PERCUTANEOUS IMAGE GUIDED CUTTING NEEDLE BIOPSY OF MEDIASTINAL MASSES: DIAGNOSTIC YIELD AND COMPLICATIONS

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ABSTRACT

Objective*: To evaluate image guided cutting needle biopsy of mediastinal masses for diagnostic yield and complications.*

Material and methods: *This was a descriptive study. Computed Tomography (CT) and ultrasound guided biopsies of mediastinal masses were performed in 30 patients. Tissue core obtained, were preserved in formalin and sent for histological examination. X-ray chest taken for evidence of pneumothorax and mediastinal widening. Hemoptysis, pneumothorax other complication were recorded.*

Result: *Definite histological diagnosis was obtained in all 30 patients. 70% (n=21) were malignant disease and 30% (n=9) were benign pathologies. Sensitivity and specificity, positive and negative predictive values were 100%. Pneumothorax occurred in 7% (n=2) cases. Hemoptysis occurred in 10% (n=3) cases. Chest intubation was not required in cases of pneumothorax. No hemodynamic instability occurred. There was no major complication.*

Conclusion: *Image guided percutaneous transthoracic cutting needle biopsy in mediastinal masses is an accurate procedure for specific histological diagnosis and has a low complication rate*

Key Words: *Percutaneous biopsy, Mediastinum, Complications.*

INTRODUCTION

There are several methods for obtaining tissue samples for cytological or histological diagnosis of mediastinal lesions. These include surgical techniques such as thoracoscopy, cervical mediastinoscopy, extended cervical mediastinoscopy, and anterior mediastinotomy, and needle biopsy techniques such as transbronchial needle biopsy endoscopic ultrasound–guided fine-needle aspiration biopsy and image guided percutaneous transthoracic needle biopsy[1-3]. Imaging-guided percutaneous cutting needle biopsy (CNB) of mediastinal masses is a safe and effective technique for obtaining tissue for histopathological diagnosis[4]. Usually, CT and ultrasound guidance is used because they can demonstrate precise localization and documentation of the biopsy needle and target lesion. The presence of major vessels, bones, intervening lung and trachea may preclude a direct approach to mediastinal lesions.

Percutaneous needle biopsy with imaging guidance allows access to lesions in virtually all mediastinal locations. A direct mediastinal approach, with extrapleural needle placement, is the preferred method to avoid the risk of pneumothorax. Techniques that allow extrapleural access include the parasternal, paravertebral, transsternal, and suprasternal approaches. The parasternal approach is used for biopsy of anterior or middle mediastinal lesions when the lesion or intervening mediastinal fat extends to the anterior chest wall, lateral to the sternum; injury to the internal mammary vessels is a potential complication. The paravertebral approach is used for biopsy of subcarinal and other posterior mediastinal lesions; saline solution is often injected to widen the mediastinum. The transsternal approach, which involves needle placement through the sternum, is used for biopsy of anterior or middle mediastinal lesions that are not accessible with the parasternal approach. Biopsy of superior mediastinal lesions can be performed with a suprasternal approach. An alternative to these direct mediastinal approaches involves advancing the needle through a pleural space created by an existing pleural effusion or

iatrogenic pneumothorax. Another alternative is the transpulmonary approach, which involves transgression of the lung and visceral pleura by the needle and is associated with a substantial risk of pneumothorax.

Keeping this in view, this study was planned to evaluate image guided cutting needle biopsy of mediastinal masses for diagnostic yield and complications.

MATERIAL AND METHODS

This descriptive study was carried out between August 2004 to March 2008. Patients with mediastinal masses demonstrated by contrast enhanced computed tomography were subjected to percutaneous transthoracic image guided cutting needle biopsies. All cases had either contrast enhanced CT of the thorax already done or done just before biopsy. Informed consent was taken from all the patients. Prothrombin time, partial thromboplastin time, and platelet count were obtained in all patients to exclude any bleeding disorder before the biopsy.

Patients with anterior or middle mediastinal masses abutting the chest wall without intervening lung were subjected to ultrasound guided biopsy by using ultrasound machine Nemio-17. The lesion was localized, safe path and entry site was identified for needle placement. Depth of the mass from the skin was determined. Entry site, underlying soft tissue and pleura was anesthetized using local anesthesia under aseptic technique. Skin incision was made using pointed tip surgical blade. Semi automated cutting biopsy needle Dr. J type, 18G was used to obtain 2cm long core of tissue. 2-3 passes were made depending upon the tissue required.

When ultrasound guided biopsy was not possible due to intervening tissues, CT guided biopsies were performed by using Toshiba Estion TSX-021B Helical CT Scanner. CT of the patient was evaluated to determine the optimal entry site, track of the needle and relation of the lesion to the vessels. Transgression of the lung was avoided when it was possible. 10mm sections were taken through the lesion. Depth of the lesion and skin puncture site was determined using laser collimator lights of the CT console. Skin was anesthetized using local anesthesia. 2cm long tissue core was obtained. 2-3 passes were made depending upon the tissue required. Specimens were put in formalin and sent for histopathology.

The patients were observed for 03 hours after the procedure to ensure their hemodynamic stability and to monitor their respiratory status. For CT guided biopsies immediate CT scan centered on and around the biopsy site were taken to look for any pneumothorax or mediastinal fluid. For ultrasound guided biopsies X-ray chest was done immediately post procedure for any increase in mediastinal size as compared to previous film. Expiratory chest radiographs were taken in both types of biopsies after 03 hours. Pneumothorax, hemoptysis and other complication were recorded. When there was no major complication, patient was sent home or concerned unit. In case of pneumothorax patient was retained in the Pulmonology unit for 6-8 hours and sent home when there was no need for intubation.

RESULTS

Thirty patients with mediastinal masses underwent percutaneous transthoracic biopsy with image guidance. Of these, 20 (66.66%) patients were male and 10 (33.33%) patients were female. Age ranged from 5 to 67 years with a mean of 35.3 years. In 11 cases, ultrasound guidance was used for biopsy while in 19 cases computed tomography guidance was used. Histological diagnosis was made in all 30 patients (Table 1).

All cases with definitive histological diagnosis of lymphoma and malignancy were taken as true positive. Surgical biopsy result in cases of thymoma was same as needle biopsy result. In case of ectopic thyroid tissue patient was followed for one year by clinical examination and repeat CT with no sign for malignancy (Increase in size or invasion of adjacent structures). Four cases with Caseating Granuloma responded to Anti-tuberculous therapy and their masses were resolved. Histology of patient with Paraganglioma was same on surgical biopsy.

Sensitivity and specificity, positive predictive value and negative predictive value of our study was 100%. (Table 2).

Minor Hemoptysis occurred in 3 (10%) patients but they did not need blood transfusion or IV fluid infusion. Pneumothorax occurred in 2 (7%) cases which was small and chest intubation was not required.

DISCUSSION

Ultrasound guided percutaneous CNB of mediastinal lesions shows up to 100% sensitivity and specificity[5]. Fine Needle Aspiration Biopsy (FNAB) usually suffices for solid malignant lesions while a core needle biopsy should be done whenever lymphoma or thymoma is suspected. A large specimen of biopsy tissue also gives the type of lymphoma[5]. The extra pleural salinoma window technique permits biopsy of deep mediastinal lesions while limiting complications like bleeding and pneumothorax. It has a diagnostic yield of 93% [6]. Keeping in view the high yield of transthoracic procedures i.e. CNB and FNAB, these should be precede

Table 1: Histological Diagnosis of cases of Image Guided Biopsies

Diagnosis	Number of patients	Percentage
Malignant		
1. Lymphoma	14	46.6
a) Hodgkin's lymphoma	06	
b) Non-Hodgkin's lymphoma	08	
2. Metastatic carcinoma	04	13.3
3. Malignant Stromell Cell Tumor	01	3.3
4. Sarcomatous Malignant Neoplasm	01	3.3
5. Malignant Germ Cell Tumor	01	3.3
Benign		
1. Thymoma	03	10
2. Thyroid adenoma	01	3.3
3. Caseating Granuloma	04	13.3
4. Paraganglioma	01	3.3

Table 2: Comparison of Histology from Mediastinal Biopsy with final outcome data

Pleural biopsy result	Final diagnosis of malignancy n = 21	Final diagnosis of benign disease n = 9
Malignant Biopsy	21	00
Benign Biopsy	0	09

mediastinoscopy in any case of mediastinal mass or lymphadenopathy. Another method for biopsy of thoracic lesions is CT/ fluoroscopy (CTF), having a sensitivity of 87% and specificity of 100% and complication rate of 2%[7]. The reported sensitivity of transbronchial mediastinal biopsy for staging non–small cell lung cancer is between 25% and 81%[2]. Although the use of CT guidance and transbronchial US guidance may help improve the yield of transbronchial needle biopsy, experience with these techniques is still limited. Transbronchial needle biopsy is generally used in patients with endobronchial lesions associated with enlarged lymph nodes adjacent to the airways, as both lesions can be sampled during the same procedure.

Endoscopic ultrasound–guided needle biopsy allows access to the lower paratracheal, subcarinal, aortopulmonary, and paraesophageal regions. The advantages of endoscopic US–guided biopsy include the ability to monitor the biopsy in real time, decreased risk of pneumothorax, and a high diagnostic yield. The reported sensitivity of endoscopic ultrasound–guided biopsy in the mediastinum is 82%–96%[2, 8]. However, anterior lymph nodes, including those in the pretracheal and high right paratracheal regions, are not accessible because of interposition of air-filled trachea.

Cervical mediastinoscopy has traditionally been accepted as the standard of reference for preoperative staging in the mediastinum in patients with non–small cell lung carcinoma and is especially useful in patients in whom multiple mediastinal nodes need to be sampled for accurate staging. It allows direct visualization and sampling of pretracheal, paratracheal, and anterior subcarinal lymph nodes and is reported to yield a diagnosis in 83%– 89% of patients with lung cancer[1,2,8].

However, the aortopulmonary, retrotracheal, posterior subcarinal, and inferior mediastinal lymph nodes are inaccessible with mediastinoscopy. Also, mediastinoscopy requires general anesthesia and may be associated with complications in 1– 3% of patients. The reported complications include vascular injury, esophageal perforation, tracheobronchial injury, mediastinitis, chylothorax, pericardial rupture, pneumothorax, and phrenic nerve injury; arrhythmias as well as death from stroke have also been reported. Extended cervical mediastinoscopy, anterior

mediastinotomy, and thoracoscopy are alternative surgical techniques that can be used to assess mediastinal regions not accessible with standard mediastinoscopy.

Percutaneous transthoracic needle biopsy performed with image guidance allows access to virtually all mediastinal regions, including those that are inaccessible with mediastinoscopy, transbronchial biopsy, and endoscopic ultrasound–guided biopsy. The accuracy of transthoracic biopsy in the diagnosis of mediastinal lesions ranges from 75% to 90% [1, 2, 8]. In a study of 135 cases diagnostic accuracy of 85.71%, positive predictive value for presence of neoplasm was 78.26 % in FNAB of anterior mediastinal masses[9]. Another study of FNAB of 157 mediastinal masses adequate diagnostic cytological material was obtained in 82 percent cases. In this case 78% agreement was there between FNAB and subsequent histological diagnosis for wide variety of mediastinal lesions[10].

In a study of CT guided percutaneous CNB of 73 procedures, there was sensitivity of 83.6% and specificity of 100% with positive predictive value of 100%, negative predictive value of 35.3% and diagnostic accuracy of 83.6%. Pneumothorax was the major complication and occurred in 5.5% cases[11]. In another study of 42 patients of anterior mediastinal masses CNB, done under ultrasound guidance, sensitivity and specificity of 100%. Pneumothorax occurred in two cases (4.7%) with pleural drainage in one of the two cases and 5 days hospitalization in one of the case. Remaining patients were treated as outdoor patients and discharged within 4 hours of the procedure. In this study 24 of 42 patients had lymphoma (Hodgkin's and Non-Hodgkin's) and it was possible to establish histological sub-types[12].

In a study of 83 cases of Percutaneous Computed Tomography guided CNB for diagnosis of mediastinal masses 96% adequate tissue was obtained for histological diagnosis. Minor complication of pneumothorax and haematoma occurred in 7.22% cases[13].

Sensitivity and specificity in our study was 100%. Pneumothorax occurred in 2 cases (7%). Pneumothorax was small and intubation and hospitalization was not required. Minor hemoptysis occurred in 3 cases (10%) and did not required IV fluid infusion or blood transfusion.

A major limitation of this technique is the risk of pneumothorax, reported to occur in 10% – 60% of cases. Various techniques, such as the administration of saline, changes in patient position, "iatrogenic pneumothorax" and use of transsternal and suprasternal approaches, can help substantially decrease the pneumothorax rate.

CONCLUSION

CT-guided percutaneous transthoracic CNB is an easy, reliable and safe procedure that obviates the need for exploratory surgery in medically treatable or unresectable cases. Our study shows that it should be the first invasive procedure in the diagnostic workup of mediastinal masses and percutaneous core needle biopsy may be encouraged before surgical biopsy.

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