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Age as a risk factor in the occurrence of pneumothorax after transthoracic fine needle biopsy: Our experience



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ABSTRACT

Transthoracic needle biopsy (TTNB) of the lung is a well-established technique for diagnosing many thoracic lesions, and is an important alternative to more invasive surgical procedures. Complications of TTNB include pneumothorax, hemoptysis, hemothorax, infection, and air embolism, with the most common complication as pneumothorax. From June 2011 to June 2014 we performed a prospective study of 188 patients who underwent TTNB with CT guidance at University Hospital of Salerno, Italy. Pneumothorax occurred in 14 of 188 biopsies (7.45%). With the respect of age of patients pneumothorax occurred more frequently in patients aged 60–70 years, while it was less frequent in younger (<60 years) and older patients (>70 years). In conclusion, data of our prospective study documented that CT-guided TTNB is a safe and reliable procedure in elderly patients with suspected chest malignancy and is well tolerated.

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1. Introduction

Transthoracic needle biopsy (TTNB) of the lung is a well-established technique for diagnosing many thoracic lesions, and is an important alternative to more invasive surgical procedures. Commonly employed modalities for imaging-guided percutaneous needle biopsy include ultrasound and conventional computed tomography (CT), which has become more widely used [1]. Indications for TTNB are pulmonary lesions inaccessible to bronchoscopy, or in which prior bronchoscopic biopsy was non-diagnostic and mediastinal or pleural mass [2,3]. The most important contraindications for TTNB are: poor respiratory function or reserve, abnormal coagulation indices, bleeding diatheses, severe bullous emphysema, contralateral pneumonectomy, hydatid cyst,

pulmonary hypertension, highly vascular lesion, and the inability to tolerate a pneumothorax [4–7].

Complications of TTNB include pneumothorax, hemoptysis, hemothorax, infection, and air embolism, with the most common complication as pneumothorax [8,9]. Pneumothoraces can occur during or immediately after the procedure, which is why it is important to perform a CT scan of the region following removal of the needle [8]. The incidence of pneumothorax in patients undergoing TTNB has been reported to be from 9% to 54%, according to reports published in the past ten years [10–15], with an average of around 20% [16]. Risk factors for the development of pneumothorax after TTNB include the presence of chronic obstructive pulmonary disease (COPD), small lesion size, lesion depth, and repeated pleural puncture [6]. Increased patient age has been reported to represent a possible risk factor [17], however the occurrence of pneumothorax after TTNB in older patients has been scarcely evaluated. Therefore we performed a prospective study to evaluate the significance of age as a risk factor in the occurrence of pneumothorax after TTNB.

2. Materials and methods

From June 2011 to June 2014 we performed a prospective study of 188 patients who underwent TTNB with CT guidance at

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University Hospital of Salerno, Italy. Our hospital has a policy of performing CT-TTNB for inpatients only and of taking immediate CT after CT-TTNB and chest PA. Before the beginning of each procedure, the risks and benefits of TTNB were discussed, and informed consent was obtained from each patient. The biopsy of peripheral lesions was often performed directly using a 20 or 22-gauge needle (Chibell, Biopsybell, Modena, Italy) (See Fig. 1). The procedure was performed with the patient in a prone, supine, or lateral decubitus position, depending on the location of the lesion. A cytotechnologist was present during all procedures, and specimens were immediately processed and stained to determine if there was sufficient cellularity to make a diagnosis. The fine needle cytology procedures and the ancillary techniques have been extensively described elsewhere [18–27].

After biopsy, all patients were placed in the decubitus position to compress the biopsy site. To confirm the occurrence of pneumothorax (PNX), chest posteroanterior radiographs (PAs) using a digital imaging system and displayed by a picture archiving and communication system (PACS) were performed when simultaneously done CT showed a PNX or patient's condition was suggestive for PNX. If PAs showed a PNX <3 cm the patient was treated conservatively with monitoring of vital signs, administration of supplemental oxygen, and follow-up chest radiography at 6 and 24 h to value the stability of the pneumothorax. If the patient presented symptoms such as dyspnea or respiratory distress, aspiration of the pneumothorax was attempted. If aspiration was inadequate or if a large or rapidly enlarging pneumothorax was found, a tube was placed in the patient's chest. All patients who underwent chest tube placement were admitted to a surveillance unit where the tube was connected for at least 24 h to a closed pleural drainage and collection system set to deliver 20 cm of water pressure with moderate continuous wall suction. The next morning, suction was discontinued, the tube was placed to the water seal, and chest radiography was repeated. If the pneumothorax resolved, the chest tube was removed and the patient was discharged. If the pneumothorax persisted, the chest tube was kept in place for another day and the process was repeated.

Statistical analysis was performed using commercially available software (SPSS 10.0 for Windows; SPSS; Chicago, IL). Quantitative

variables were compared using the unpaired *t* test, and qualitative variables were compared using the χ^2 test.

3. Results

One hundred eighty-eight patients (142 males and 46 females, with age from 29 to 94 years (average 69.7) were included in the study. Pneumothorax occurred in 14 of 188 biopsies (7.45%). Four patients with pneumothorax required pleural drains; one was discharged the following day and three other required drainage for 3 days. Hemoptysis was not a problem but occurred as a transient after biopsy event in five patients. With the respect of age no statistical difference was detected in the occurrence of pneumothorax, however it developed more frequently in patients aged 60–70 years, while it was less frequent in younger (<60 years) and older patients (>70 years) (See Fig. 2).

4. Discussion

CT-guided TTNB is one of the most used procedure in the diagnosis of tumoral and non tumoral lung pathologies [28–34]. It is regarded as a safe procedure with limited morbidity and extremely rare mortality. In deciding whether to pursue TTNB of a lung lesion, it should be considered the risk factors that may increase the individual patient's risk of complications. Important considerations include the presence of comorbidities such as COPD and the size and location of the lesion. The incidence of pneumothorax in patients undergoing TTNB has been reported to vary from 9 to 54%, according to reports published in the past ten years, with an average of around 20%. In our study we detected a very low incidence of pneumothorax. In fact, only fourteen on one hundred eighty-eight (7.45%) patients experienced pneumothorax after TTNB. Increased patient age has been reported to represent a possible risk factor. There are few reports of transthoracic needle biopsy in elderly (>70 years) patients although there is some evidence that age may be a risk factor in developing pneumothorax. The weakening of elastic recoil in aged lung parenchyma may facilitate the occurrence of pneumothorax after TTNB. In our study the highest percentage of pneumothorax was detected in patients aged 60–70 years while a lower risk was found in younger (<60 years) and in older (>70 years) patients. Our data are similar to that of Wiener [35] et al. who in a multi-center study found risk of pneumothorax to be highest in patients aged 60–69 years, with a lower risk in young patients (likely reflecting a healthier, more robust population) and in elderly patients (likely reflecting a selection bias through which frail patients at high risk of



Fig. 1. A CT scan of a needle inserted into the lung to obtain a sample for biopsy.

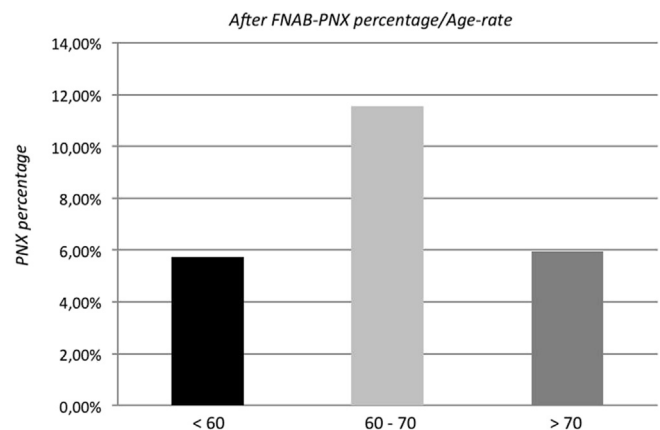


Fig. 2. PNX after TTNB percentage grouped by age.

complications were not referred to biopsy). In conclusion, pneumothorax after TTNB is a widely reported complication. Its occurrence is not easy to predict. Many reports have suggested that age may represent a possible risk factor but data of our prospective study documented that CT-guided TTNB is a safe and reliable procedure in elderly patients with suspected chest malignancy and is well tolerated.

Ethical approval

Ethical approval was requested and obtained from Campania Sud ethical committee.

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Author contribution

Alessandro Vatrella: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data; also participated substantially in the drafting and editing of the manuscript.

Antonio Galderisi: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Carmine Nicoletta: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

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Vincenzo Di Crescenzo: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data; also participated substantially in the drafting and editing of the manuscript.

Conflict of interest

The Authors have no conflict of interest.

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