Fine-Needle Aspiration Cytologic Technique for Lung Cancer Has a High Potential of Malignant Cell Spread Through the Tract*

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Background: Fine-needle aspiration cytologic technique (FNAC), a method to detect malignancy for undetermined pulmonary nodules, may have a high potential to spread malignant cells from the tumor to the pleural cavity.

Objective: The authors assessed malignant cell spread through the needle tract following FNAC for peripheral lung carcinoma.

Materials and methods: Lung lobes resected from 20 patients during the treatment of lung carcinoma were examined. The visceral pleura over the lung carcinoma was irrigated by heparinized saline solution to clean the surface, and then irrigated before FNAC and irrigated following FNAC to collect cells on the visceral pleura. FNAC was performed once for each tumor. Papanicolau’s method was employed for cytologic examination.

Results: There were 15 specimens of adenocarcinoma, 4 specimens of squamous cell carcinoma, and 1 specimen of atypical carcinoid. The maximum diameter of the specimens ranged from 10 to 60 mm (median, 25 mm). Pleural indentation was observed in 15 samples. All results of FNAC were positive and matched the histologic diagnosis. Pre-FNAC specimens revealed a positive malignancy rate of 10% (2 of 20), but post-FNAC specimens had a rate of 60% (12 of 20; \( p = 0.002 \))

Conclusion: FNAC has the potential to spread malignant cells to the pleural space. Further study is needed to determine the clinical significance of the spread of malignant cells in the pleural space.

Key words: lung cancer; fine-needle aspiration cytologic technique; malignant cell; pleural space

Abbreviation: FNAC = fine-needle aspiration cytologic technique

Undetermined pulmonary tumors are often diagnosed employing fine-needle aspiration cytologic technique (FNAC).1–3 Pneumothorax and hemoptysis are encountered with varying frequency, but they have no long-term implications and are relatively easy to treat. Rare instances of air embolism pose serious problems of morbidity and even death.4 Chest wall implantation may also be a serious case of morbidity.5,6 Tumor dissemination through the needle tract is another possible danger. There are some physicians who believe that malignant cells are spread through the needle tract caused by FNAC.7,8 However, there was no evidence for spreading of cancer cells through the tract into the pleural space. The object of this study is to evaluate the potential of malignant cell spread following FNAC.

Materials and Methods

Lung lobes resected during the treatment of lung carcinoma in 20 consecutive patients (16 men and 4 women; age range, 54 to 68 years), in whom lung cancer was diagnosed using bronchoscopy before surgery, were examined. Surgical interventions included right upper lobectomy (n = 5), right lower lobectomy (n = 8), left upper lobectomy (n = 5), and left lower lobectomy (n = 2); all the patients underwent mediastinal lymph node resection. The pleural surfaces over and near the tumor were treated so as to minimize damage. The clinical stages of the 20 patients were as follows: IA (n = 16), IB (n = 2), IIA (n = 1), and IIB (n = 1). Pathological stages were as follows: IA (n = 15), IIA (n = 2), and IIB (n = 3).

FNAC was achieved with a 22-gauge needle and performed once for each tumor. The visceral pleura was washed by hepa-
rinsed saline solution to clean cells on the surface (clearance), and then irrigated before FNAC and irrigated following FNAC to collect cells on the visceral pleura, employing the modified jet stream technique described by Ichinose and coworkers. In brief, the surface over the peripheral tumor was irrigated by a stream of heparinized saline solution employing a 20-mL syringe with a 22-gauge needle. The needle was passed only once through the visceral pleura. The method of collecting cells on the visceral pleura is schematically shown in Figure 1. Two cups of 20-mL saline solution containing cells collected from the visceral surface were spun at 1,000 revolutions/min for 10 min. Then, the sediment obtained containing samples of FNAC was stained by Papanicolau’s method and examined by a cytopathologist for malignancy. The cytopathologist was half blinded: he knew the hypothesis and the patients, but did not know if the fluids given to him were pre-FNAC type or post-FNAC type. We defined positive as “more than four malignant cells observable in a glass slide” for squamous cell carcinoma and atypical carcinoid, and as “clustered malignant cells observable in a glass slide” for adenocarcinoma.

The frequencies of positive malignancy were statistically examined using Fisher’s Exact Test.

**Results**

There were 15 specimens of adenocarcinoma, 4 specimens of squamous cell carcinoma, and 1 specimen with an atypical carcinoid. The maximum diameter of the specimens ranged from 10 to 60 mm, with a median of 25 mm. The distance from the visceral pleura ranged from a minimum of 0 mm to a maximum of 15 mm, with a median of 10 mm. Pleural indentation was observed in 15 samples (Table 1). All results of FNAC were positive and matched the histologic diagnosis. Pre-FNAC pleural irrigation demonstrated 2 cases (10%) positive; however, post-FNAC pleural irrigation demonstrated 12 cases (60%) positive ($p = 0.002$; Fig 2).

**Discussion**

FNAC is a sensitive method for lung cancer diagnosis$^{1–3}$ and is employed during video-assisted thoracic surgery.$^{10–12}$ Examination of malignant cell spread following preoperative transthoracic FNAC has revealed little correlation between FNAC and malignant pleural cytology during surgery.$^{13,14}$ However, the preoperative FNAC may cause the mechanical exfoliation of cancer cells into the pleural cavity, and cases of cancer dissemination into the pleural space after FNAC have been reported.$^7$

![Figure 1. Schema of collecting cells on the visceral pleura following FNAC.](image-url)
It is very difficult to prove that pleural carcinomatosis has been caused by contaminated malignant cells in the pleural space after tumor excision or FNAC, because pleural carcinomatosis is able to occur even in patients with lung cancer diagnosed using a transbronchial procedure, which has little potential to spread malignant cells in the pleural space. It is also unknown whether disseminated malignant cells mature into tumor masses.

The incidence of clinically evidenced malignant implantation and growth along the biopsy tract or violated space has not been estimated. It is generally believed that most lung cancer cells have a low potential to grow in the pleural space. However, malignant tumors such as poorly differentiated carcinoma, small cell carcinoma, large cell carcinoma, and atypical carcinoid may have potential to grow, leading to pleural carcinomatosis. The next step in this research process will be to establish more concretely risk factors related to the malignant types of tumor.

Pleural carcinosis also has been reported after excision of malignant lung tumors diagnosed using video-assisted thoracic surgery. Negative malignancy at the surgical margin is necessary in order to prevent recurrence in the pleura. However, Sawabata and colleagues demonstrated that among samples showing a safe marginal distance (> 1 cm), 40% had cytologically positive margins. Our current experiment demonstrates positive malignant cells in 60% of pleura-irrigated specimens after FNAC, compared to 10% positive malignancy before FNAC. Even though this is not an in vitro examination, the same way of contamination through the needle hole in the pleura may occur during the clinical procedure. Both tumor excision and FNAC have the potential to spread malignant cells into the pleural space.

Lung cancer has to be diagnosed as early as possible in order to maximize the chance of recovery. Therefore, patients who might have lung cancer should undergo FNAC or excision or both when other examinations such as bronchoscopy or sputum cytology have failed to diagnose a lesion. Between FNAC and tumor excision, inasmuch as FNAC is less traumatic than tumor excision, FNAC is preferable despite the higher potential of malignant cell spread.

In conclusion, we demonstrated a 60% frequency of malignant cell spread from tumors through the needle tract. Thus far, it is not clear if disseminated malignant cells mature into tumor masses. Further study is needed to determine the clinical significance of the spread of malignant cells in the pleural space.

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REFERENCES