Chinese Journal of Cancer Research 9(3):217-220,1997.

CT-GUIDED PERCUTANEOUS TRANSTHORACIC FINE-NEEDLE ASPIRATION BIOPSY OF SMALL PERIPHERAL PULMONARY LESIONS

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CT-guided percutaneous transthoracic fine needle aspiration biopsy (PTFNAB) was performed in twenty-four sputum-negative cases of small peripheral pulmonary lesions smaller than 2 cm in diameter, which are not easily diagnosed or accessible to fibrobronchoscopes. After thin-slide scanning and localization with Somatom DR-H computed tomography, pulmonary nodules were biopsied with a 20 Gauge needle guided by a ruler specially designed. Biopsy materials were used for cyto-and histopathologic examinations. The diagnosis accuracy of biopsy was evaluated by the result of postoperative pathology and/or follow-up for 2 years. Sixteen pulmonary lesions were proved to be malignant and 8 were benign. The sensitivity was 75.0% (12/16), speciti-vity 100% (8/8) and accuracy 83.3% (20/24) according to cytopathology and 87.5% (14/16), 100% (8/8), 91.7% (22/24) by histopathology, respectively. Two cases of early-stage peripheral lung cancer were detected and proved by operation. CT-guided PTFNAB is safe and quick for diagnosis with high accuracy for small peripheral pulmonary lesions which are usually negative in sputum examination and bronchoscopy. PTFNAB should be routinely used in the diagnosis of lung neoplasms.

Key words: Lung neoplasm, Biopsy, Radiography, X-ray computed.

Accepted July 2, 1997

For small peripheral pulmonary lesions, conventional methods such as sputum cytology and fiberoptic bronchoscopy usually fail to provide a definite diagnosis. However, CT-guided PTFNAB of these lesions allows earlier diagnosis, which increases the chance for effective intervention and cure. This report summarizes our experience with 24 CT-guided thoracic biopsies during the period of April 1992 to April 1994.

MATERIALS AND METHODS

Collection of Patients

Twenty-four patients with small peripheral lesions (2 cm or less in diameter), from the Department of Thoracic Surgery of the First Clinical College of China Medical University, aged 36 to 66 years with a median age of 50 years (18 males and 6 females), underwent CT-guided PTFNAB. All patients had previously undergone negative sputum examination and fiberoptic bronchoscopy. Two years follow-up results were available.

Clinical Manifestations

Fourteen asymptomatic patients were accidentally found with pulmonary lesions in chest X-ray films or CT (7 proven lung cancers later); 8 cases had

cough and hemoptysis in the form of blood streaking of sputum (8 proven lung cancers later); 2 cases had chest pain of dull, nonspecific type (1 cancer). There were no tumor-related specific signs.

Imaging Features

It was difficult to differentiate malignant lesions from benign lesions due to the lack of imaging specificity. Most of the lesions were not lobulated or fuzzybordered. Nine malignant tumors showed the feature of crab-feet-like vascularization. Calcification was also observed in cancer focus (Table 1).

Treatment Protocol and Follow-up Data

Thirteen cases received surgical treatment: 7 were malignant tumors, including 3 adenocarcinomas, 2 squamous cell carcinomas, 1 adenosquamous carcinoma and 1 metastatic carcinoma. There were 6 benign tumors, including 3 tuberculomas, 2 inflammatory pseudotumors and 1 hamartoma. The other 11 cases received conservative therapy and/or observation for the lesions: 9 malignant tumors were confirmed due to enlargement of masses and occurrence of malignant pleural effusion or distant metastasis (7 died of carcinoma); 2 benign lesions were diagnosed because of the lack of enlargement of masses and other malignant appearance over a two-year period. (Strong reactivity of OT test supported the diagnosis of tuberculomas).

Table 1. Imaging features

Nature	No. of cases	Lobulation	Fuzzy border	Vascularization connection	Vacuolation	Uneven density	Calcification
Malignant	16	4	3	9	1	5	3
Benign	8	2	1	0	0	2	3

Biopsy

The patients were examined with thin-slide CT(Somatom DR-H, Simens) scanning in supine, prone or lateral decubitus position depending on the proximity of the lesions to the chest wall. Lesions were localized by means of CT with the use of laser lights and a graduated grid system. After local anesthesia, the 20 Gauge outer biopsy needle with an inner 22-gauge spiral needle was inserted into the edge of the lesion guided by a self-made locator according to the depth and angulation ascertained with CT scanning. When the needle tip was detected inside the mass (Figure 1, 2), the 22G needle was spirally advanced for 1 cm and withdrawn, then the outer 20G needle was connected to a 20 ml syringe. After suctions for three times, the needle was pulled out. Enough materials should be obtained to provide 2 cytologic slides and the remained materials plus tissue fragments were dipped into PAT preservative liquid (specially made in the laboratory of lung cancer, Institute of Cancer Research, China Medical University). After centrifugation, the sediments were prepared for formalin fixation and paraffin embedment. The sections were stained with hematoxylin and eosin for histological analysis. Immunochemical and histo-chemical staining could be performed if required.

Fig. 1. A retrocardiac nodule 1 cm in diameter was localized by CT graduated grid system.

RESULTS

The diagnosis was established by puncture specimen obtained during CT-guided biopsy, surgery and clinical follow-up data. There were 16 malignant tumors and 8 benign lesions, including 11 adeno-carcinomas, 2 squamous cell carcinomas, 1

adeno-squamous carcinoma, 1 small cell carcinoma, 1 metastatic tumor; 5 tuberculomas, 2 inflammatory pseudotumors and 1 hamartoma.

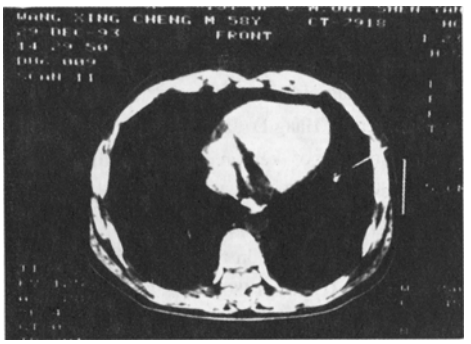

Fig. 2. The needle tip was detected inside the nodule.

Of the 16 malignant lesions, 12 cases were diagnosed by cytologic examination of smears, consisting of 6 adenocarcinomas, 1 squamous cell carcinoma, 1 small cell carcinoma, 4 unclassified carcinomas, and 4 cases with false negative diagnosis. For 8 benign lesions, epithelioid cells were seen in one case, and only little amount of inflammatory cells or fibrous tissue were found in the other 7 cases, no false positive diagnosis. The cytologic sensitivity, specificity and accuracy of CT-guided PTFNAB were 75.0 percent (12/16), 100 percent (8/8) and 83.3 percent (20/24), respectively.

According to histologic examination of biopsy, 14 of the 16 malignant lesions were diagnosed, including 10 adenocarcinomas, 2 squamous cell carcinomas, 1 adenosquamous carcinoma, 1 small cell carcinoma, and 2 cases with false negative diagnosis (1 adenocarcinoma and 1 metastatic tumor were later confirmed by surgery). There were typical tuberculous nodules in 2 of 8 benign lesions, the others remained to be diagnosed as nonspecific benign lesions. The diagnostic sensitivity, specificity and accuracy were 87.5 percent (14/16), 100 percent (8/8) and 91.7 percent (22/24) respectively.

Two patients had hemoptysis which did not require any intervention as it ceased spontaneously. No other complications were registered.

DISCUSSION

CT-guided percutaneous aspiration biopsy has become a popular tool and is widely spread due to 4 advantages: (1) CT is superior to conventional radiography and ultrasonography in the demonstration of small nodules measuring less than 2 cm in diameter. With the additional information provided by CT and well established fine-needle techniques, biopsy can be performed for the previously nonvisualized or less accessible, such as retrocardiac, paraspinal and paraaortic lesions, with the ability of prebiopsy localizing and determining optimal site of entry and depth of needle placement and lessening the risk of complications; (2) Diagnostic rate can be improved by sampling in the cancerous tissue and avoidance of necrotic tissue; (3) CT scanning after puncture can reveal the occurrence of hemothorax and pneumothorax; (4) Operators receive no radiation during biopsy.

The main objective of aspiration biopsy is to provide a rapid and early diagnosis of malignancy. The high rate of diagnostic success in patients with malignant masses, 87.5 percent in our study, was comparable to the results of 74 to 97 percent.[1,2] A remarkable accuracy has been developed from cytological preparations and small tissue fragments if the lesion is precisely localized and enough material can be obtained. Immunohistochemical staining may be performed for further diagnosis when necessary.[3] Adenosquamous carcinoma was confirmed before surgery in 1 case by keratin and pas-ab staining. 2 cases with false negative diagnosis underwent operations. 1 proven cystoadenocarcinoma (1 cm in the greatest diameter) metastasized from oral cavity was not diagnosed before thoracotomy because of insufficient specimen; the other case was a false negative because the aspirate was necrotic tissue. Therefore, the improvement of diagnosis can be achieved by sampling at the marginal area of the lesions guided by computed tomography with the advantage of high sensitivity. It is more difficult to establish the diagnosis of benign disease by fine-needle biopsy because it requires more tissue specimen than in malignant lesions. Diagnosis of tuberculosis can be made in case of caseation nodules consisting of Langhans' and epithelioid cells. It was suggested that rapid staining after aspiration should be employed to ascertain the nature of masses.[4] The biopsy should be repeated after primary negative procedure, and consideration of benign lesion should be based on three consecutive negative results.

In our study, one adenocarcinoma and one

adenosquamous carcinoma of early stage were detected and proved by postoperative pathologic examination. The tumors were less than 2 cm in diameter without mediastinal lymphonode metastasis and pleural invasion, staged as $T_1N_0M_0$.

In summary, carefully performed transthoracic fine needle biopsy guided by CT can provide extremely high accuracy for the diagnosis of peripheral pulmonary lesions. We conclude that it should be the method of first choice for those small lesions (2 cm or less in diameter) which can not be diagnosed by sputum cytology and fiberoptic bronchoscopy, due to its simplicity and low rate of complications.

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