Original Article

Sensitivity of Computed Tomography-guided Transthoracic Biopsies in a Nigerian Tertiary Institution

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Abstract

Introduction: The indications for open biopsies for intrathoracic lesions have become almost negligible. This development was made possible by less invasive maneuvers such as computed tomography-guided (CT-guided) biopsy, thoracoscopy or video-assisted thoracoscopy, and bronchoscopy. CT-guided percutaneous lung biopsy was first reported in 1976. **Aim of Study:** The aim of the study is to report our experience with CT-guided transthoracic biopsy. **Materials and Methods:** Patients with clinical and radiological evidence of intrathoracic mass were counseled and consent obtained for the procedure. They were positioned in the gantry, either supine or prone. A scout scan of the entire chest was taken at 5 mm intervals. The procedure was carried out by the consultants and senior registrar. Following visualization of the lesion, its position in terms of depth and distance from the midline was measured with the machine in centimeter to determine the point of insertion of the trucut needle (14–18-G). The presumed site of the lesion was indicated with a metallic object held in place with two to three strips of plasters after cleaning the site with Povidone-iodine. After insertion, repeat scans were performed to confirm that the needle was within the mass. A minimum of 3 core cuts was taken to be certain that the samples were representative. The results were analyzed by the determination of means and percentages. **Results:** Twenty-six patients underwent this procedure between 2011 and 2015. There were 15 males and 11 females (M:F = 1.4:1). The age range was between 30 and 99 years with a mean of 55 years. Histological diagnosis was obtained in 24 of the patients giving sensitivity of 92.3%. There were 3 mild complications giving a rate of 11.5%. The complications included a case of mild hemoptysis and two patients who had mild pneumothoraces which did not require tube thoracostomy. **Conclusion:** CT-guided biopsy is a reliable procedure for obtaining deep-seated intrathoracic biopsies with high sensitivity and minimal complication rate.

Keywords: *Complications, computed tomography, sensitivity, transthoracic biopsy*

Introduction

A biopsy is a medical test involving extraction of sample cells or tissues for examination to determine the presence or extent of a disease. In other words, it is the removal of part or the whole of a tissue for the purpose of diagnostic evaluation, commonly pathological (histology and cytology) and microbiological analysis.[1] Tissue biopsy of the lungs is necessary in the diagnosis and management of most intrathoracic pathologies, most commonly the diagnosis

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and management of bronchogenic carcinoma and mediastinal masses. The indications for transthoracic tissue biopsy include evaluation of primary and secondary lung malignancies, benign lung lesions, mediastinal masses (including lymph nodes), and obtaining specimen for microbiological analysis.[2] Various routes have been employed to retrieve lung tissue for histology and they range from open biopsies including through thoracotomy (open- or video-assisted), incisional (from tumors penetrating the chest wall), and pleural biopsy to the minimally invasive biopsies including bronchoscopic biopsies, and transthoracic-guided biopsies.[3-5] The indications for open biopsies for intrathoracic lesions have become almost negligible. This development was made possible by less invasive maneuvers such as the bronchoscopic, thoracoscopic, and computed tomography-guided (CT-guided) biopsies. Bronchoscopy is of great value in diagnosing central tumors of the lungs, but less useful in evaluating peripheral ones.[2] However, the use of CT-guided transbronchial cryobiopsy using flexible bronchoscopy to take biopsies from peripheral lesions have been documented.[6] The guided biopsies commonly employ the use of fluoroscopy, ultrasound, CT, and magnetic resonance imaging (MRI). MRI is of limited value in guided biopsy due to the high cost, difficulty in assessing the patient within the magnet during the procedure, poor visualization of lung lesions, and interference with ferromagnetic equipment within the magnetic field. Sensitivity of CT-guided percutaneous transthoracic lung biopsy has been put at 76%–96%.[2] Bozbaş *et al*., in a 10-year experience reported a sensitivity of 87.5% following CT-guided transthoracic lung biopsy and a complication rate of 25.1%.[2]

Although not uncommon in our locality, there are few published reports in Nigerian literature. In Nigeria, the first published experience was in University College Hospital, Ibadan.[7]

Documented complications following the procedure include pneumothorax (4%–60%), hemoptysis (10%), pneumothorax requiring chest drain (4%–10%), hemothorax, hemopneumothorax, pain, air embolism, atrial fibrillation, tumour seeding through the needle tract, chest infection, cardiac tamponade, and on rare occasions, death (0.5%).[4,8-11]

Materials and Methods

Twenty-six patients with clinical and radiological evidence of intrathoracic mass were counseled and consent obtained for the procedure over a period of 5 years (2011–2015). They were positioned in the gantry either supine or prone [Figure 1]. A scout scan

Figure 1: Surgeon inserting trucut biopsy needle with patient prone in computed tomography gantry

of the entire chest was taken at 5 mm intervals. The procedure was carried out by the consultants and senior registrar. The presumed site of the lesion was indicated with a metallic object [Figure 2] held in place with two to three strips of plasters after cleaning the site with Povidone-iodine. The site was infiltrated with 1% xylocaine up to the intercostal muscle layer. Size 11 blade was then use to make a small puncture wound to allow for easy passage of the needle through the subcutaneous layer. Following visualization of the lesion, its position in terms of depth and distance [Figure 3] from the midline was measured with the machine in centimeter to determine the point of insertion of the trucut needle (14–18-G). After insertion, repeat scans were performed to confirm that the needle was within the mass [Figure 4]. A minimum of 3 core cuts were taken to be certain that the samples were representative. The results were analyzed by the determination of means and percentages.

Results

Twenty-six patients underwent this procedure between 2011 and 2015 and were recruited into the study. The age range was between 30 and 99 years with a mean of 55 years. Histological diagnosis was obtained in 24 of the patients giving a sensitivity of 92.3%. The anatomical sites of the biopsy were lung biopsies (22) and mediastinal biopsies (4). The histopathology result was representative (positive) in 20 of the lung biopsies and negative in 2 patients. Of the positive lung biopsies, 16 were malignant while four were benign. The benign lung biopsies included one case of tuberculosis and chronic granulomatous inflammation and two normal tissues. For the negative lung biopsies, one required a mini-thoracotomy, while the other eventually had a definite diagnosis following the infiltration of the

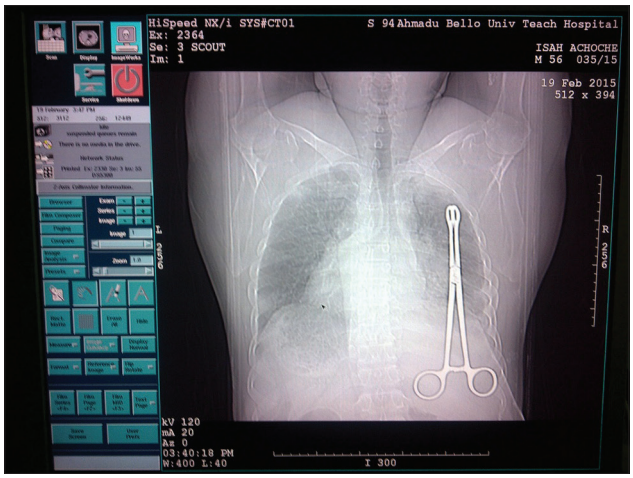

Figure 2: Scout film with metallic object used to localize lesion

Figure 3: Localization of the lesion by computed tomography scan ruler indicated by the white vertical line in the lesion on the right and a horizontal limb pointing to the metallic object

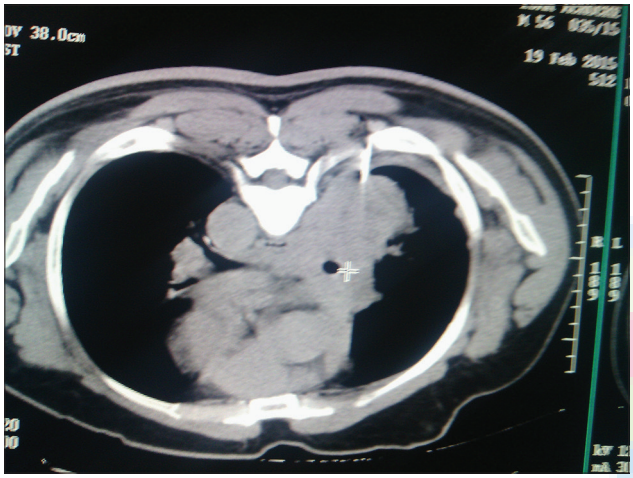

Figure 4: Image confirming entry of needle (radiopaque shadow) into lesion on the left (upper zone)

ANATOMICAL SITE	POSITIVE		NEGATIVE
LUNG	MALIGNANT	16	2
	BENIGN	4	
MADIASTINAL	MALIGNANT	3	
	BENIGN	1	

Figure 5: Table showing the anatomical sites, the number and outcome of the trucut biopsies over the period

chestwall by the tumor which allowed for incisional biopsy. Of the mediastinal biopsies, three were malignant, and one was benign [Figure 5]. There were three mild complications giving a rate of 11.5%. The complications included a case of mild hemoptysis two patients had mild pneumothoraces which did not require tube thoracostomy.

Discussion

Although Leyden first described percutaneous lung biopsy in the 19th century, CT-guided lung biopsy became widely accepted in the 1970s following the initial report by Haaga and Alfidi in 1976.[12] In Nigeria, the first published experience was in University College Hospital, Ibadan.[7]

The methodology employed in this study is generally similar to that recommended by most authors.[2,4,6-9,11-14] Sensitivity of CT-guided percutaneous transthoracic lung biopsy has been put at 76%–96%.[2,13-15] Bozbaş *et al*., in a 10-year experience reported a sensitivity of 87.5% following CT-guided transthoracic lung biopsy and a complication rate of 25.1%.[2] In our study of 26 patients, a CT-guided biopsy had a sensitivity of 92.3%. Tsukada *et al*. have shown that the lesion size is a significant factor contributing to the sensitivity of CT-guided percutaneous lung biopsy and that the sensitivity could be as high as 93% in lesions >30 mm in diameter.[16] This was corroborated by Li *et al*. who identified a sensitivity of 94% in lesions >15 mm in diameter and also noted that the sensitivity was lower (74%) for small pulmonary nodules.[14] The sensitivity of the procedure in our study was as high as 92.3% most likely because most of the lesions were >30 mm in diameter. Furthermore, the sensitivity could theoretically be increased by taking more cores of tissue. We took a minimum of three cores and a maximum of five or six to get a good tissue representation for histology, while tentatively minimizing the risk of emergence of complications. Some researchers who took more number of cores of tissue have recorded higher sensitivity from the procedure, possibly at the expense of a higher complication rate.[2]

Complications identified during the study included a case of mild hemoptysis and two patients who had

mild pneumothoraces which did not require tube thoracostomy, giving a complication rate of 11.5%. This was similar to but milder than complications documented in other studies.[2,9] Bozbaş *et al*. recorded a complication rate of 25.1%, and found that its incidence was not related to age, gender, the presence of emphysema on lung parenchyma, or the number of biopsy specimens obtained.[2] Thus, this possibly nullifies the number of biopsy specimen as a risk factor for the emergence of complications. However, attempt to verify the above was not part of the objectives of our study.

Size of biopsy needle could affect the incidence of complications. With the use of 14–18-G biopsy needles, the incidence of pneumothorax in our study was 7.7%. Hiraki *et al.*, using size 20-G needles, recorded a 42.3% incidence for pneumothorax following CT-guided lung biopsy. However, they found that the significant independent risk factors for development of pneumothorax were no prior pulmonary surgery ($P = 0.001$), lesions in the lower lobe ($P < 0.001$), greater lesion depth ($P < 0.001$), and a needle trajectory angle of <45° ($P = 0.014$), and those for chest tube placement for pneumothorax were pulmonary emphysema ($P < 0.001$) and greater lesion depth ($P < 0.001$).[17] These confounding factors were not taken into consideration in our study. Choi *et al.*, who also used size 20 G needles, found that the overall incidence of pneumothorax following core, needle aspiration, and combined core and needle aspiration biopsy was 16.8%. Pneumothorax was present in 19.3% (33/171) of patients who underwent core biopsy, 15.6% (17/109) of patients who underwent only aspiration, and 4.0% (1/25) who underwent the combination procedure.[15] A well-designed randomized study would be needed to verify the claims on the effect of needle size on the incidence of complications including pneumothorax.

Although needle tract implantation of tumor has been reported to occur (<1%) following transthoracic biopsies (especially when using thicker gauge needles),[18-22] we did not record such in our study. However, to mitigate the occurrence of such complication, video-assisted thoracoscopy biopsy, and retrieval through a plastic bag would be recommended.[23,24]

Conclusion and Recommendation

CT-guided transthoracic biopsy of pulmonary lesions can be performed with high sensitivity and diagnostic yield while encountering minimal complications in our institution. Thus, it is highly recommended in the evaluation of patients with lung masses.

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Conflicts of interest

There are no conflicts of interest.

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