Our Experience with CT Guided Lung FNAC/ Biopsy

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ABSTRACT

Introduction: CT guided lung FNAC/Biopsy is being increasingly used for the tissue diagnosis of lung lesions. CT is the safest and most accurate method of biopsying central lesions and lesions adjacent to or involving the hila and mediastinal structures. This study was aimed at evaluating the frequency of complications following CT – guided lung Biopsy/FNAC

Material and methods: This was a retrospective study. 53 CT guided procedures performed during the year 2016 were included in the study. All the patients had a CT examination of the chest (plain and contrast) done before the guided procedure which was used as a road map. CT examination was done on a Siemens somatom 148 slice scanner. In some patients table dose oral contrast was also given done to delineate the oesophagus.

Results: The incidence of pneumothorax was 1.06% i.e. only 1 patient out of 53 had minimal pneumothorax which was treated conservatively.

Conclusion: CT guided lung FNAC/Biopsy is a safe procedure if done in expert hands with a multi-disciplinary team approach. Complications can be minimised by careful selection of the patient... considering the site and size of lesion; associated lung conditions etc.

Keywords: CT Guided Lung FNAC/Biopsy, Core Biopsy Needle, Patient Position, Pneumothorax

INTRODUCTION

The lung together with the bronchi accounts for highest rate of invasive cancer in males and females, as per WHO estimates.[1] In the near future, CT-guided coaxial core biopsy will be an important technique in the personalized treatment of lung cancer.[2] Core biopsy requires special attention to avoid cutting the vessel surrounding the tumor in order to prevent major hemorrhage.[2]

We intend to discuss the topic under the following headings:

- Indications
- Contraindications
- Biopsy equipment
- Consent
- Precautions
- Complications
- Technique Staffing issues
- Patient information[3]

Indications

- A new or enlarging solitary nodule or mass on the chest radiograph which is not amenable to diagnosis by bronchoscopy, or CT shows it is unlikely to be accessible by bronchoscopy and when a decision has been made by the multidisciplinary team that a tissue diagnosis should be obtained.
- Multiple nodules in a patient not known to have a malignancy or who has had a prolonged remission.
- Persistent infiltrates, either single or multiple, for which no diagnosis has been made by sputum or blood culture, serology or bronchoscopy.
- Hilar mass following negative bronchoscopy.

Contraindications to lung biopsy

There are few relative contraindications to lung FNAC / biopsy and the balance of benefit against risk for the procedure should be assessed at a multidisciplinary meeting.[3]

Biopsy equipment

CT is the safest and most accurate method of biopsying central lesions and lesions adjacent to or involving the hila and mediastinal structures. The cross-sectional view also allows anatomic hazards such as bullae/ blebs, large vessels, and the pulmonary fissures to be avoided**.** The coaxial technique has the primary advantage of limiting the number of pleural punctures, thereby decreasing the risk of the most common complication of lung biopsy, a pneumothorax. The two basic needle types used for lung biopsy are needles for FNA and core biopsy needles. Generally smaller gauge needles (18 g or smaller) should be used, as large-gauge needles are considered to place the patient at increased risk of hemorrhage and pneumothorax.

Type of needle and number of passes

The number of passes needed per procedure has not been defined. Most operators perform at least two.[3]

Rapid needle-out patient-rollover time during percutaneous CT-guided transthoracic lung biopsy reduces the rate of overall pneumothorax and pneumothorax necessitating a drainage catheter. Use of this technique attenuates the

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influence of traditional risk factors for pneumothorax.[7]

Techniques regarding ctguided core biopsies of lung lesions:

Basic Concepts[1]:

Respiratory Motion:

Patient should breathe freely and quietly during the biopsy procedure. We directly observe the patients' breath rhythm and insert the needle during inspiration.

Cardiac Motion:

The left lingula, near the left ventricle and pulmonary trunk is most affected by cardiac motion. While performing biopsy in the lingula, care is taken to avoid myocardium or epicardial coronary artery injury.

Chest Wall Vessels:

Generally, all vessels greater than 5 mm (as seen on CT) are to be avoided. When performing biopsy of an anterior lesion behind vessels in the upper chest, such as the subclavian or internal thoracic vessels, a path should be chosen that avoids the vessels. The intercostal arteries are avoided, by insertingthe coaxial needle above the rib rather than below the rib.

Pre-procedure

Preoperative investigations: coagulation indices:

Prothrombin time (PT), activated partial thromboplastin time (APTT), and platelet count should be checked before percutaneous lung biopsy.Oral anticoagulants should be stopped before a percutaneous lung biopsy in accordance with the published guidelines on perioperative anticoagulation.[3]

Post procedure:

A period of bed rest is advised with observation for some hours after the procedure.The observation period should allow us to identify and treat a potential complication in a timely manner thus to prevent any serious /catastrophic outcome. After the procedure, x-rays are performed usually at four hours post biopsy.

Relative contraindications include:

Platelet count <100 000/ml, APPT ratio or PT ratio >1.4[3]

Pulmonary function

All patients should have recent pulmonary function tests(spirometry) donebefore needle biopsy. Patients with FEV1 <35% should not undergo needle biopsy without further assessment by the multidisciplinary team.[3]

Chest radiography and CT scanning

Recent chest radiographs and CT scans and all previous radiological investigations should be reviewed to decide if a biopsy is appropriate and must be available to the radiologist at the time of the biopsy. CT should preferably be performed before bronchoscopy.[3]

Sedation

Biopsy should be performed without sedation whenever possible.[3]

Staffing

Staffing should be adequate to enable the patient to be monitored for signs of distress during and after the procedure.

Complications

Pneumothorax and pulmonary haemorrhage are the most common complications.Air embolism and tumour seeding of the pleura and chest wall are rare complications of needle biopsy of the chest.[2] Careful attention to biopsy planning and technique and post-procedural care is important and thus prevent or minimizepotential complications.[2]

The majority of cases of pneumothorax developing after needle biopsy resolve spontaneously, but a few intractable cases require chest tube placement.[10]

Risk factors for pneumothorax

The risk factors for pneumothorax are chronic obstructive pulmonary disease (COPD),size of the lesion, a long needle path and repeated pleural punctures.[2]

Study aimed to evaluate the frequency of complications following CT – guided lung Biopsy/FNAC with the objectives to establish guidelines for the procedure of CT – guided lung biopsy/FNAC and to standardise the protocol for CT – guided lung biopsy/FNAC and to minimise complications following CT – guided lung Biopsy/FNAC.

MATERIAL AND METHODS

This was a retrospective study. 53 CT guided procedures were performed during the year 2016 were included in the study. All the patients had a CT examination of the chest (plain and contrast) done before the guided procedure which was used as a road map.CT examination was done on a Siemens somatom 128 slice scanner. In some patients table dose oral contrast was also done to delineate the oesophagus. Patints were made to lie down in supine,prone or lateral decubitus positions depending on the site of lesion ie. supine for lesions which are anterior in location; prone for lesions which are near the posterior chest wall and right and left lateral decubitus position for lesions which are along the lateral chest wall.

The access route is decided depending on the site of lesion avoiding the broncho-vascular structures.The patient is made to practice " breath- holding " before the procedure. Under aseptic precautions and local anaesthesia, the procedure is performed. Pre- Post –Procedure vital data of the patient recorded. Patient is told to inform if there is any respiratory difficulty.A plain radiograph of the chest is taken in erect position.Patient is shifted to the ward. After 4 hrs another chest radiograph is repeated.

Scan protocol

Scan Protocols during the procedure is obtaining a routine low-dose axial scan with 130 kVp, 70 mAs per slice, 0.6second rotation time,2mm slice thickness,1.2 pitch, and collimation of 8 × 5 mm on a 64-MDCT scanner.

Informed Consent

Since CT-guided lung biopsy is an invasive procedure with potential complications, obtaining informed consent from the patient andthe familymembers (after explaining about the procedure and potential risks) is important. The British Thoracic Society guideline further suggests,

"Operators should audit their own practice and calculate their complication rates to inform patients before consent is given.[4]"

Written information should be given to all patients before the procedure. Informed consent should be obtained in a written form from all patients.[3]

CT biopsy procedure

Protective clothing:

The procedure is performed using standard universal precautions. Protective gloves should be worn. If possible, non-powdered latex gloves or non-latex gloves should be used.

Patient positioning and instruction

The patient ispositioned prone or supine depending on the this,skin entry site is chosen. Breathing technique required during the procedure is explained to the patient and practised beforehand.

Imaging techniques

The imaging technique chosen is dependent on the size and position of the lesion, its visibility on plain radiographs, its relation to other structures such as fissures, vessels and bullae, equipment availability. This is operator- dependent. Forlesions which arenot suitable for ultrasound guided biopsy, CT is now the preferred imaging modality. If the biopsy is to be performed using fluoroscopy, the best results are usually obtained with C-arm screening (or, if available, bi-plane) with vertical or horizontal needle insertion. The correct depth of needle insertion may be estimated from the pre-biopsy CT scan. A needle entry site which avoids crossing fissures, bullae and large vessels should be chosen if possible to reduce the incidence of pneumothorax and haemorrhage.

Biopsy technique

The skin entry site should be sterilised with standardised antiseptic solution and the cutaneous and subcutaneous tissue infiltrated with 2% lidocaine (lignocaine) solution up to a maximum dose of 20 ml. The pleura should not be anaesthetised directly as this increases the risk of pneumothorax before the biopsy itself.

When the biopsy needle is being advanced or withdrawn the patient is instructed to suspend respiration. Most patients find it more comfortable to hold their breath after a submaximal inspiration. For lesions at the lung bases, a breath is held on gentle expiration may make the biopsy procedure easier. Wherever possible a needle entry site immediately cephalad to a rib should be chosen to avoid intercostal vessel puncture. Care should be taken to avoid the internal mammary vessels if the biopsy is performed adjacent to the costal cartilages and sternum.

Fineneedle aspiration biopsy (FNAB) has an accuracy of up to 95% for malignant lesions.[5]

RESULTS

Fifty-three patients with suspicious lung lesion detected on chest X-ray or CT chest were included in this study. There were 32 (73%) males and 21(27%) females in the age group 38-75 years (mean age 65) (table-1).

Male	32
Female	21

Table-1: Gender ratio

Age	Male	Female
Youngest(yr)	38	38
Oldest(yr)	75	65

Table-2: Age distribution

History	Out of 53
Smoking	32
COPD	28

Table-3: smoking history

Peripheral lesions	43
Central lesions	10

Table-4: Type of lesion

In our study, we found the youngest male and female were of the age of 38 years. The oldest male patient was 75 years and female patient was 65 years (table-2).

32 out of 53 had history of smoking and 28 out of 53 had COPD (table-3). 43 hadperipheral lesions and 10 had central lesions (table-4)**.**

In our study, one case of pneumothorax was seen in patient who was smoker, had a history of COPD and the patient had central lesion. This complication was resolved spontaneously, did not require evacuation with a chest tube, because there were asymptomatic and stationary in nature. Concerning haemoptysis, in our practice none of the patients showed bleeding complications.

DISCUSSION

According to the protocol followed in our Department few blood investigations like, APTT; CT; BT and INR are mandatory.The patient's Chest X-ray and CT films are well studied before undertaking the procedure. CT guided FNA/ Biopsy involves team work of Pulmonary medicine, Radiology and Pathology. Patient and the relatives are informed about the procedure and its complications; due informed consent taken. The access route is decided depending on the site of lesion avoiding the broncho-vascular structures.The patient is made to practice " breath-holding " before the procedure. Under aseptic precautions and local anaesthesia, the procedure is performed. Pre- Post –Procedure vital data of the patient recorded. Patient is told to inform if there is any respiratory difficulty.A plain radiograph of the chest is taken in erect position.Patient is shifted to the ward. After 4 hrs another chest radiograph is repeated.

53 lung FNAC/biopsy performed in the year 2016 were analysed retrospectively.The incidence of pneumothorax was 1.06% i.e. only 1 patient out of 53 had minimal pneumothorax which was treated conservatively. The angle between the needle and pleura was $<90^0$. The positioning

was maintained to increase ease with which the operator would insert the needle.The angle between the needle and the pleura was <90 degree in the anterior,posterior and right left positions.

Our results confirm that CT guided lung biopsy is a safe procedure which allows diagnosis of lung lesions in majority of the patients. CT is a well-established guiding modality for the FNA/biopsy of lung lesions. In our study the incidence of pneumothorax was very less(1.06%). Incidence of this complication was reduced due to schematic technique and proper use of breathholding with reduced diaphragmatic movement. We thought that few lesions were to be highly challenging to reach due to respiratory motion as we could communicate well with the patient this procedure was successful with no major complications.

CT guided FNAC is an uncomplicated, secure and unfailing procedure with high diagnostic efficiency.[9]

FNAC of these lesions can differentiate between benign and malignant lesions and also the small cell carcinoma of the lung from non-small cell carcinoma of the lung which helps in early initiation of the treatment and avoid more invasive surgeries in maximum number of cases specially in patients with inoperable lesions due to patient's general condition and local factors.[10]

Shabnam Sarfraz et.al suggests that squamous cell carcinoma still remains the commonest histological subtype. Most of the patients were elderly with smoking as the principal risk factor.[11]

Study by Takumi Kuriyamaet.al showed that use of CT-guided lung biopsy can reduce the rate of pneumothorax development that occurs when other procedures are used. The access route is simple and easy to puncture, and proper use of breath holding reduces diaphragmatic movement.[12]

Anna Chodorowska et.al conducted a study in which they concluded that fine-needle biopsy of the focal lung lesions is an affective and a relatively safe method, which can replace the more invasive diagnostic thoracotomy in the majority of patients.[13]

CONCLUSION

CT-guided core biopsy is playing an increasing role in the diagnosis of lung disease. Radiologists should be familiar with the technique so that they may safely obtain specimens while minimizing complications.

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