COMPLICATIONS OF THE COMPUTED TOMOGRAPHY GUIDED TRANSTHORACIC BIOPSY OF THE LUNG

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ABSTRACT

Objective: *To evaluate the frequency of pneumothorax and hemoptysis after computed tomography (CT)-guided percutaneous co-axial cutting needle biopsy of lung lesions.*

Material and Methods: *This was a descriptive study of patients who underwent CT guided percutaneous coaxial cutting needle biopsy of lung lesions at department of Radiology, Postgraduate Medical Institute, Lady Reading Hospital, Peshawar from August 2004 to June 2005. CT scan of the lung at the level of pleural puncture was taken immediately after biopsy and an X-ray chest in upright position was taken after 04 hours for evidence of pneumothorax. Pneumothorax and hemoptysis were recorded.*

Results: *Out of 53 patients, 26 (49%) were male and 27 (51%) were female with age ranging from 06-80 years. Of 53 biopsies, in 49 cases tissue sample was sufficient for histological diagnosis (Diagnostic yield 92.45%). Out of 53 biopsies, 32 (60.4%) were histologically malignant, 17 (32.1%) were benign and 4 (7.5%) were non-representative, normal lung tissue or inadequate tissues. Overall complication rate was 9.43% (n=5/53). Hemoptysis occurred in 4/53 (7.45%). Pneumothorax occurred in 1.9% (n=1/53) patients. No patient required chest tube insertion. There was no major complication or death.*

Conclusion: *CT guided percutaneous coaxial cutting needle biopsy of the lung lesions is a safe and effective procedure.*

Key Words: *CT Guided Lung Biopsy, Pneumothorax, Hemoptysis.*

INTRODUCTION

Transthoracic needle biopsy of the pulmonary lesions is traditionally performed as an out-patient procedure. It is safe, sensitive and obviates surgical diagnosis. Percutaneous fine-needle aspiration biopsy (FNAB) is a safe and high yield technique for diagnosing malignant lung lesions, with a diagnostic accuracy reaching to 83%,[1] but its diagnostic sensitivity rate in benign lung diseases is reported to be lower than 50% in most series.[2] Lung needle biopsy with small-caliber (18-20 gauge) coaxial automated cutting needle technique was reported to have a high diagnostic sensitivity rate for malignant (88% 95%) and benign diseases (71%97%).[3,4] Cutting needle lung biopsy has other merits compared to FNAB in that it can be used as a stand-alone test without the need for an on-site cytopathologist.

It is also the most reliable percutaneous lung biopsy technique when a focal lung lesion is presumably benign according to results of an imaging study. However, there are concerns regarding its safety because of its apparent higher rate of bleeding complications, which include a 4-10% rate of hemoptysis, compared to a rate of 2.4-5% with FNAB.[4,5] Bleeding complications are the most common cause of death in lung needle biopsy.[6] Pneumothorax is another common complication of the procedure.

Although the rapid-firing automated cutting needle is implicated as a possible cause of increased risk of hemoptysis[4] there appear to be no reports that analyze risk factors for both pneumothorax and bleeding after CT-guided transthoracic coaxial cutting needle biopsy.[7,8]

The purpose of this study was to describe the frequency of pneumothorax and hemoptysis after CT-guided percutaneous coaxial cutting needle biopsy of lung lesions.

MATERIAL AND METHODS

This study was conducted at Radiology

Department of Lady Reading Hospital Peshawar from August 2004 to June 2005. In Radiology Department of Lady Reading Hospital Peshawar, transthoracic needle biopsy is performed routinely with use of the CT-guided coaxial cutting needle technique. Cases included consecutive patients referred both from out door and admitted cases for trans-thoracic needle biopsy of intra thoracic lesions. Patients with mediastinal lesions, pleural and chest wall lesions were excluded and only patients with intra pulmonary lesions were included in this study. Intrapulmonary lesions were defined as lung lesions surrounded by aerated lung or lung lesions whose epicenters were within the lung, with their edges abutted to, but not invading, the visceral pleura surface.

No patients had a history of bleeding tendency and had normal platelet counts, prothrombin time, and activated prothrombin time at the time of biopsy.

Pulmonary function tests were not performed before the transthoracic needle biopsy. Informed consent was obtained in all cases. All transthoracic needle biopsies were performed under CT guidance by one Radiologist assisted by one resident and two radiographers. Only Dr. J Fine Core Disposable Semiautomatic 18-gauge biopsy cutting needles were used. No sedation was given. Needle biopsies were performed in either supine or prone position according to the location of the lesion.

After previous chest CT scans were reviewed, a biopsy needle path was selected to avoid bullae, fissures, and visible vessels. It was directed away from the heart and great vessels whenever possible. After local anesthesia was given, a small incision was made. The pleura was punctured. The needle path was corrected as localization CT was performed until the lung lesions were successfully punctured. The cutting needle was manually pushed into the lung lesion and a fixed 2cm-long tissue core was obtained by triggering the spring-loaded cutting needle. Specimens were immersed in 10% formalin solution and sent for pathologic examination.

Post-biopsy CT centered on and around the pleural puncture site was then performed. Post-biopsy CT was used to verify the appearance of the lung and to detect and grade pneumothorax. Any hemoptysis, chest tightness, shortness of breath, and chest pain during or after the needle biopsy were recorded.

Patients' symptoms, post-biopsy CT, and chest radiographs taken 4 hours after needle biopsy were used to judge whether the patients were fit to be discharged from the hospital at the end of a routine 4-hour observation period.

Correlation of pneumothorax with patient symptoms (dyspnea) was made. Hemoptysis if any was recorded. Any association with hemodynamic instability was noted.

RESULTS

From August 2004 to June 2005, 99 CT-guided Transthoracic coaxial cutting needle biopsies were performed. After excluding 16 mediastinal lesions, 28 pleural and 2 chest wall lesions, 53 intra pulmonary lesions were included for the purpose of this study. There were 53 transthoracic coaxial cutting needle biopsy procedures performed on 53 intrapulmonary lesions.

Out of 53 patients, 26 (49%) were male and 27 (51%) were female with age ranging from 06-80 years. Out of 53 biopsies, in 49 cases tissue sample was sufficient for histological diagnosis (Diagnostic yield 92.45%). 32 of 53 biopsies were histologically malignant (60.4%), 17 of 53 were benign (32.1%) and 4 of 53 were non-representative, normal lung tissue and inadequate tissues (7.5%). Thirty-nine focal lung lesions (n=39/53, 73.6%) had abutted the pleural surface and CT did not reveal any involvement of pleural surfaces. Aerated lung was traversed in only 26.4% (n=14/53) cases.

Following complications were observed (Table 1).

Hemoptysis

Hemoptysis occurred in 7.54% (4 of 53). No blood transfusion, Oxygen, or suction was needed for patients with hemoptysis.

Pneumothorax

Pneumothorax occurred in 1 of 53 patients (1.9%) during needle biopsy, and was detected by CT. Patient did not experienced shortness of breath. No intubation was needed. Patient was kept under observation in casualty medical ward for about 08 hours. As there was no increase in pneumothorax as noted by X-ray chest and patient did not feel breathlessness, so was discharged.

DISCUSSION

Percutaneous transthoracic biopsies are

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Complications	Frequency n=53	%age
Hemoptysis	4	7.54
Pneumothorax	1	1.9
Total	5	9.43

Table 1

commonly performed for the diagnosis of thoracic lesions. The common modalities employed in the guidance of percutaneous lung biopsy are fluoroscopy and CT scanning. Since the advent of CT scanning, fluoroscopic guidance has been utilized less often, and CT scanning and CT scan-fluoroscopic guidance dominate the current literature. Ultrasound guidance can be used for the biopsy of subpleural lesions. However, the use of ultrasound as an imaging modality for guiding lung biopsies has not been widely adopted.

Technologic advances in both needle design and imaging equipment have broadened the range of lesions that are accessible to needle biopsy. Lung biopsies can be performed by fine-needle aspiration (FNA), providing a specimen for cytologic examination. Numerous reports have advocated the use of FNA, since it is a reasonably simple and safe technique with an accuracy of about 83% for malignant lesions, and a lower yield for benign lesions. Early reports cited cytology to be less reliable than histology in determining the cell type of malignant lesions. This disadvantage can be obviated by the presence of a cytopathologist during the biopsy, which has been shown to increase the diagnostic accuracy of FNA. However, at many centers, well-trained cytopathologists are not available to immediately interpret FNA specimens. To avoid this problem, several series have advocated the use of automated cutting needles to obtain core tissue for histologic evaluation. Complication rates for automated cutting needle biopsies are comparable to, or slightly higher than those for FNA. The most common complications of percutaneous transthoracic lung biopsy are pneumothorax and bleeding. Pneumothorax has a broad frequency range of 1 to 24%. Bleeding occurs less often (range, 1 to 4%) but is more frequently fatal.

In our study we analyzed the frequency of pneumothorax and bleeding in 53 consecutive CT scan guided percutaneous needle cutting biopsies. Our study shows that CT-guided coaxial cutting needle biopsy is safe, with a 1.9% pneumothorax rate and 7.5% hemoptysis rate, and no chest tube insertion. In a study by Yeow KM et al there was 23% pneumothorax, chest tube insertion of 1% and hemoptysis in 4% in 660 coaxial cutting needle lung biopsies.[9] In another study by Yeow KM et al there was 12% pneumothorax, no chest tube insertion and 3% hemoptysis after CT guided percutaneous coaxial needle cutting biopsies of lung lesions in 117 patients.[10] In a study by Loubeyre P et al core needle biopsy of thoracic lesions in 75 patients using 18 gauge needle with diagnostic yield of 97%, pneumothorax 19% and hemoptysis 1%.[11]

Possible reasons for a low pneumothorax rate in our series may be due to large number of intrapulmonary lesions abutting the pleural surface (73.6%) and not requiring traversing of aerated lung, a larger lung lesion size (mean size, 5.3cm).

Yeow MK et al demonstrated a sevenfold increase in the rate of pneumothorax for biopsy of subpleural lesions that were 2cm from pleural surface compared with the lesions that were abutting the pleural surface.[10] Cox et al[8] used a coaxial system in combination with a fine or cutting needle technique and showed a dramatic increase in pneumothorax rate whenever an aerated lung was violated. In our study aerated lung was traversed in only 26.4% cases. In dealing with pneumothorax, a small chest tube is indicated when it is symptomatic or when a large pneumothorax measuring more than 35% of a hemithorax is encountered. In our study there was no need for tube insertion.

Our hemoptysis rate of 7.5% is slightly higher compared with reported rates of 1% - 4%[9-11] but it is not significantly higher. Comparatively low hemoptysis rate is again due to most of the lesions being peripheral. In peripheral lesions, radiologist is less likely to traverse a pulmonary vessel and if a vessel is traversed it is likely to be smaller one.

Pneumothorax rates range from 9% to 23%[9-13] and chest tube insertion rates 3%, and hemoptysis rates range from 1% to 4%. Our complication rate of 1.9% pneumothorax and no chest tube insertion are within the range from recent reported series.

In a study by Mullan CP et al,[1] there was 17% pneumothorax in 36 patients and 24% pneumothorax in 17 patients under going coaxial and non-coaxial fine needle aspiration biopsy of lung nodules respectively. There was 11% and 12% chest tube insertion in coaxial and non-coaxial groups respectively. Provisional cytological diagnosis was recorded in 74%.[1]

In another study significantly more core biopsies than fine needle aspiration biopsies were diagnostic (93 versus 78%) with no difference in frequency of pneumothorax between these two groups.[14]

It is concluded that because of its high accuracy rate for diagnosing both benign and malignant lung lesions with no remarkable increase in frequency of complications, it may be used as an initial method for lung biopsies.

REFERENCES

1. Mullan CP, Kelly BE, Ellis PK, Hughes S, Anderson N, Clugg MC et al. CT guided fine

needle aspiration of lung nodules; effect on outcome of using coaxial technique and immediate cytological evaluation. Ulster Med J 2004; 73(1): 32-6.

2. Sagel SS, Ferguson TB, Forrest JV, Roper CL, Weldon CS, Clark RE. Percutaneous transthoracic aspiration needle biopsy. Ann Thorac Surg 1978; 26: 399-405.
3. Moulton JS, Moore PT. Coaxial percutaneous biopsy technique with automated biopsy devices: value in improving accuracy and negative predictive value. Radiology 1993; 186:515-22.
4. Lucidarme O, Howarth N, Finet JF, Grenier PA. Intrapulmonary lesions: percutaneous automated biopsy with a detachable, 18-gauge, coaxial cutting needle. Radiology 1998; 207:759-65.
5. Laurent F, Latrabe V, Vergier B, Michel P. Percutaneous CT-guided biopsy of the lung: comparison between aspiration and automated cutting needles using a coaxial technique. Cardiovasc Intervent Radiol 2000; 23:266-72.
6. Berquist TH, Bailey PB, Cortese DA, Miller WE. Transthoracic needle biopsy: accuracy and complications in relation to location and type of lesion. Mayo Clin Proc 1980; 55:475-81.
7. Laurent F, Michel P, Latrabe V, Lara MT, Marthan R. Pneumothoraces and chest tube placement after CT-guided transthoracic lung biopsy using a coaxial technique: incidence and risk factors. Am J Roentgenol 1999; 172: 1049-53.
8. Cox JE, Chiles C, McManus CM, Aquino SL, Choplin RH. Transthoracic needle aspiration biopsy: variables that affect risk of pneumothorax. Radiology 1999; 212:165-8.
9. Yeow KM, SU IH, Pan KT, T Say PK, Lui KW, Cheung YC, et al. Risk factors of pneumothorax and bleeding: Multivariate analysis of 660 CT guided coaxial cutting needle biopsy. Chest 2004;126: 748-54.
10. Yeow KM, See LC, Lui KW, Lin MC, Tsao TC, Ng KF, et al. Risk factors for pneumothorax and bleeding after CT guided percutaneous coaxial cutting needle biopsy of lung lesions. J Vasc Inter Radiol 2001; 12:1305-12
11. Loubeyre P, Copercini M, Dietrichpy. Percutaneous CT guided multisampling core needle biopsy of thoracic lesions. AJR Am J Roentgenol, 2005; 105:1294.
12. Laurent F, Latrabe V, Vergier B, Montaudon M, Vernejoux JM, Dubrez J. CT-guided transthoracic needle biopsy of pulmonary nodules smaller than 20mm: results with an automated 20- gauge coaxial cutting needle. Clin Radiol 2000; 55:281-7.
13. Connor S, Dyer J, Guest P. Image guided automated needle biopsy of 106 thoracic lesions: a retrospective review of diagnostic accuracy and complication rates. Eur Radiol 2000; 10:490-4.
14. Anderson JM, Murchison J, Patel D. CT guided lung biopsy factors influencing diagnostic yield and complication and etc. Clin Radiol 2003;58:791-7.

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