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ASSESSMENT OF TYPE OF COMPLICATIONS AND FACTORS AFFECTING COMPLICATIONS IN PATIENTS UNDERGOING CT GUIDED LUNG BIOPSY.

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ABSTRACT

Background : Transthoracic CT guided needle biopsy of an indeterminate pulmonary mass/ nodule is a well established, highly accurate and minimally invasive diagnostic procedure. Lesion characteristics have no significant impact on diagnostic yield. Sensitivity and specificity for detection of malignancy are high for CT guided lung biopsy. Even the positive and negative predictive values are high. The diagnostic accuracy is also quite high with this procedure. So purpose of the study is to assess type of complications and factors affecting complications in patients undergoing CT guided lung biopsy.

Methodology : A total of 224 patients with lung lesions who had undergone a CT guided lung biopsy using a core biopsy needle were studied to know the various complications, their rate of occurrence and accuracy over a period of two years. Result : 25.0% of the cases who belongs to < 20 years of age had haemorrhage complication followed by 20.0% of the cases that belongs to 20 – 40 years of age and 15.4% who belongs to > 40 years of age had haemorrhage complication. 25.0% of the cases who belongs to < 20 years of age had pneumothorax complication. 12.0% of the cases that belongs to 20 – 40 years of age and 13.3% who belongs to > 40 years of age had pneumothorax complication.

Conclusion: The technical and diagnostic accuracy is high with this technique. Thus it can be concluded that CT guided biopsy using a semi-automated core biopsy needle for lung is a highly accurate and safe procedure for lung lesions.

KEYWORDS :

Introduction :

Transthoracic CT guided needle biopsy of an indeterminate pulmonary mass/ nodule is a well established, highly accurate and minimally invasive diagnostic procedure. A pulmonary nodule in virtually any location is accessible to transthoracic CT guided needle biopsy. The most common indications for CT guided needle biopsy of lung masses include the possibility of primary lung cancer, metastatic disease and infections of unknown etiology. CT guided lung biopsy is a very safe procedure and the only major contraindication is an uncooperative patient. Relative contraindications are bleeding diathesis and arteriovenous malformation.[1]

Pneumothorax and pulmonary hemorrhage are the most common complications of percutaneous needle biopsy of the chest, whereas air embolism and tumor seeding are extremely rare.[2]

Pneumothorax is the most common complication of needle aspiration or biopsy of the lung. Increased depth of the lesion from the skin or long needle path is associated with an increased risk of pneumothorax. Small lesion size also plays a role in the development of pneumothorax.[3]

Pulmonary hemorrhage is the second most common complication of needle biopsy of the chest. It includes the occurrence of hemoptysis, and perilesional opacity. Hemothorax is exceedingly rare.[4]

Air embolism is a rare but potentially fatal complication of percutaneous needle biopsy of the lung. Tumor seeding of the pleura or chest wall along the needle track is an extremely rare complication.[5]

Lesion characteristics have no significant impact on diagnostic yield. Sensitivity and specificity for detection of malignancy are high for CT guided lung biopsy. Even the positive and negative predictive values are high. The diagnostic accuracy is also quite high with this procedure [6,7,8]

So purpose of the study is to assess type of complications and factors affecting complications in patients undergoing CT guided lung biopsy.

Materials And Methods:

A prospective study on an OPD basis was conducted in the department of radiology, madha medical college and research institute, chennai from a period of june 2015 to June 2017.; after approval from the ethical review board. CT guided intervention is the most technically accurate way to biopsy an indeterminate lung lesion. A total of 224 patients with lung lesions who had undergone a CT guided lung biopsy using a core biopsy needle were studied to know the various complications, their rate of occurrence and accuracy over a period of two years. A cohort of 224 patients with lung lesions was selected who underwent CT guided core needle biopsy through an intrapulmonary approach, to study the technical and diagnostic success rates, types and rate of complications, and factors affecting it.

Patients with a lung parenchymal lesion in the form of nodule, mass or mass like consolidations were included in the study.The bleeding parameters were checked on the day prior to the biopsy by testing for bleeding time, clotting time, prothrombin time and internationalized normal ratio (INR). Only those patients with normal bleeding parameters and INR value less than 1.4 were included in the study. The only major contraindication for the biopsy was an uncooperative patient.

The patient was asked to discontinue any anticoagulant and antiplatelet medications 5 days prior to the procedure. The patients bleeding parameters were checked and confirmed 1 day prior to the procedure. The patient is asked not to eat or drink for atleast 8 hrs prior to the procedure.

The risks and complications of the procedure are discussed with the patient on the day of biopsy prior to the procedure. A well informed and written consent is obtained from the patient or the relative in case when the patient is minor.

After a brief explanation of the steps involved, patient is asked to stay calm, not to move or talk and avoid coughing during the procedure. No sedation or anaesthesia was used for any patient.

All the lung biopsies carried out were CT guided as CT scan is the best modality for lesion localization and it also allows precise needle placement in the lesion without causing much discomfort to the patient.The lesion was localized with a 32 slice MDCT scanner by using 4.8mm thick contiguous sections through the region of

interest. The CT fluoroscopy technique was used for all the procedures in which a region of interest is repeatedly scanned with a low radiation dose. A low dose axial scan is obtained with a 80kVp, 25 mAs per slice and 0.5 sec rotation time was used.

An intermittent real-time CT fluoroscopic technique was preferred while advancing the biopsy needle. Meticulous care was taken to minimize direct radiation to the operator's hands by using a forceps.The canula with stylet is advanced through the soft tissue, pleura and lung into the lesion leaving space for the throw length of gun. The stylet is then removed and the preloaded gun is then put in the canula. The gun is placed so that the distal throw end of the gun is well inside the lesion.The gun canula technique used was a semi-automated biopsy device that requires manual advancement of the trocar to expose the side notch. With pressure on its plunger, an automated biopsy action rapidly advances the cutting canula over the specimen-containing side notch of the trocar.After advancing the inner trocar into the lesion and confirming the position by CT fluoroscopy, the gun is then fired and removed so as to collect the sample in a sterile container. Similarly the gun is reintroduced and multiple samples are thus obtained with the canula still in the lung, thus avoiding multiple passes. After obtaining adequate tissue cores the gun is removed and subsequently the canula is also removed immediately. [9,10,11]

Results :

Out of 224 patients undergoing CT guided core biopsy, 68 patients had complications. The complications which occurred were pneumothorax and haemorrhage. No patient developed air embolism or cardiac tamponade.

The most common complication was haemorrhage occurring in 16.1% (36/224). Out of the 36 patients, 30 patients had needle track haemorrhage, 5 had perilesional haemorrhage, 2 developed consolidation, 2 patient developed hemoptysis and 1 patient developed haemoeffusion. Of the 36 patients having haemorrhage, 2 patients had both needle track and perilesional haemorrhage, and 2 with needle track haemorrhage also had hemoptysis.

Next common complication was pneumothorax occurring in 13.4% (30/224). Out of the 30 patients, 20 had pneumothorax <1cm and 10 had pneumothorax > 1cm. No case required insertion of chest tube for pneumothorax drainage and all the patients were stable before they were allowed to go with no patient requiring hospitalization.

Out of 68 patients having complications, 1.3% (3/224) had both pneumothorax and haemorrhage. The technical accuracy was 100% (224/224) and the diagnostic accuracy was 92.8% (208/224).

Pneumothorax was observed in 13.4% (30/224) of cases. Most of the cases in which pneumothorax developed, the size of the pneumothorax (taken as the maximum distance from the pleural surface to the lung margin) was <1 cm (20 cases, i.e. 66.6% of the total pneumothorax cases). All the pneumothorax < 1cm stabilized over 1 hour except 2 cases which stabilized over 2 hours. There were 10 cases with size of pneumothorax < 1 cm (33.3% of the total pneumothorax cases) with one case with pneumothorax < 4 cm in size. Most of the cases with pneumothorax > 1 cm stabilized over 2 hours except one case which stabilized over 4 hours.

No case required insertion of chest tube for pneumothorax drainage and all the patients were stable before they were allowed to go with no patient requiring hospitalization.

Table : ASSOCIATION BETWEEN COMPLICATIONS AND AGE GROUP

Types of Complications	Age group in years					
	< 20 (N = 04)		20 – 40 (N = 25)		> 40 (N = 195)	
	No	%	No	%	No	%
Haemorrhage	01	25.0	05	20.0	30	15.4
Pneumothorax	01	25.0	03	12.0	26	13.3

By Chi – Square Test P > 0.05 Not Significant

This table shows that 25.0% of the cases who belongs to < 20 years of age had haemorrhage complication followed by 20.0% of the cases that belongs to 20 – 40 years of age and 15.4% who belongs to > 40 years of age had haemorrhage complication.

25.0% of the cases who belongs to < 20 years of age had pneumothorax complication. 12.0% of the cases that belongs to 20 – 40 years of age and 13.3% who belongs to > 40 years of age had pneumothorax complication.

ASSOCIATION BETWEEN COMPLICATIONS AND LESION SIDE

Types of Complications	Lesion Side			
	Left (N = 103)		Right (N = 121)	
	No	%	No	%
Haemorrhage	15	14.6	21	17.4
Pneumothorax	14	13.6	16	13.2

By Chi – Square Test P > 0.05 Not Significant

In this table 14.6% of the cases with left side lesion had complication of haemorrhage which was less as compared to 17.4% cases with right side lesion but difference was not significant.

13.6% of the cases with left side lesion had complication of pneumothorax which was same as compared to 13.2% cases with right side lesion and difference was not significant.

DISCUSSION

CT is superior to conventional radiography for detecting small pulmonary nodules. Once a lesion is found, the most important point is determining whether it is malignant or benign. Even when a lesion appears to be either malignant or benign on imaging, histologic or bacteriologic examinations are needed for confirmation of the final diagnosis. In this respect, CT guided semiautomated needle biopsy, which obtains core specimens from the lesions, is an excellent method for confirming the diagnosis of pulmonary lesions. [13,14] However, studies to date have not evaluated in detail the factors determining diagnostic accuracy in CT-guided semiautomated needle biopsy of the lung. Thus, this study was undertaken to evaluate the incidence of complications, factors affecting complications and to evaluate accuracy of this procedure.

In our study all the biopsies were performed under CT fluoroscopy guidance. Thus the dose to the patient and operator was minimized. To further minimize dose to operator's finger, long forceps was used to hold the biopsy needle during needle advancement under fluoroscopy guidance. Another advantage of CT fluoroscopy is needle tip visualization thus allowing almost real time imaging for advancement of needle within the lesion. Since we used semiautomated core biopsy system the inner needle with side notch was advanced within the lesion and it was confirmed by CT fluoroscopy prior to firing the external cannula to obtain a core of tissue. This process increases the probability of obtaining adequate sample for histopathological analysis and thus the technical as well as diagnostic accuracy. [15,16]

In our study, 224 patients underwent CT guided core biopsy and 68 patients had complications. The complications which occurred were pneumothorax and haemorrhage. No patient developed air embolism or cardiac tamponade.

The factors subjected to analysis were age of patient, lesion side, lesion site, lesion size, depth of lesion from skin surface, position of patient, approach, number of throws and time taken. All these factors were subjected to analysis in relation to the observed complications, i.e. haemorrhage and pneumothorax. The method used for statistical analysis was univariate analysis (Chi-Square test) and a 'p' value was obtained for each. A 'p' value of <0.05 was considered significant and >0.05 was considered as insignificant.

The most common complication was haemorrhage occurring in 16.1% (36/224). Out of the 36 patients, 30 patients had needle track

haemorrhage, 5 had perilesional haemorrhage, 2 developed consolidation, 2 developed hemoptysis and 1 patient developed haemoeffusion. Two patients had both needle track and perilesional haemorrhage, and two patients with needle track haemorrhage also had hemoptysis. [17,18]

Next common complication was pneumothorax occurring in 13.4% (30/224). Out of the 30 patients, 20 had pneumothorax <1cm and 10 had pneumothorax > 1cm. No case required insertion of chest tube for pneumothorax drainage and all the patients were stable before leaving with no patient requiring hospitalization.

This study was carried out to evaluate the various complications of CT guided core needle lung biopsy, to analyze the various factors affecting complications and to obtain accuracy of this procedure. This was a prospective study carried out over two years. All procedures were performed under 32 slice MDCT scanner using the CT fluoroscopy technique. The various complications observed during the procedure and the various risk factors were noted down in a separate proforma maintained for every individual patient. Similarly the diagnostic and technical accuracy was also noted for every patient. The various factors were analyzed using Chi square test and 'p' value was obtained. A 'p' value of <0.05 was considered as significant. Findings in our study were then compared with other similar studies. CT guided lung biopsy using a semi-automated core biopsy needle is an excellent method for obtaining tissue diagnosis of a lung lesion. [19,20] Pulmonary haemorrhage and pneumothorax are the most common complication. Lesion size, lesion depth, contact of lesion with pleura, number of throws of the biopsy needle within the lesion and time taken for the procedure, had significant correlation with complications. Careful attention to biopsy planning, technique and postprocedural care help to prevent or minimize the potential complications. [21] The technical and diagnostic accuracy is high with this technique. Thus it can be concluded that CT guided biopsy using a semi-automated core biopsy needle for lung is a highly accurate and safe procedure for lung lesions.

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