Fluoroscopy-Guided Percutaneous Transthoracic Biopsy: Comparison between Fine Needle Aspiration Biopsy and Core Biopsy with an Automated Cutting Needle

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Purpose: To compare the diagnostic accuracy and complication rates of fluoroscopy-guided percutaneous transthoracic fine needle aspiration biopsy (FNAB) and core biopsy (CB).

Materials and Methods: Ninety-one fluoroscopy-guided lung biopsies were performed in 86 patients using a 22-gauge fine needle (n = 52) or a 21-gauge automated cutting needle (n = 39). The size of pulmonary lesions were 1-9 cm. Histologic diagnosis rates and complications rates of the two groups were compared.

Results: The overall sensitivity of FNAB was 98% (51/52) which was higher than that of CB 89.7% (35/39) (p = 0.160, Fisher's exact test). For the diagnosis of malignancy, sensitivities of FNAB and CB were 97.2% (35/36) and 89.7% (26/29), respectively (p = 0.316). For the diagnosis of benignancy, sensitivities of FNAB and CB were 100% (16/16) and 90% (9/10), respectively (p = 0.384). The specific histologic diagnosis rate of CB was 80% (8/10) in benignancy, which was higher than that of FNAB 56% (9/16) (p = 0.398). The pneumothorax rates were 7.7% (4/52) for FNAB and 15.4% (6/39) for CB (p = 0.316).

Conclusion: Although not statistically significant, a higher overall sensitivity was found in fluoroscopy-guided FNAB in the diagnosis of both malignancy and benignancy, and FNAB also achieved lower complication rates. More specific histologic diagnoses were obtained with CB.

Index words: Lung
- Lung neoplasms
- Percutaneous biopsy

Since the introduction of automated core biopsy cutting needles, there have been reports of good results in diagnostic accuracy in percutaneous transthoracic biopsies of intrapulmonary lesions. However, this technique has a relatively high incidence (9-54%) of complications such as pneumothorax [1-4]. In the majority of papers dealing with the efficacy of percutaneous core biopsies, the technique has been performed under CT guidance [1-6]. Percutaneous transthoracic needle biopsies can be performed under either fluoroscopy- or CT-guidance depending on the circumstances at the institute and the preferences of attending radiologists. To our knowledge, there has been little research performed on the comparison between fine needle aspiration biopsy
(FNAB) and core biopsy (CB) under fluoroscopic guidance in English literature.

The aim of this study was to compare the diagnostic accuracy and complication rates between FNAB and CB when performed under fluoroscopic guidance.

Materials and Methods

Between December 2003 and March 2004, 91 fluoroscopy-guided transthoracic biopsies were performed by an experienced chest radiologist. Biopsy procedures were performed in 86 patients (33 women, 53 men; aged 19-86 years; mean, 58 years) using a 22-gauge fine needle (Chiba needle) \( n = 52 \) or a 21-gauge automated cutting needle (Autovac biopsy needle; angiomed, Karlsruhe, Germany) \( n = 39 \). In five patients, both the fine needle and the automated cutting needle techniques were used for a single lung lesion during the procedure. After explaining the possible complications, informed consent was obtained from all patients prior to performing the procedure. In this prospective study, we tried to use each method alternately in randomized patients in order to lower the possibility of patient selection bias.

The majority of the lung lesions were located peripherally, but anterior mediastinal masses \( n = 5 \) and a pleural mass were included in the study. The size of the lesions were 1-7 cm in diameter (mean, 3.1 cm) for FNAB, and 1-9 cm (mean, 3.6 cm) for CB. Prior to performing the procedure, posteroanterior chest radiograph and CT scans were carefully reviewed in order to determine the optimal needle track, taking into consideration the diameter of the lung lesion and the length of the needle pathway. When using the FNAB technique, needle penetration through the lesion was performed repetitively in a to-and-fro movement (10-15 times), applying continuous negative pressure with a 20-mL syringe after the tip of the needle had reached the margin of the lesion. The actual biopsy site of the lesion was monitored throughout the procedure by fluoroscopy. A hemostat was used to keep the operator’s hands out of the X-ray beam and to prevent excessive needle penetration beyond the lesion. Specimens obtained from FNAB were smeared on glass slides and fixed in a 95% alcohol solution. Core tissues obtained from CB were fixed in a formalin solution. The procedure was completed when it was determined that the specimens that were obtained were completely adequate, because an on-site cytopathologist was not available during the procedure in the institute. The average length of time to perform the complete procedure was approximately 15 minutes and no procedure took longer than 30 minutes. Immediately following the procedure, the patients were advised to rest for at least 4 hours in a puncture-site-down position (7). A chest radiograph was obtained in all patients one hour post-biopsy to check for a possible pneumothorax.

The histopathologic diagnosis rates and the incidences of complications (pneumothorax, perilesional hemorrhage, and hemoptysis) of the two groups were compared using Fisher’s exact test and Student’s t-test, respectively. A p value of less than 0.05 was considered to be significant.

Results

The average number of pleural punctures was 1.4

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<th>Table 1. Comparison between Percutaneous Transthoracic Fine Needle Aspiration Biopsy and Core Biopsy with an Automated Cutting Needle under Fluoroscopic Guidance</th>
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<td><strong>FNAB ( n = 52 )</strong></td>
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<td><strong>Average size of lesions (cm)</strong></td>
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<td><strong>Average No. of pleural punctures</strong></td>
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Note. – FNAB; 22-gauge fine needle aspiration biopsy, CB; core biopsy using a 21-gauge automated cutting needle.
(range, 1–3) for FNAB and 2.1 (range, 1–5) for CB (p = 0.312, student t test). Overall sensitivities and specific diagnosis rates of FNAB and CB and corresponding results for both malignancy and benignancy are summarized in Table 1. The rate of inadequate specimens obtained and failure rate of FNAB for both malignancy and benignancy was 1.9% (1/52), and that of CB was 10.3% (4/39). The complications rates (pneumothorax, chest tube insertion, hemoptysis, and perilesional hemorrhage) are also summarized in Table 1. Minor hemoptysis (less than 1/2 cup) occurred during the procedure in 7.7% (4/52) of FNAB and 2.6% (1/39) of CB. In all cases the hemoptysis subsided within two days without any specific treatment.

According to the final diagnosis, there were 36 malignancies and 16 benignancies in the FNAB group (n = 52). Of the malignant cases, 35 of 36 (97.2%) were diagnosed correctly by FNAB. The remaining case with malignant lymphoma only displayed atypical lymphoid cells on the FNAB specimen, which was not sufficient for the specific diagnosis of malignant lymphoma. Specific cell type was diagnosed by FNAB in 25 of 36 (69.4%) malignancies, and the remaining ten cases were diagnosed as non-small cell lung cancer. Of the benignant cases, there were nine nonspecific inflammatory lesions, five cases of tuberculosis, one abscess, and one aspergillosis. Two of the nine nonspecific inflammatory lesions could be considered a specific diagnosis because subsequent video-assisted thoracoscopic surgeries also revealed nonspecific chronic inflammation. Therefore, nine cases (56%), including these two nonspecific inflammatory lesions, were specifically diagnosed by FNAB in benignancy. The remaining seven inflammatory lesions were considered both clinically and radiologically to be tuberculosis or organizing pneumonia, and have been followed up for 4–8 months with antituberculous (n = 5) or antibiotics (n = 2) medication without any further diagnostic work-up. In addition, all seven cases showed regression of the lesion during the follow-up period.

According to the final diagnosis, there were 29 malignancies and 10 benignancies in the CB group (n = 39). Of the malignant cases, 26 of 29 (89.7%) were diagnosed correctly by CB. Of the three patients with false negative results, two patients were found to have adenocarcinoma by either FNAB or surgery, although a prior CB revealed only chronic inflammation or necrotic material. In the remaining patient, a tissue sample using the CB technique was not obtained due to hemoptysis. Specific cell type was diagnosed by CB in 24 of 29 (82.8%) malignancies, and the remaining two cases were diagnosed as non-small cell lung cancer. Of the benignant cases, there were three cases of tuberculosis, two aspergillosis, one benign fibrous tumor of the pleura, one fibrocollagenous tissue, one chronic eosinophilic pneumonia, one chondroid hamartoma, and one anthracocibrotic nodule as a final diagnosis. Eight (80%) of the cases were specifically diagnosed by CB. An adequate tissue sample was not obtained using the CB technique in one benign case due to perilesional hemorrhage, which was later found to be chronic inflammation, suggestive of tuberculosis, on both the simultaneous FNAB and the subsequent video-assisted thoracoscopic surgery. The remaining case with a nonspecific inflammatory lesion was considered to be tuberculosis, and has been followed up for seven months with antituberculous medication and has shown gradual regression.

**Discussion**

The reported range of inadequate specimens obtained with FNAB is 2.4%–25.5% in the literature [8–10]. In our group, the overall rate of inadequate specimens obtained and failure rate with FNAB was 1.9% (1/52). The sensitivity of FNAB in the diagnosis of malignancy in our group (97.2%, 35/36) was within the reported range of 82%–99% [8, 11, 12]. Our rate of an accurate specific diagnosis of benign lesions in FNAB (56%, 9/16) was also within the reported range of 39%–77% [1, 10, 13–15]. Our overall sensitivity of CB under fluoroscopic guidance was 89.7%, while the reported range of CB under CT guidance is 62%–93% [1–6].

Since repeated to-and-fro passes through the lesion (10–15 times) after one pleural puncture were technically possible in FNAB, the number of pleural punctures in FNAB [1.4 times] were smaller than that of pleural punctures in CB [2.1 times]; only a single shot was possible with each pleural puncture in CB using an automated cutting needle. The FNAB technique would increase the chance of obtaining an adequate amount of tissue with fewer pleural punctures. The reported rate of pneumothorax in the literature is 7.6%–46% for FNAB [13, 16–19] and 9%–54% for automated biopsy systems [1–4]. In our group, the rate was 7.7% (4/52) for FNAB and 15.4% (6/39) for CB. Our rate of chest tube insertion in CB (2.6%, 6/39) was also within the reported range of 2%–18% [1, 4, 6, 17, 20]. However, no chest tube insertion was necessary for FNAB. We think that the higher
FNAB specimens were followed up with regression of ic diagnosis but nonspecific inflammatory lesion in sequent treatment modality. All patients with no specif-

...cell versus non-small cell lung cancer was possible with CB, the subcategorization of malignancy into small malignancy was obtained less frequently with FNAB than specific cell type diagnosis of both malignancy and be-

massive endobronchial hemorrhage (22). Although a has been associated with fatal complications such as pathalogy- and CT-guided biopsies was not investigated in our study. The lower capacity of chest radiography to detect a small-sized pneumothorax than CT may have also influenced our low pneumothorax rate (4). Our he-

mopty rates (7.7% for FNAB and 2.6% for CB) were within the reported range of 0%– 10% (4, 8, 9, 19, 21).

Among the 39 patients who underwent a CB, four pa-
tients were not correctly diagnosed; an adequate tissue sample was not obtained in two patients (both due to he-

mopty and perilesional hemorrhage), and in the re-

main ing two patients a false negative diagnosis of malignancy was made due to inadequate specimens. When the size of the lesion is small and the first shot results in hemoptysis or hemorrhage without obtaining adequate core tissue, the second targeting becomes difficult because of persistent coughing and difficulty in the pa-
tients ability to hold their breath. Furthermore, the mar-
gin of the lesion is obscured by perilesional hemorrhage. In such a situation, repetitive to-and-fro passes of a fine needle through the lesion under continuous fluoroskop-
ic monitoring will increase the chance of obtaining tis-

... with a lower possibility of complications than multiple gun shots. The CB technique with an automated cut-
ting needle has several advantages such as increased di-
agnostic accuracy for nonmalignant lesions and better characterization of cell types in malignancy (4, 8). However, it can be risky when the great vessels are located near the lesion or in the direction of the needle pathway. Moreover, CB with large-bore cutting needles has been associated with fatal complications such as massive endobronchial hemorrhage (22). Although a specific cell type diagnosis of both malignancy and be-

ignnancy was obtained less frequently with FNAB than with CB, the subcategorization of malignancy into small cell versus non-small cell lung cancer was possible with FNAB in our group, enabling the determination of a sub-
sequent treatment modality. All patients with no specif-
ic diagnosis but nonspecific inflammatory lesion in FNAB specimens were followed up with regression of the lesions. Therefore, it is best to reserve automated cutting needles for biopsies of pulmonary lesions with strong clinical suspicion of benignancy, large pulmonary or mediastinal masses, or when a prior FNAB has failed to give a specific histologic diagnosis (23).

In our experience, CT-guided biopsies requires longer procedural time than do fluoroscopy-guided biopsies, especially when the lesion is small, because several at-
tempts with repeated scanning are usually needed for the exact needle localization to the lesion. When the amount of inspiration in a patient is not constant during scanning, which occurs frequently due to pain during deep inspirations after needling, the localizing proce-
dure becomes more difficult and time-consuming. The needle dwell time is also prolonged, which presumably increases the risk of pneumothorax. In fluoroscopy-
guided biopsies, however, we can localize the lesion both expeditiously and with precision because we can manipulate the direction of the needle toward the lesion on a real-time basis. Therefore, it is usually best to per-
form a CT-guided biopsy in specific situations such as when a lung nodule is inconspicuous on fluoroscopy.

In summary, although not statistically significant, flu-
oroscopy-guided FNAB showed a higher sensitivity than that of CB in the diagnosis of both malignancy and be-

ignnancy with a lower complication rate. Considering the subcategorization of malignancy into small cell- and non-small cell lung cancer is more often feasible using the FNAB technique, FNAB may be enough for the di-
agnosis of malignancy and for the determination of a subsequent treatment modality. However, CB may be a more favorable technique when benignancy is suspect-
ed at CT, because a specific histologic diagnosis is more readily obtained by CB than by FNAB. Ed. Note: con-
firm wording

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