

CT-Guided Fine-Needle Aspiration Biopsy of Pulmonary Nodules 8 mm or Less Has a Higher Diagnostic Accuracy than Positron Emission Tomography–CT

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ABSTRACT

Purpose: To compare diagnostic accuracy of CT-guided fine-needle aspiration biopsy (FNA-B) with positron emission tomography (PET)–CT for pulmonary nodules ≤ 8 mm.

Materials and Methods: A retrospective review of all CT-guided lung FNA-Bs performed between 2011 and 2014 at a single institution was undertaken to evaluate patients who had FNA-B and PET-CT imaging of nodules of ≤ 8 mm. Patients without surgical pathology or 2-year follow-up CT scans were excluded. Of 1,896 patients, 41 patients with 43 subcentimeter pulmonary nodules met study criteria. The McNemar test was used to compare FNA-B with PET-CT results.

Results: FNA-B had a sensitivity and diagnostic accuracy of 88.9% and 81.4%, respectively. PET-CT had an overall sensitivity and diagnostic accuracy of 38.9% and 46.5%, respectively. FNA-B had a significantly higher sensitivity and diagnostic accuracy for malignant nodules compared with PET-CT ($P < .001$). Pneumothorax rate after FNA-B was 13.9%, and chest tube insertion rate was 0%.

Conclusions: FNA-B is a safe procedure with superior sensitivity and higher diagnostic accuracy compared with PET-CT in pulmonary nodules ≤ 8 mm in size.

ABBREVIATIONS

FDG = fluorodeoxyglucose, FNA-B = fine-needle aspiration biopsy

Lung cancer is the leading cause of mortality in men and women in the United States (1). High-resolution low-dose computed tomography (CT) scans performed during lung cancer screening have increased the detection rate of subcentimeter solitary pulmonary nodules (2). Additionally, strict surveillance of patients with a diagnosis of non-pulmonary cancers has yielded an increase in detection of small metastatic foci to the lungs. The Fleischner guidelines

do not recommend surgical or nonsurgical sampling of these subcentimeter nodules owing to lower probability of malignancy, lower diagnostic yields, and increased risk of adverse outcomes such as pneumothorax (2–5). However, newer studies have shown that CT-guided fine-needle aspiration biopsy (FNA-B) for subcentimeter pulmonary nodules is a relatively safe procedure with high sensitivity and diagnostic accuracy (6,7).

Although positron emission tomography (PET)–CT also has high sensitivity (96.8%) in detecting malignancy in pulmonary nodules > 10 mm in diameter, a negative PET-CT scan for subcentimeter nodules does not necessarily exclude malignancy (2,8,9). PET-CT is reported to have a higher rate of false-negative results when evaluating sub-solid nodules, adenocarcinomas, and other metastatic lesions (2). Nevertheless, because it is less invasive, PET-CT continues to be used in diagnosing malignancy in pulmonary nodules measuring 5–10 mm that are deemed low-to-intermediate risk (9). Although FDG-PET has been shown to be more cost-effective in diagnosis of patients with pulmonary nodules, CT-guided FNA-B was found to be

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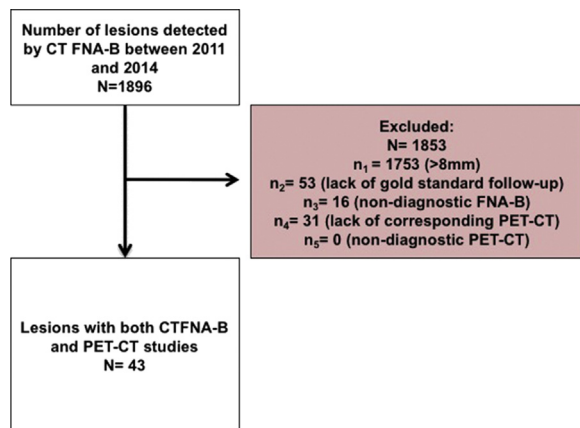


Figure. Selection criteria.

superior with respect to diagnosing malignancy in intermediate- and high-risk patients (10).

Prior studies have compared the diagnostic accuracy of FNA-B with PET-CT for larger primary pulmonary nodules, recommending the latter as a safer and diagnostically superior modality; however, there have been no recent studies to our knowledge that compare the diagnostic accuracy of CT-guided FNA-B with PET-CT for subcentimeter pulmonary nodules. In the age of screening for patients at high risk for primary lung cancer and close oncologic surveillance for patients at risk for developing secondary lung cancers, identifying modalities that can provide a safe and effective diagnosis of subcentimeter pulmonary nodules is of paramount interest. This study compares the sensitivity and diagnostic accuracy of FNA-B with PET-CT for pulmonary nodules ≤ 8 mm. Procedural risks of FNA-B, such as pneumothorax and chest tube insertion rates, were also calculated.

MATERIALS AND METHODS

After approval by the institutional review board, a retrospective review of imaging records of patients who had undergone CT-guided FNA-B of pulmonary nodules between January 1, 2011, and November 30, 2014, was performed. Of 1,896 patients, 41 patients with 43 pulmonary nodules who fit eligibility criteria for this study and who had a concurrent diagnostic PET-CT within 30 days underwent a diagnostic CT-guided FNA-B of pulmonary nodules of ≤ 8 mm. Patients who did not subsequently undergo surgical resection or who had at least 2 years of follow-up imaging (terms of gold standard follow-up) were excluded (Fig). Patient demographics, nodule characteristics, and FNA-B complication profiles were collected (Table 1). There were 23 (56.1%) female patients, 34 (82.9%) patients with a prior cancer history, 16 (39%) patients with a prior lung cancer history, and 4 (9.8%) patients with a history of emphysema. Nodule size ranged from 4 to 8 mm with an average nodule size of 6.9 mm.

The sensitivity and accuracy of FNA-B and PET-CT were calculated and compared (Table 2). In addition, the

Table 1. Descriptive Statistics

Variable	Value
Number of patients	41
Number of nodules	43
Age, y	64.1 \pm 11.6
Sex	
Female patients	23 (56.1)
Male patients	18 (43.9)
Health status	
Cancer history present	34 (82.9)
Lung cancer history present	16 (39.0)
Emphysema history present	4 (9.8)
Nodules	
Range, mm	4–8
Size, mm	6.9 \pm 1.2
Lobes	
Upper	14 (32.5)
Middle/lingula	3 (7.0)
Lower	26 (60.5)

Note—Continuous values were presented as mean \pm SD. Values in parentheses are percentages.

Table 2. Comparison of Diagnostic Values of FNA-B and PET-CT for Nodules with Both Studies

FNA-B							
TP	32	TN	3	FP	4	FN	4
PET-CT							
TP	14	TN	6	FP	1	FN	22
		Sensitivity (%)		Diagnostic Accuracy (%)			
FNA-B		88.9		81.4			
PET-CT		38.9		46.5			
<i>P</i>		< .0001		< .0001			

FN = false negative; FNA-B = fine-needle aspiration biopsy; FP = false positive; TN = true negative; TP = true positive.

diagnostic accuracy of the aforementioned diagnostic tests was recalculated and compared for 2 size categories of pulmonary nodules: 4–5 mm and 6–8 mm (Table 3). Clinical and procedural parameters were correlated with accuracy.

FNA-B Procedure

FNA-B procedures were performed at a tertiary care academic center by 10 board-certified interventional radiologists with mean 10 years (range 1–25 years) of experience in interventional procedures. The procedure was performed with serial CT guidance using a commercially available scanner (GE Healthcare, Chicago, Illinois). Images acquired through the region of interest were viewed by using lung window settings with a section thickness of 2.5 mm. The intended site of entry was prepared and draped in a standard

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