CASE REPORT

CT-guided percutaneous transthoracic lung biopsy: First experience in Ibadan, Nigeria

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Abstract

Percutaneous lung biopsy had been described in the nineteenth century by Leyden, but image- guided needle chest biopsy only gained widespread acceptance in the 1970s. Currently, tissue sampling of a thoracic lesion is indicated when the diagnosis cannot be obtained by the non-invasive techniques and cytological diagnosis will modify the stage of the disease or influence the therapeutic strategy. Cytology obtained by small-gauge needle aspiration biopsy confirms the nature of the lesion in 80 – 95% of cases and carry a low incidence of major complications. The purpose of this report was to provide information on our first experience with CT-guided biopsy and show that with some innovativeness much can be achieve with limited resources and good team work. We performed a CT of the thorax using appropriately placed improvised metal markers, which determined the optimal cutaneous entry point. We then re-checked the location of the lesion scanning intermittently at 5mm slice thickness; we marked the entry point with a pen and cleaned the surface with methylated spirit. A local anaesthetic was subcutaneously injected around marked area. We used a 21G aspiration needle to obtain cytology sample then 18G Trucut biopsy needle to obtain histology specimen. The length of the needle was chosen based on predetermined distance of the target lesion from the skin estimated from the CT images. Our patient was a 51-year-old Nigerian female with a peripherally located nodule in the posterior aspect of the right lung. She had CT-guided biopsy of the nodule. The procedure was well tolerated with no complication of pneumothorax. The histology report provided the basis for treatment regimen. Our experience indicates that percutaneous transthoracic CT-guided needle biopsy is feasible and a safe procedure in our hospital for evaluation of undetermined lung lesions.

Key words: CT-guided biopsy, pneumothorax, pulmonary nodule

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Introduction

Percutaneous transthoracic needle aspiration biopsy (TNAB) of the lung is a well-established method in the cytologic diagnosis of pulmonary nodules. Haaga and Alfidi[1] reported computed tomography (CT)-guided biopsy in the 17th, and numerous reports since that time have shown TNAB procedures to be both effective and accurate.[2,3] The diagnostic accuracy has been reported as greater than 80% for benign disease and greater than 90% for malignant disease.[2,4]

CT-guided TNAB is generally regarded as a safe procedure with limited morbidity and extremely rare mortality.[2,3] Pneumothorax remains the most frequent complication of TNAB. The reported frequency of pneumothorax for CT-guided procedures is variable and usually less than 10% in most series.[2,5] Nevertheless fatal complications such as air embolism, hemorrhage, or pericardial tamponade have been reported,[6,7] but these are rare. Coaxial biopsy systems diminish the number of passes through the visceral pleura and theoretically may reduce the likelihood of pneumothorax.[4,8] During the past two decades, there has been a trend toward the use of smaller needles (19 gauge or smaller).[2,9] This change was driven by reports of clinically important bleeding associated with large cutting needles,

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not by unacceptable rates of pneumothorax.[2,6] To the best our knowledge, there are no reports of this relatively safe diagnostic procedure in Nigeria. The purpose of this report was to demonstrate our first experience and show that with some innovativeness much can be achieved with limited resources and good team work.

Case Report

A 51-year-old Nigerian woman presented in the surgical outpatient department of the University College Hospital (UCH), Ibadan on account of an incidental finding of a pulmonary lesion during a comprehensive medical review. She had a chest X-ray and CT scan that revealed the lesion in the right lung. She had no complaint referable to the chest. She had no prior history of cough or chest pain. There history of weight loss noticed a month prior to presentation but no jaundice, abdominal swelling, or pain.

She had been having joints (especially left hip) and lower back pain for 6 months and had been on treatment for gout.

She had excision of left breast masses on three different occasions (1989, 1990, and 1991). The initial two returned as fibroadenosis but the later showed intra-ductal carcinoma on histology. She subsequently had a left simple mastectomy and axillary clearance plus adjuvant combination chemotherapy and hormone therapy. She also had myomectomy 15 years prior to presentation. Attempt at hysterectomy 5 years before presentation was abandoned due to frozen pelvis.

On examination, she was not ill-looking afebrile, anicteric, well hydrated, and was not pale. There was no lymph node enlargement, digital clubbing or peripheral edema. She walked with a limp on the left lower limb. Scar of previous left mastectomy was noted with no evidence of local recurrence. She was not dyspnoeic and the breath sounds were vesicular. The pulse rate was 64/min and the blood pressure, 100/80 mmHg. Midline infraumbilical and pfannenstiel scars of previous gynaecological procedures were noted. There was no organ enlargement or ascites. An assessment of metastatic breast cancer to the lung and bones was made.

The plain chest radiograph showed a peripherally located solitary nodule in the right mid-zone, confirmed on chest CT to be in the posterior aspect of the apical region of the lower lobe, measuring about 3 × 3 cm. It also demonstrated a small nodule in each upper lobe and minimal right pleural effusion.

The lumbosacral spine X-ray showed straightening of the lumbar spine with osteophytes on the second, third, and fourth lumbar vertebrae, the pelvic X-ray showed areas of lucencies with sclerotic rim around the pubic symphysis and areas of patchy opacities in the femoral neck suggestive of osteoblastic deposits. Radionuclide bone scan confirmed osteoblastic and osteolytic deposits in the skull, spine (cervical, thoracic, and lumbar), left sacroiliac joint, and pelvis.

She subsequently had a CT-guided trans-thoracic right lung mass biopsy. The post-procedure chest X-ray showed neither pneumothorax nor evidence of increased fluid collection.

The Procedure (CT-Guided Trans-Thoracic Biopsy)

The patient was duly counseled about the procedure, and gave an informed consent. She was appropriately positioned on the CT scanner in the prone position. A scout CT scan of the entire chest was taken at 10 mm intervals. The solitary pulmonary nodule was visualized in the apical segment of the right lower lung lobe at the level of the 6th and 7th posterior ribs. A repeat scan was done at 5 mm intervals which showed the mass to be 6 cm from the midline and 4.2 cm from the skin surface with the most appropriate site of entry found to be between the 6th and 7th intercostals space posteriorly. Four radio-opaque markers (size 16G canula needles) were evenly placed on the skin over this region with a thin strip of plaster after adequate skin preparation and sterile draping was done [Figure 1] and thinner 1 mm slices were acquired covering just the level of the lesion. The images showed the optimal biopsy route to be between the 2nd and 3rd cannula needle from the medial end, 0.5 cm from their inferior tip [Figure 2]. A 21G needle was placed percutaneously into the lesion under aseptic conditions as a guide for the trucut needle and to obtain aspirate for cytology. The appropriateness of the position of the needle was then confirmed by another scan. An aspirate of the lesion was taken with a 5 ml syringe for cytology and thereafter the trucut needle was introduced into the

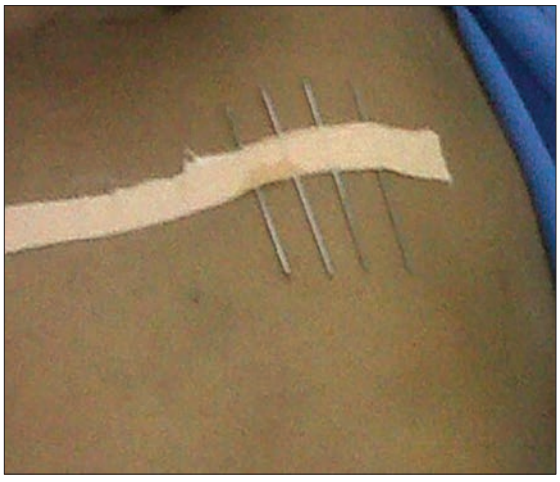

Figure 1: A 16G Cannula metallic Stylets placed over the skin of the back of the patient in the region overlying the Nodule

lesion along the same tract and confirmed to be within the nodule [Figure 3] by a repeat scan then samples were taken for histology.

The specimens were appropriately labeled and preserved and were immediately transported to the histopathology laboratory for processing by the pathologist who was also present during the procedure.

Post Procedure Imaging and Care

After the procedure, CT images were obtained to help verify the appearance of the lung and to check for immediate pneumothorax. The patient was monitored in the CT unit, and a postero-anterior erect expiratory chest radiograph was obtained 2 h after the biopsy. The patient showed no symptoms of pneumothorax such as dyspnea or respiratory distress. There was no bleeding following the procedure and the post-procedure chest X-ray done was normal. Cytologic examination showed features of metastatic papillary carcinoma while histology result of Tru-cut biopsy specimen showed adenocarcinoma [Figure 4]. When reviewed with previous mastectomy slides showed was reasonable consistency.

Discussion

CT-guided percutaneous biopsy allows precise location of target lesions. Percutaneous CT biopsies are cost effective as they shorten the period from admission to diagnosis, decrease the number of surgical procedures and shorten the time of hospital stay as well as require only local anaesthesia.[10]

In developed countries the slice of interest is usually marked with an axial laser beam localizer incorporated in the CT Gantry and radiopaque markers are positioned along this laser light beam after precise location (entry and depth from skin surface) they are removed and area marked with indelible pen.[11] We modified the technique with the use of 16G metallic cannulas which serve as good cutaneous markers for approximation of the location and depth of the lesion from the skin surface.

The sensitivity and specificity for malignant lesions with percutaneous CT-guided biopsy is >90%[12-14] which correlates with our cytological diagnosis of metastatic breast carcinoma.

Tsukada *et al.* have shown that the lesion size is a significant factor contributing to diagnostic accuracy and that a lesion size greater than 30 mm in diameter the accuracy is as high as 93%,[4] Li *et al.* in another study showed that the diagnostic accuracy for lesions greater than 15 mm is 96% and is significantly less accurate for small pulmonary

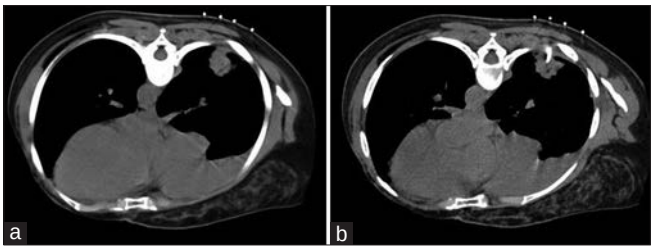

Figure 2: (a) Unenhanced chest CT showing right pulmonary Nodule with metallic Cannula Markers placed over the nodule and (b) 21G Needle used as a guide seen within the Nodule

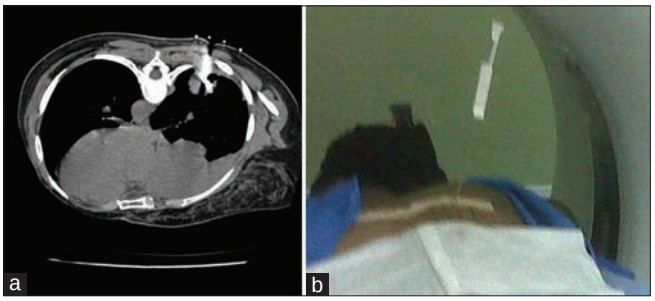

Figure 3: (a) Prone chest CT scan with trucut needle seen entering and within pulmonary lesion (b) patient placed within Gantry with Trucut Needle positioned between the markers on the skin of patient before performing biopsy

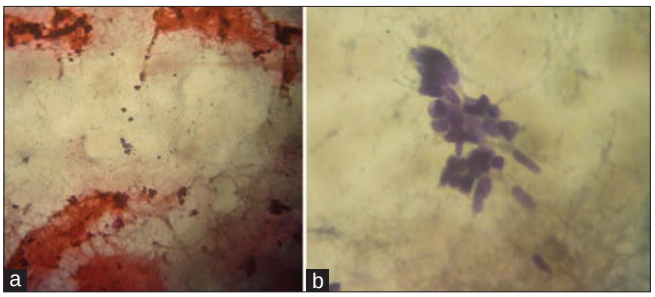

Figure 4: (a) Low power view showing cluster of showing epithelial cells on hemorrhagic background (b) High power view showing the cluster of cells nuclear pleomorphism and hyperchromasia and vague differentiation

nodules (74%).[8] The lesion in our patient had a diameter of 30 mm, making it more likely for us to obtain a good sample. Immediate cytologic evaluation had been suggested to significantly increase the adequacy and diagnostic accuracy of CT-guided Fine Needle Aspiration Cytology (FNAC) of indeterminate pulmonary nodules.[15] The involvement of a pathologist during the procedure enabled an immediate and prompt reading which provided the required assurance to the rest of the team and may have contributed to the accuracy.

Pneumothorax which is the most common complication of this procedure has a broad frequency range of 8-64% from various reports,[5] Yeow *et al.* in a study of 660 consecutive biopsies showed that patients with lesions ≤20 mm have a higher incidence of pneumothorax than those with larger lesions.[16]

Also the pleura to lesion distance influence the risk of pneumothorax with Haramati and Austin reporting a negligible risk of pneumothorax for lesions abutting on the pleura and not requiring the traversal of aerated lung.[5]

The post procedure Chest X-ray showed no evidence of pneumothorax with the size of the nodule and proximity to the pleura likely contributing to the reduced risk in our patient.[17] Geraghthy *et al.* on studies done on 846 CT-guided lung biopsies found that a smaller needle substantially decreases the risk of pneumothorax with comparable diagnostic accuracy, sensitivity, and specificity for histopathologic diagnosis of pulmonary nodules.[18]

Conclusion

Transthoracic percutaneous CT-guided needle biopsy is feasible in our Hospital and can be an effective and safe procedure for evaluating undetermined lung lesions.

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