

CT GUIDED BIOPSY: 146 CASE REVIEW

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ABSTRACT

Introduction: A lung biopsy is a procedure performed to assess a specimen from the lung for disease or cancer. It is a multidisciplinary procedure involving the pulmonologists, pathologists, and radiologists with an interest in chest diseases. Lesion depth is the predominant risk factor for pneumothorax in patients undergoing CT-guided transthoracic lung biopsy. The aims of this study were to estimate the risk of pneumothorax in patients undergoing CT-guided lung biopsy and to determine which factors effect its occurrence.

Materials & Methods: It was a retrospective study conducted on 146 cases from June 2015 to June 2016. Data was collected from the archives of the Liverpool Heart and Lung Hospital using a performa that included parameters such as gender/age, Forced Expiratory Volume (FEV1), size of lesion, chest wall thickness, distance of lesion from pleura, rate of pneumothorax, number of needle passes and grade of operator. Statistical Analysis was performed at the Cardiothoracic Centre Liverpool NHS Trust Chest unit using Statistical Package for Social Sciences (SPSS) version 13.0.

Results: Out of the total 146 cases in this study, 45 patients (30.82%) developed Pneumothorax while 101 patients (69.18%) did not. The most common anatomical site of lesion was the Left Upper Lobe (35.33%). Out of the patients developing Pneumothorax, 26 patients (30.59%) developed Pneumothorax after one pass. On the contrary, 59 patients (77.63%) did not develop Pneumothorax after one pass. A similar trend was seen in the other patients who underwent more than one pleural pass. The mean size of lesion in patients that develop Pneumothorax after CT guided biopsy was 3.0 cm. In the patients who did not develop Pneumothorax, mean size of lesion was 3.8 cm. The mean distance of pleura to site of lesion in patients who developed Pneumothorax was 2.5 cm.

Conclusion: Technically difficult biopsies were done by consultants with high complication rate. The smaller and deeper lesions were associated with a high rate of Pneumothorax and the rate of pneumothorax was not affected by no of passes, chest wall thickness, FEV1, gender or age ($p = \text{NS}$) however, the distance from pleura and size of lesion ($p < 0.05$) affects it.

Key-words: CT, Pneumothorax, Percutaneous Biopsy

INTRODUCTION

A lung biopsy is a procedure performed to assess a specimen from the lung for disease or cancer. It is a multidisciplinary procedure involving the pulmonologists, pathologists, and radiologists with an interest in chest diseases.¹ Lung biopsy can be performed by surgical or non-surgical approach. Trans-thoracic Needle Biopsy (TTNB), also known as percutaneous biopsy is one form of Needle biopsy. It can be Fluoroscope guided, Computed Tomography (CT) guided or Ultrasoundography guided. CT guided biopsy is far superior to Ultrasound guided biopsy due to its greater sensitivity (92.1% as compared to 88.7%).²

The indication for imaging guided chest biopsy

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include presence of a new or enlarging solitary nodule or mass, multiple nodules in a patient without known neoplastic disease or in prolonged remission, focal parenchymal infiltrates in which an infectious organism cannot be isolated, diagnosis of hilar masses following negative bronchoscopy, undiagnosed mediastinal mass and biopsy or re-biopsy for targeted therapy. A major contraindication for CT guided lung biopsy is a violent uncooperative patient. Inability of a patient to cooperate during the procedure or to suspend respiration on request or control cough can lead to complications.²

Although CT guided lung biopsy is less invasive as compared to the surgical biopsy, complications sometimes do occur.³ Complications of TTNB include pneumothorax, hemoptysis, hemothorax, infection, and air embolism, with pneumothorax as the most common complication with a reported variance from 8% to 61%.⁴

Pneumothorax (PNTX) is defined as the presence of gas in the pleural space which can impair oxygenation/ventilation.⁵ Although it can be spontaneous and traumatic, most Pneumothoraces are iatrogenic and can be caused by a physician during surgery, central line placement, lung biopsy, or bronchoscopy. The reported incidence of pneumothorax as a complication of TTNB varies widely from 8 to 61%. Because pneumothorax usually occurs immediately, a further 9% are detected

by chest radiography 1 hour after biopsy, and an additional 2% are detected at 4 hour interval.⁶ A CT will significantly detect Pneumothoraces more prominently as compared to X-Ray radiographs.⁴ Risk factors for the development of biopsy-related pneumothorax include the presence of chronic obstructive pulmonary disease (COPD), small lesion size, a long needle path, repeated pleural puncture, and the absence of a history of ipsilateral surgery.¹

The aims of this study were to estimate the risk of Pneumothorax in patients undergoing CT-guided lung biopsy, and to determine which factors affect its occurrence.

MATERIALS & METHODS

It was a retrospective study conducted on 146 cases from June 2015 to June 2016. Data was collected from the archives of the Liverpool Heart and Lung Hospital using a Performa that included parameters such as gender/age, Forced Expiratory Volume (FEV1), Size of lesion, chest wall thickness, distance of lesion from pleura, rate of pneumothorax, number of needle passes and grade of operator. Statistical Analysis was performed at the Cardiothoracic Centre Liverpool NHS Trust Chest unit using Statistical Package for Social Sciences (SPSS) version 13.0.

RESULTS

Figure 1 shows the anatomical site of lesion in a lung biopsy. The right lobes (52.00%) were involved more as compared to the Left Lobe (47.33%), however, the left upper lobe (LUL) (35.33%) was the most common site of lesion. Bilateral lesions (0.67%) were seen least as site of biopsy.

Figure 2 shows the chest wall thickness of patients undergoing CT guided biopsy. The mean chest wall thickness was 3.6 cm. 73.68% of the patients presented with Chest Wall thickness above 3 cm. Upon applying Pearson Chi Square Test, the results were not significant as the result was above 0.05 significance level.

Out of the total 146 cases in this study, 45 patients (30.82%) developed Pneumothorax while 101 patients (69.18%) did not as shown in Figure 3.

As depicted in Figure 4, out of the total 113 patients, 37 patients (32.74%) developed Pneumothorax while 76 patients (67.26%) did not. Out of the patients developing Pneumothorax, 26 patients (70.27%) developed Pneumothorax after one pass. On the contrary, 59 patients (77.63%) did not develop Pneumothorax after one pass. A similar trend was seen in the other patients who underwent more than one pleural pass. Upon applying Pearson Chi Square Test, the results were not significant as the result was above 0.05 significance level.

The size of lesion is defined as the lesion inside

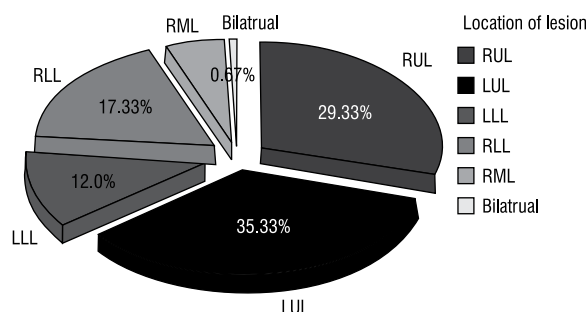


Figure 1: Anatomical Site of Lesion

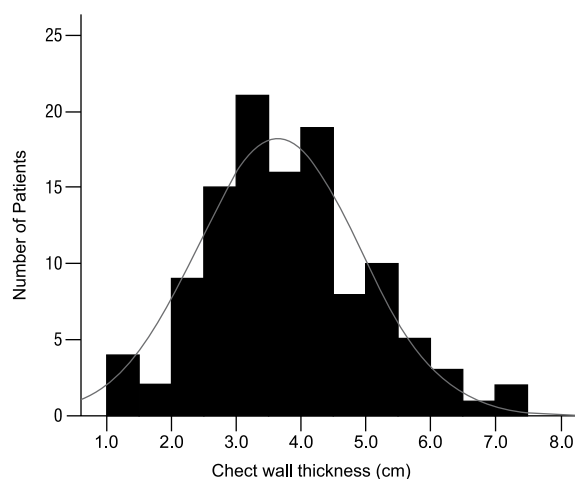


Figure 2: Chest Wall Thickness (cm)

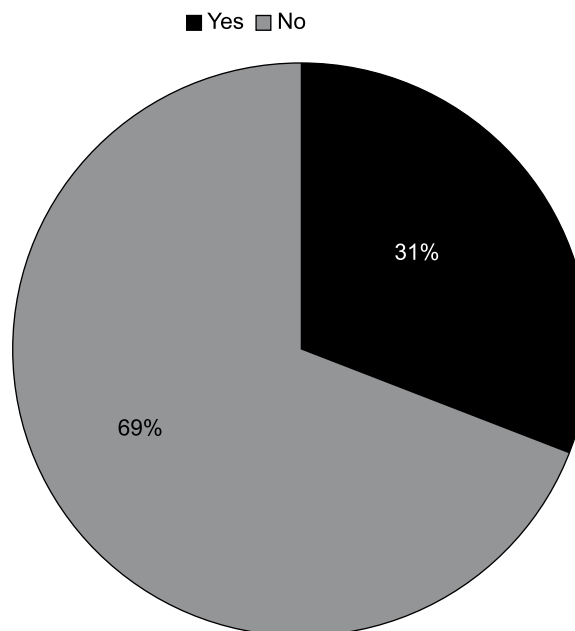


Figure 3: Cases developing Post Procedure Pneumothorax

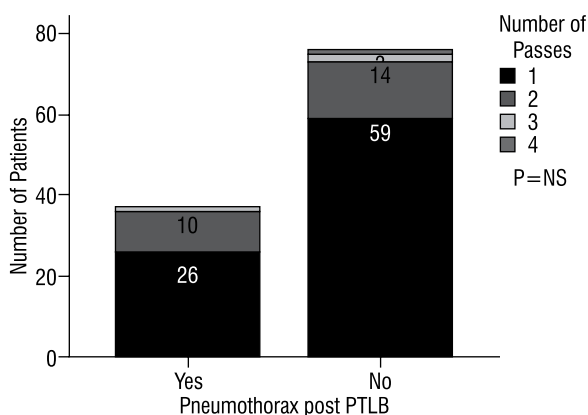


Figure 4: Relationship between Post Procedure Pneumothorax and number of passes

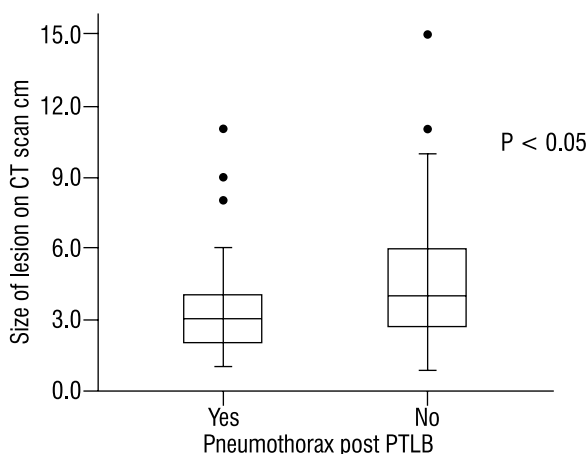


Figure 5: Relation between Post Procedure Pneumothorax and Size of lesion

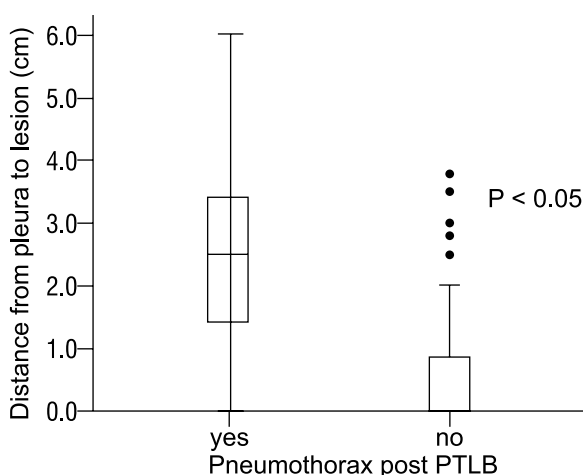


Figure 6: Relation between Post Procedure Pneumothorax and distance from pleura to lesion

the lungs. The mean size of lesion in patients that develop Pneumothorax after CT guided biopsy was 3.0 cm. Pneumothorax developed from a lesion as small as 0.75 cm and as large as 6.0 cm. The patients that didn't develop Pneumothorax, the smallest lesion was 0.5 cm and the largest lesion size was 9.8 cm with a mean size of 3.8 cm as shown in Figure 5. Upon applying Pearson Chi Square Test, the results were found to be significant as they were below the 0.05 significance level.

The mean distance of pleura to site of lesion in patients who developed Pneumothorax is 2.5 cm (range of 0.0 cm to 6.0 cm). The mean distance of pleura to site of lesion in patients who did not develop Pneumothorax is 0.0 cm (range of 0.0 cm to 2.25 cm) as shown in Figure 6. Upon applying Pearson Chi Square Test, the results were found to be significant as they were below the 0.05 significance level.

DISCUSSION

Pneumothorax remains the most common complication of percutaneous CT guided lung biopsy, despite improved techniques.⁷ This study shows, out of a total 146 CT guided biopsies, 30.82% of patients developed Pneumothorax. A study published in Journal of Bras Pneumol in 2011 showed the incidence of Pneumothorax to be 27.8% which is slightly lower as compared to this study.⁸ A study conducted in the United States show a prevalence of 20% post procedure Pneumothorax.⁹ In a study conducted in Department of Radiology, Mayo Hospital Lahore, 35% of post procedure Pneumothorax developed when the lesion size was 2 – 3 cm.¹⁰ In this study, most of the small lesions were targeted hence the mean lesion size was 3 cm in patients who developed post procedure Pneumothorax. A study conducted in China show that 22.7% developed Pneumothorax with pleural distance less than 2.56 cm while only 16% patients developed Pneumothorax with pleural distance greater than 3.46 cm.¹¹ The average distance from pleura for patients developing pneumothorax is 2.5 cm which correlates with findings in other studies. However as the distance from pleura increases, the chances of Pneumothorax too increase as more of the lung parenchyma was damaged to reach the affected site. Percutaneous CT guided lung biopsy can be performed for any anatomical location as depicted in the Figure 1 above, hence it shows how safe the procedure is. A study conducted by American College of Chest Physician in 2004 also state that, all anatomical sites lesion can be reached safely with complication rate of 21.83% out of 458 biopsies.¹²

CONCLUSION

Technically difficult biopsies were done by consultants with high complication rate. The smaller and deeper lesions were associated with a high rate of Pneumothorax and the rate of pneumothorax was not affected by no of passes, chest wall thickness, FEV1,

gender or age ($p = \text{NS}$) however, the distance from pleura and size of lesion ($p < 0.05$) affects it.

RECOMMENDATIONS

CT guided lung biopsy is an advanced procedure which helps doctors pin down on diagnosis for effective management of diseases, hence it should be used more judiciously. Pakistan is a country in which CT guided biopsy is not commonly practiced since doctors fear its complications however, the only complication that occurs and is known in literature is Pneumothorax or hemothorax, 20 – 30% and 1 – 2% respectively hence this procedure should be encouraged. Trained staff is required for performing this procedure, however, not many centers are present hence more centers should be made for training of young graduates.

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