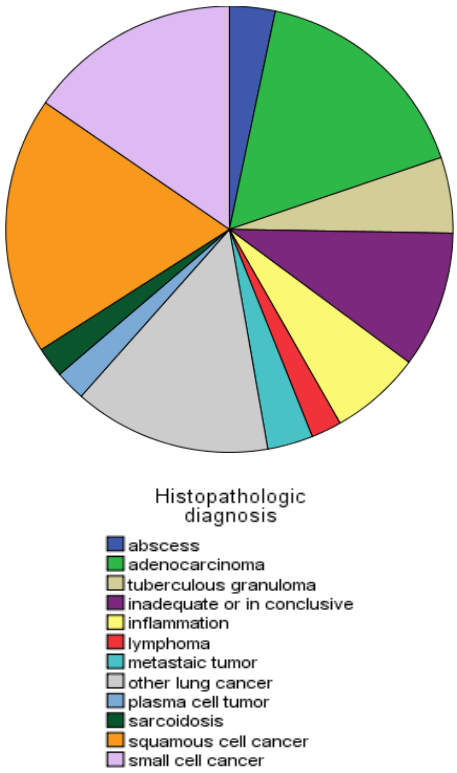
(Table 2) Histopathology results of TTLB in the 38 patients with normal FB

Diagnosis	percentage
Malignant lesion	22/38 (57.9%)
Benign lesion	13/38 (34.2%)
Non-conclusive	3/38 (8%)
Diagnostic yield of TTLB	35/38 (92.1%)

(Table 3) and (figure 1) show the histopathologic results of the TTLB samples; squamous cell lung cancer was the most frequently reported malignancy 17/91(18.7%), followed by adenocarcinoma and small cell lung cancer 15/91(16.5%) and 14/91(15.4%) respectively.

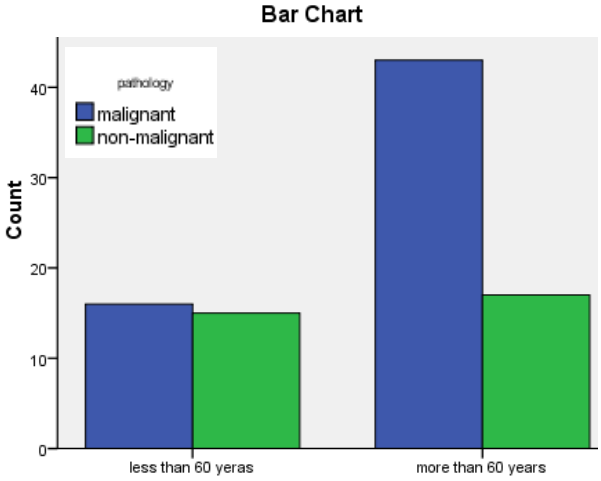
(Table 3) Histopathology results of the TTLB performed in the 91 studied patients

Diagnosis	Percentage
Adenocarcinoma	15 /91(16.5%)
Squamous cell carcinoma	17/91(18.7%)
Small cell carcinoma	14/91(15.4%)
Other lung cancer	12/91(13.2%)
Metastatic tumor	3/91(3.3%)
Lymphoma	2/91(2.2%)
Plasma cell tumor	2/91(2.2%)
Sarcoidosis	2/91(2.2%)
Tuberculosis granuloma	5/91(5.5%)
Abscess	3/91(3.3%)
Inflammation	6/91(6.6%)
Inadequate or inconclusive	10/91(10.1%)



(Figure 1) Distribution of the studied patients by the histopathologic diagnosis

The mean age of the patients with malignant lesions was 68.1 ± 15 years compared with 53.4 ± 20.2 for patients with benign lesions (P <.000) (figure 2), and 52 of them were males (P .370).



(Figure 2) Age and pathologic diagnosis

DISCUSSION

According to the result of a comparative systematic search performed by Rivera et al[3]; the diagnostic yield of bronchoscopy for peripheral lung lesions more than 2 cm in diameter was (63%) compared with (34%) yield for lesions less than 2 cm (34%). The (33.7%) diagnostic yield of FB in this study was comparable. According to Rivera et al findings; the pooled diagnostic yield of TTNA for the diagnosis of lung cancer was 90%. The results of this study were comparable too with (89%) diagnostic yield for TTLB.

Previous studies by Milam et al[14] and Levine et al[15] showed (73.8%) and (43%) diagnostic yield of TTLB following negative FB. In this study, following negative FB findings in 38 patients, the diagnostic yield of TTLB was higher (92.1%).

In 10 out of the 91 patients (10.1%), the result of TTLB was inadequate or inconclusive, which could have been due to inadequate needle adjustments, or extensive central necrosis[16]. A repeat biopsy would have been recommended but the patients were lost for follow up.

Pneumothorax is the most frequently encountered complication of TTLB, with reported incidence of (21%)–(43%)[17], in this study, one patient developed pneumothorax that needed chest catheter insertion (1.2%). No other complication reported.

Like other solid tumors, lung cancer is predominantly a disease of the elderly[18]. 83.5% of this study patients were males with a mean age of 63.8 ±17.9 and based on the TTLB results; 64 out of the 91 studied patients (69.2%) had malignant lesions .The malignancy was statistically associated with older age (P <.000), but not with male gender (P .370). The most frequently detected lung malignancy was squamous cell cancer in 18.7%, followed by adenocarcinoma in 16.5% and small cell carcinoma in 15.4% of the patients.

CONCLUSION

In this study the diagnostic yield of TBB in the suspected peripheral lung lesions was low (33.7%) compared with 89% diagnostic yield for US-guided TTLB. Following negative FB findings, the diagnostic yield of TTLB was higher (92.1%). US-guided TTLB was safe with 1.2% complication rate. Malignant lung lesions were detected in 69.2% of all cases study, and squamous cell cancer was the most frequent diagnosis.

REFERENCES

1- Jamnik, S., Santoro, I. L. & Uehara, C. (2002). Comparative study of prognostic factors among longer and shorter survival patients with bronchogenic carcinoma, *J.Pneumologia* 28(5): 245 – 249.

2- A Manhire, M Charig, C Clelland, F Gleeson, R Miller, H Moss,et al. Guidelines for radiologically guided lung biopsy. BTS GUIDELINES. Thorax 2003; 58:920–936.

3- Rivera MP, Mehta AC, Wahidi MM. Establishing the diagnosis of lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. Chest 2013; 143:e142S.

4- Blasco LH, Hernandez IMS, Garrido VV, et al. Safety of the transbronchial biopsy in outpatients. Chest. 1991; 99:562–5.

5- British Thoracic Society guidelines on diagnostic flexible bronchoscopy. Thorax 2001; 56 (Suppl 1): i1–21.
6- Jin, F., Um, D., Chu, D., Fu, E., Xie, Y. & Liu T. (2008). Severe complications of bronchoscopy, *Respiration* 76(4):429-33.
7- Ladina Joos, Nicola Patuto, Prashant N. Chhajed, Michael Tamm. Diagnostic yield of flexible bronchoscopy in current clinical practice. SWISS MED WKLY 2 0 0 6 ; 1 3 6 : 1 5 5 – 1 5 9.
8- Devbhandari MP, Quennell P, Krysiak P, Shah R, Jones MT. Implications of a negative bronchoscopy on waiting times to treatment for lung cancer patients: results of a prospective tracking study. Eur J Cardiothorac Surg. 2008 Sep; 34(3):479-83.
9- Chandra S, Mohan A, Guleria R, Singh V, Yadav P. Delays during the diagnostic evaluation and treatment of lung cancer. Asian Pac J Cancer Prev. 2009 Jul-Sep; 10(3):453-6.
10- Sheth S, Hamper UM, Stanley DB, Wheeler JH, Smith PA. US guidance for thoracic biopsy: a valuable alternative to CT. Radiology 1999; 210:721-726.
11- Yang PC, Chang DB, Yu CJ, et al. Ultrasound guided core biopsy of thoracic tumors. Am Rev Resp Dis 1992; 146:763-767.
12- X. *Ya, M.M. Gomes, M.S. Tsao, C.J. Allen, Geddie and H. Sekhon.* Fine-needle aspiration biopsy versus core-needle biopsy in diagnosing lung cancer: a systematic review. *Curr Oncol*, Vol. 19, 16-27.
13- Schubert P, Wright CA, Louw M, *et al.* Ultrasound-assisted transthoracic biopsy: cells or sections? *Diagn Cytopathol* 2005; 33:233–7.
14- Milman N, Faurschou P, Grode G. Diagnostic yield of transthoracic needle aspiration biopsy following negative fiberoptic bronchoscopy in 103 patients with peripheral circumscribed pulmonary lesions. Respiration. 1995; 62(1):1-3.
15- Levine MS, Weiss JM, Harrell JH, Cameron TJ, Moser KM. Transthoracic needle aspiration biopsy following negative fiberoptic bronchoscopy in solitary pulmonary nodules. Chest. 1988 Jun; 93(6): 1152-5.
16- Gelbman BD, Cham MD, Kim W, Libby DM, Smith JP, Port JL,et al. Radiographic and clinical characterization of false negative results from CT-guided needle biopsies of lung nodules. J Thorac Oncol. 2012 May; 7(5):815-20.
17- Lee In Jae, Im Hyoung June, Yie Miyeon, Lee Kwanseop, Lee Yul, Bae Sang Hoon. Percutaneous core needle biopsy for small (≤10 mm) lung nodules: accurate diagnosis and complication rates. Diagn Interv Radiol 2012; 18:527–530.
18- J G Blanco,I S Toste, R F Alvarez, G R Cuadrado, A M Gonzalvez and I J González Martín. Age, comorbidity, treatment decision and prognosis in lung cancer. Age Ageing (2008) 37 (6): 715-718