ORIGINAL ARTICLE

Diagnostic Value and Safety of Ultrasound-guided Needle Biopsy in Evaluation of Peripheral Lung and Mediastinal Nodules

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ABSTRACT

Background: Per-cutaneous needle biopsy is utilized next to imaging for the diagnosis of peripheral lung and mediastinal nodules. This is traditionally done under CT-guidance, which is not frequently available in resource-limited areas. Ultrasound (US) has been reported as a useful tool in evaluation of pleural or subpleural pulmonary nodules in the absence of an interposed aerated lung tissue and is reported as safe and effective tool for guided needle biopsies of masses abutting the chest wall in expert hands.[1-3] This study aims to evaluate the diagnostic yield and safety of ultrasound-guided biopsy using Sure-Cut Needle.

Methods: This prospective study was done in the department of Pulmonary Medicine, Gulab Devi Chest Hospital Lahore from March 2014 till June 2015.Total of 146 ultrasound-guided biopsies were evaluated. Only cases with peripheral lung nodules, pleural and mediastinal lesions were included. The Chest X-ray (CXR) PA and Lateral views were obtained. Point of biopsy was localized by consulting chest radiographs, CT films (if available) & chest sonography. Biopsy was done under aseptic technique after an informed consent. The specimens obtained underwent histopathologic evaluation.

Results: Adequate samples were 97.94%, 89 cases (62.23%) were malignant, 54 cases (37.76%) were non-malignant. The sensitivity & specificity in diagnosing malignancy was 100%. The sensitivity for benign lesions is 100%, but specific disease characterization in benign issues is 87.04%. Biopsy-related complications were pneumothorax in 8.90%, haemoptysis in 7.53% and pain in 15 % patients.

Conclusion: An ultrasound-guided needle biopsy of peripheral lung and mediastinal pathologies is a useful and safe modality with an excellent diagnostic yield and fewer complications.

Keywords: Sure-Cut needle biopsy, ultrasound-guided biopsy, mediastinal mass, peripheral lung nodule

INTRODUCTION

Peripheral lung nodules are not picked by Bronchoscopy.[4] Similarly, the yield of sputum examination is also very low in such situations.[5] Per-cutaneous Sure-cut Needle Biopsy is an important and useful investigation and is considered next to imaging for characterization and diagnosis of such disorders.[6-12] This is traditionally done under CT-guidance.[13—15] However, CT is not frequently available in resource limited centres. Similarly obtaining a CT-guided biopsy is a costly procedure and also involves ionizing radiations.[16] Ultrasound can image the pleural based nodules successfully[2,17-18] but remains underutilized due to common belief that due to the presence of air in the lungs, such lesions cannot be visualized. On the other hand, US guidance is easily available and is extremely cost effective.[3] In fact, ultrasound guidance is an undiscovered jewel of the pulmonary interventional radiology.[18] Previously this guidance was limited to thoracentesis or tube-thoracostomy only but currently tissue sampling of chest wall, pleural, pulmonary and mediastinal lesions is done by using this modality.[19-21]

This study aims to evaluate the diagnostic yield and safety of ultrasound-guided biopsy by using Sure-Cut Needle for peripheral lung, chest wall & mediastinal nodules.

PATIENTS AND METHODS

This prospective study was carried out in the male ward of Respiratory Medicine, Gulab Devi Chest Hospital, Lahore from March 2014 to June 2015.The study included 146 consecutive male patients.

Patients with peripheral lung nodule on chest x-ray (not diagnosed by bronchoscopy and sputum cytology), persistent focal infiltrates which have not

been diagnosed by sputum serology or bronchoscopy, gross hilar mass, mediastinal mass, pleural mass and chest wall mass were included. Exclusion criteria comprised patients with Platelet count <100,000/ml, APTT or PT ratio >1.4, patients with FEV_1 <35% predicted, absence of a safe access to the lesion, non-cooperative patients, central pulmonary nodule and patients with nodules less than 2cm. Fresh Chest X-ray PA & Lateral views were obtained. CT-scan films (if available), were consulted. A disease-localizing preliminary ultrasound scan was done using 3.5–5.5MHz frequency, convex probe and the entry point was marked. Local infiltration anesthesia was given by 2% xylocaine injection. Biopsy was done with aseptic technique using Sure-Cut Needle No. 16.The transducer was held in the intercostal space parallel to the rib with firm contact with the skin and the needle was advanced into the lesion during suspended respiration under real-time visualization. The biopsy was performed during constant real-time observation. The areas deemed less necrotic on US appearance were specifically hit. Sample was collected in ajar containing 10% formalin solution for fixation and was transported to Histopathology department after proper labeling. All patients underwent an expiratory CXR one hour and 24 hour after the procedure to monitor the complications. For each biopsy, the procedure time from skin cleaning to the bandage placement was noted. The biopsy success was established on receiving the histopathology result. The biopsy showing successful sampling were considered as adequate and the samples not representing the lesions were regarded as inadequate. A record of complications was kept.

RESULTS

Total of 146 US-guided biopsies were obtained. Age of the patients ranged from 16 to 65 years with median age of 48years. One hundred and eighteen patients had lung lesions, 23 cases had Mediastinal while 5 had chest wall lesions. Three samples (2.05 %) were inadequate while 143 (97.94%) samples were adequate. The lesion size ranged from 2 to 5 cm (mean 3.2cm). The procedure time ranged from 9 to 24 minutes (mean 15.9 minutes). Eighty-nine cases (62.23%) had malignant etiology while 54 cases (37.76 %) had non-malignant pathology. Biopsy Success Rate was 97.94%. Figure 1 summarizes the non-malignant pathologies reported in 54 patients.

Out of 21 chronic inflammatory lesions, 4 (7.40%) cases were non-granulomatous infections, 16 (29.62%) caseating granulomatous and 1(1.85%) was reported as non-caseating granuloma. Although in 7 cases, the malignant etiology was clearly ruled out, but no specific benign disease was described in these cases. Therefore, the sensitivity for benign nature is 100%, but specific disease characterization in benign issues is 87.04%. Table 1 presents the frequency of malignant disorders reported in eight-nine cases.

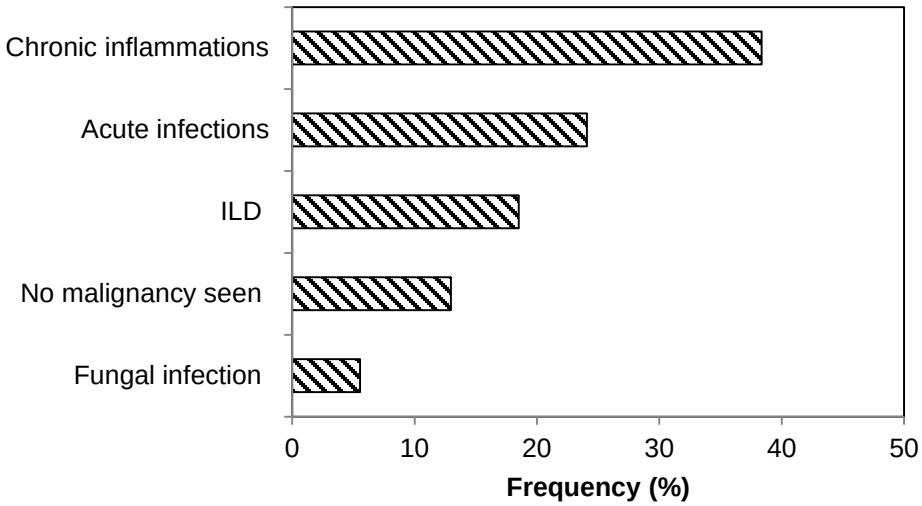

Figure 1: Distribution of Non-malignant Pathology Reports (N=54)

Table 1: Malignant disorders reported in 89 cases

Etiology	No. of cases	Percentage
Non-small cell carcinoma	49	55.05 %
Small cell carcinoma	10	11.23 %
Lymphoma	10	11.23 %
Malignant cells	08	8.98 %
Miscellaneous Group	12	13.48 %

Table 2: Significant complications observed in 81 cases

Complication	Frequency (%)*
Biopsy site pain	39 (26.71)
Bleeding at biopsy site, just a few drops	19 (13.01)
Pneumothorax	13 (8.90)
Minor haemoptysis (streaking only)	10 (6.84)

*percentages calculated for 146 cases

This is evident from Table 1 that the sensitivity for malignant etiology is 100%. Because only 8 (8.98%) cases were reported as “Malignant cells seen”, and no specific tumors were identified for these cases, therefore, the specific disease characterization for malignant pathologies is 91%. By applying Pearson Chi square for Specific Disease Characterization for malignant and benign issues, p-value is 0.4521, so there is no significant evidence of difference of Specific Disease Characterization between malignant and benign lesions. Figure 2 summarizes the distribution of non-small cell carcinoma lesions reported in 49 cases. Figure 3 depicts the characterization of miscellaneous group pathologies reported on needle biopsy. Out of 23 mediastinal cases, 20 (87%) were anterior mediastinal and 3 (13%) were from posterior mediastinum. Figure 4 presents histology reported in 20 anterior mediastinal cases. On the other hand, out of the 3 posterior mediastinal cases, 2 (66.7%) were of caseous necrosis and 1 (33.3%) was reported as consistent with cold abscess and later proved as a case of spinal tuberculosis by further evaluation. All posterior mediastinal cases were of tuberculous etiology. Table 2 summarizes the significant complications observed in 81 of 146 cases. Tube thoracostomy was required only for 4.79% cases.

DISCUSSION

This study shows that US-guided biopsy has an excellent diagnostic yield with biopsy success rate 97.94 % by using sure-cut needle. The literature shows a diagnostic yield of US-guided biopsy from 64% to 97%[19,22-25], while this study showed 97.94% diagnostic yield which is very much similar to the reports quoted in the literature.[1,20,24] In this study, this technique successfully differentiated between benign and malignant lesions with a sensitivity of 100%. It is found capable of classifying small cell and non-small cell carcinomas.

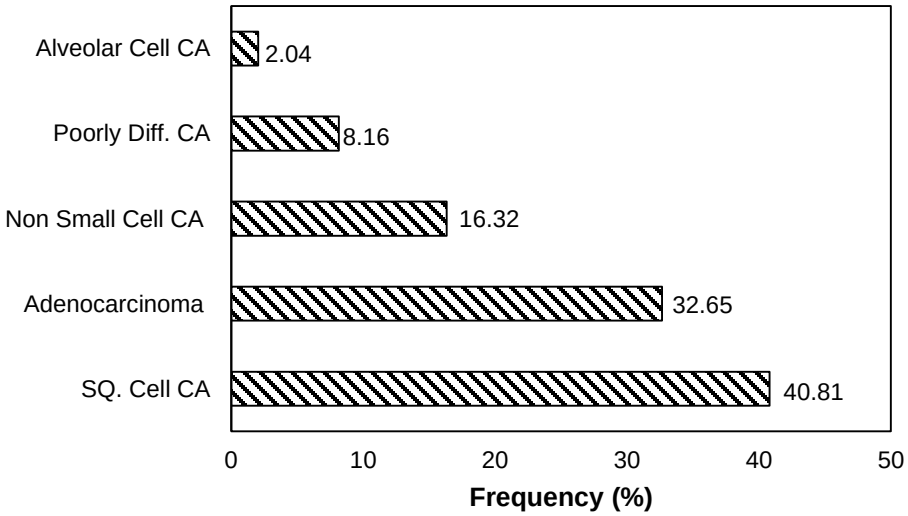

Figure 2: Distribution of non-small cell carcinoma lesions reports in 49 cases

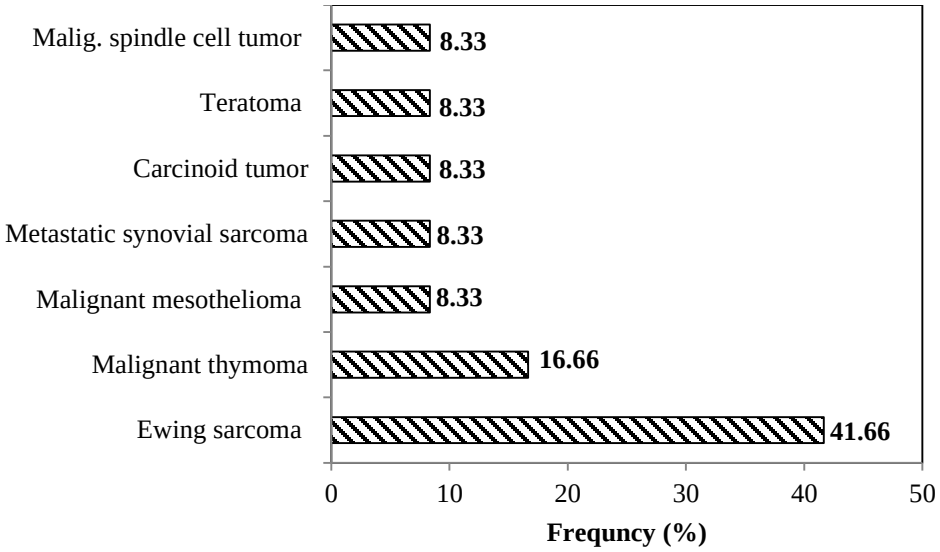

Figure 3: Characterization of miscellaneous malignant pathology reported in 12 cases

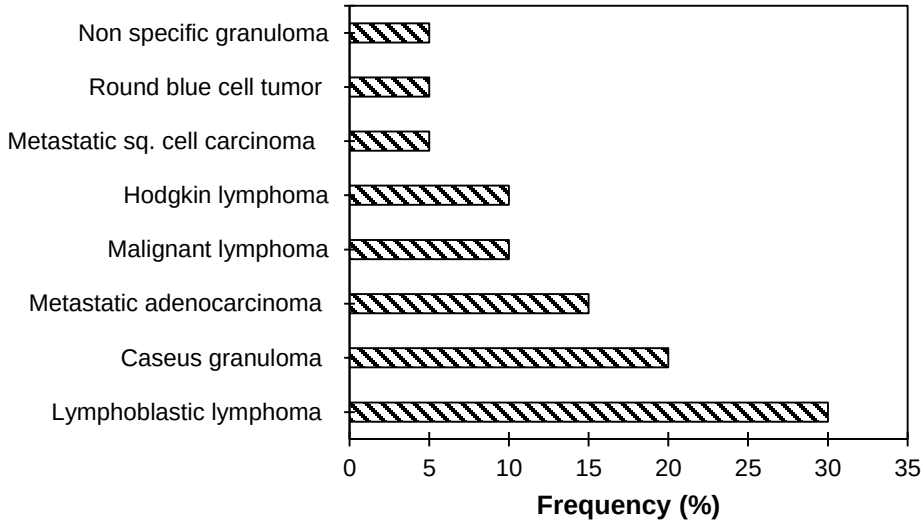

Figure 4: Anterior mediastinal pathologies reported in 20 cases

On the other hand, Specific Disease Characterization for malignancy is 91% and for non-malignant etiology it is 87.04%. Over all specific disease characterization is 89%. Coley and colleagues also endorsed that core biopsy technique provides adequate tissue for reaching a diagnosis.[6] Out of the total 23 biopsies for mediastinal lesions, 15 cases (65.21%) were successfully diagnosed as of malignant etiology while 8 cases (34.78%) were classified as benign. Specific Disease Characterization for malignancy is 100% for mediastinal lesions and Specific Disease Characterization for non-malignant cases is 87.5%.Werneccke and colleagues showed diagnostic yield of up to 67% in mediastinal lesions.[26] Hence, biopsy under US-guidance for mediastinal lymphadenopathy is a reliable alternative to CT-guided procedure or surgical techniques for staging and treatment planning.[26,27] US-guided procedure in this study shows 100% accuracy in defining benign and malignant lesions and specific disease characterization for malignancy is 91.01% and for 87% for non-malignant lesions. These figures are comparable

to the results of various other studies.[20,22,24] Ikezoe and group have shown sensitivity to malignant lesions 90% and to benign lesion 67% by using US guidance.[28] In present study, mean procedure time is 15.9 minutes (range from 9 to 24 minutes) which is also reported in other studies.[20,29] As for as complications are concerned, pneumothorax was seen in 8.9% cases which is very much comparable with the published rate in literature.[17,20,22,24,27] The frequency of other complications was haemoptysis 6.84%, Biopsy site pain 26.71% and minor bleeding (only a few drops) 13.01%. Ultrasound-guided biopsy can be considered a safe alternative because of acceptably low complication rates and without any exposure to ionizing radiations. Such low complication rate is possibly due to real-time and accurate biopsy procedure. Similarly, a portable ultrasound machine is less expensive and can offer real-time guidance even at the bed side. It is really a tremendous tool for point-of-care use as stated by other researchers as well.[29-31] There is another advantage that US-guided biopsies can be done even by an experienced pulmonologist.[1,22,24]

CONCLUSION

Because of an excellent diagnostic yield, low complication rate and a significantly short procedure time ultrasound-guided needle biopsy is a safe alternative in the evaluation of mediastinal as well as peripheral pulmonary lesions especially in resource-limited set ups.

Conflicts of Interest

There are no conflicts of interest.

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