Tuberculosis and Respiratory Disease 결핵 및 호흡기질환, Vol. 44, No. 5, Oct, 1997

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폐종괴에서 경피적 자동생검의 유용성

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= Abstract =

The Usefulness of Automated Biopsy Device for Lung Masses

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Background : To evaluate how efficaciously and safely we can make transthoracic lung biopsy with an 18-gauge automated biopsy device.

Methods : We performed 130 transthoracic needle biopsies including 16 repeat biopsies in 114 patients with a pulmonary mass using an 18-gauge biopsy device (ASAP 18, Microvasive—. Eighty-three biopsies were performed by an experienced radiologist and 47 by several less experienced radiologists. All biopsies were guided by biplane fluoroscopy.

Results : We successfully obtained sufficient tissue(>2-mm in the length) in 128(985) of 130 biopsies. Biopsy provided the specific diagnosis in 97 (85%) of 114 patients including 78 (88%) of 89 patients with a malignant tumor and 19 (90%) of 21 patients with a benign condition. The diagnosis could not be made in the remaining four patients. Of interest to note was the superb capability (74/74) of biopsy to make a distinction between small cell carcinoma and non-small cell carcinoma. There was no significant difference in the diagnostic yields between the experienced and less experienced radiologists. Of the total 130 biopsies, pneumothorax appeared in 13 (10%), among which treatment was required in 2 (2%), Mild, self-limiting hemoptysis was noted in seven (5%), but in no case was the treatment required.

Conclusion : We conclude transthoracic lung biopsy with an 18-gauge automated device is an effective proce-

dure for the specific diagnosis of benign and malignant lung disease. It is safe with the complication rate comparable to that of fine-needle aspiration biopsy as well.

Key words : Lung neoplasms, Biopsies, Complications

INSTRODUCTION

Although the reported sensitivity of the state-of-the-art fine-needle biopsy to diagnose a milagnant lung disease is 92%-100%[1~5], this range of high figure may not be achieved without the constant availability of dedicated cytopathologists. The accuracy of fine-needle biopsy to reach a specific diagnosis of benign lung disease is reported to be much lower with the range of 12%-68%[1, 4~7]. Recent introduction of automated biopsy devices mostly available with an 18-or 20-gauge needle has made it easy to obtain core tissure from various organs more convincingly, thus providing more specific diagnosis[8~21]. They are believed to increase the sensitivity and specificity for both benign and malignant diseases even when there is no trained cytopathologist available[13]. Despite this advantage, the prevailing fear of serious complications that might be expected to occur makes radiologists somewhat hesitating in their use during lung biopsy. Several studies have shown that the frequency of pneumothorax during transthoracic biopsy with an automated device is comparable to that of fine-needle aspiration with a reported frequency of 9%-27%[16, 18~21]. Accordingly, the purpose of this study was to evaluate how efficaciously and safely we can make transthoracic lung biopsy with an 18-gauge automated biopsy device for the large benign and malignant lung masses.

MATERIALS AND METHODS

One hundred and thirty transthoracic lung biopsies, including 16 repeat biosies, were done in 114 patients with a pulmonary mass using an 18-gauge automated biopsy device (ASAP 18, Microvasive, Watertown, MA, U.S.A.) from January 1992 to June 1995. Once fired, the needle is thrust forward 2cm with this device.

Accordingly, we performed biopsy only for the patients with a mass no less than 2cm in diameter. Otherwise, there was no exclusion criterion from this study except for the cases in which culture was primarily aimed for the detection of an organism in the patients with pulmonary infection. There were 86 men and 28 women, aged ranging from 13 to 79 years (mean, 58 years). All patients underwent CT of the thorax prior to biopsy to better evaluated the size, nature, and depth of the lesion, and the relationship between the lesion and the adjacent critical organs. Based on CT, the mean size of the lesions was 4.8cm (range, 2.8cm-14.3cm). The lesions were pleural-based in 56 patients, and non-pleural-based in 58 patients. The mean depth of the non-pleural-based lesions measured from the pleura was 2.1cm (range, 03cm-7.0cm).

All biopsies were performed under the guidance of biplane fluoroscopy (Optimus M-200, Philips Medical Systems, Holland). Eighty-three biopsies were performed by an experienced chest radiologist and the remaining 47 biopsies were

performed by several less experienced in-training or staff radiologists. The needle was positioned into the peripheral portion of the lesion through the shortest anteroposterior or posteroanterior route during a single breath-hold. After the fluoroscopic confirmation, we pulled the trigger with the needle axis as straight as possible with the patient in suspended respiraton. We immediately swished the needle in 10% formalin to free tissue from the specimen notch. Although one needle pass was usually enough to obtain an adequate core tissue, the additional needle pass was occasionally made. If there is no evidence of a pneumothorax, the patient was subjected to "positional precautions", as recommended by Moore et al[22] for at least an hour. We obtained follow-up chest radiographs with the patient in the upright position three hours after biopsy or as indicated by any clinical situations. No pathologic examination was available at the time of biopsy.

RESULTS

For a total of 130 biopsies, we successfully obtained sufficient tissue, 2-mm or longer, in all but two (98%). A significant pneumothorax was the cause of failure in these two cases. The average number of needle pass and the average length of tissue obtained in 130 biopsies were 1. 2times and 6.8mm, respectively.

The underlying disease was proved histopathologically in 110 (89 malignant and 21 benign) of 114 patients. Eighty-nine malignant diseases comprised of 85 primary lung carcinomas (59 squamous cell carcinomas, 12 adenocarcinomas, 7 undifferenciated carcinomas, 6 small cell carcinomas, and 1 adenosquamous carcinoma) and four solitary metastases (2 osteogenic sarcomas, 1 malignant melanoma and 1 malignant cystosarcoma phylloides). Twenty-one benign conditions were 12 cases of tuberculoma, five cases of aspergilloma, two cases of organizing pneumonia and one case each of sclerosing hemangioma and cytomegalovirus pneumonia. In the remaining four patients, the diagnosis could not be confirmed histologically because of their refusal against further evaluation.

Bispsy provided the specific diagnosis in 97 of 114 patients indluding 78 of 89 patients with a malignant tumor and 19 of 21 patients with a benign condition. The diagnosis was made in 76% (87/114) from the initial biopsy. If we count 16 repeat biopsies separately, the diagnostic accuracy becomes 75% (97/130> However, this figure rises up to 85% (97/114) on an individual patient basis (Table 1).

Biopsy could not give a histologic clue to the diagnosis in 17 patients including six patients who had repeat biopsy. The diagnosis was subsequently made in 13 patients by surgery or bronchoscopy.

Of interest to note was the superb capability (74/74, 100%) of biopsy to make a distinction between small cell carcinoma and non-small cell carcinoma, once the histologic diagnosis could be made. There was no single case of mismatching between histopathology obtained by biopsy and that obtained by other procedures in 29 patients in whom the additional tissue diagnosis was made by other methods including surgery as well. In 13 patients with a benign condition the histologic diagnosis of which was solely based on

Table 1. Results of 130 Biopsies in 114 Patients

Final Diagnosis of Underlying Disease	No. of Biopsy			
	Injitial Biopsy		Repeat Biopsy	
	Diagnostic	Nondiagnostic	Diagnostic	Nondiagnostic
Malignant	69	20	9	4
Benign	18	3	1	0
Inconclusive	0	4	0	2
Total	87	27	10	6

Table 2. Complications of 130 Biopsies

Lesion Location In Relation To pleura	No. of Biopsy					
	Overall Complication*		Pneumothorax*		Hemoptysis	
	Present	Absent	Present	Absent	Present	Absent
Pleural-based	4	56	2	58	2	58
Non-pleural-based	16	54	11	59	5	65

*Significantly higher in non-pleural-based lesion than in pleural-based-lesion($p<.05$)

needle biopsy, follow-up radiography showed either an improvement of the lesion after the medical treatmentn or no size change during the follow-up period of at least one and half yerars. There was no significant difference in the diagnostic yields between the experienced and less experienced radiologists.

There was no mortality related to biopsy. Of the total 130 biopsies, pneumothorax appeared in 13 (10%) with the treatment required in two (2%), Mild, self-limiting hemoptysis was noted in seven (5%), but in no case was the treatment necessary. The frequency of pneumothorax was significantly higher in non-pleural-based lesion than in pleural-based lesion(Table 2).

DISCUSSION

We exclusively performed biopsy under biplane fluoroscopy in this study. although CT-guided lung biopsy has the advantage of better needle localization into the lesion than fluoroscopy-guided biopsy, the longer time needed and more chances of pneumothorax are the trade-offs[23-26]. The advantages of performing the biopsy under fluoroscopic guidance are that it is easier, faster, and less expensive and that it is associated with a less chance of pneumothorax as well[24]. We had no problem to localize lesion by fluoroscopy. This seems to be largely attributed to the study design which excluded lesions smaller than 2cm. However, there may be situations CT is the preferred guiding tool, including small lesions not seen or poorly seen at fluoroscopy, lesions immediately adjacent to major cardiovascular structures, small or poorly seen lesions at the lung apex, and hilar masses[1, 24].

Based on metaanalysis of the data from their own study and from others, Austin and Cohen[2] emphasized the importance of the presence of a

cytopathologist at the time of fine-needle aspiration biopsy of the lung. The reported sensitivity of the state-of-the-art fine-needle biopsy to diagnose a malignant lung disease is 92%-100%[1~5]. However, this range of high figure may not by achieved without the constant availability of such an expertise in cytopathology[10, 27]. In addition, the accuracy of fine-needle biopsy to reach a specific diagnosis of benign lung disease is reported to be much lower with the range of 12%-68%[1, 4~7]. Recently the use of automated biopsy devices mostly armed with an 18-or 20-gauge needle has been popular for obtaining core tissue from the various sites of the body[8~21]. They are believed to increase the sensitivity and specificity for both benign and malignant diseases even when there is no trained cytopathologist available[13]. However, the prevailing fear of serious complications that might be expected to occur makes radiologists somewhat reluctant to use them during lung biopsy[10, 13].

In the present study, the diagnositic accuracy in the patients with histologically proved lesion was 88% (78/89) for malignancy and 90% (19/21) for benign lesion. There have been several reports about the usefulness of automated biopsy devices applied to the chest[16, 18, 19]. Our results are superior to those by Haramati[19] and Lee et al[21] who reported the accuracy of 81% (26/32) and 84% respectively, but inferior to those by Moulton and Moore[16] and by Burbank et al[18] who reported the accuracy of 90% or greater. The direct comparison between their studies and ours may be irrelevant because of the different methods used : most of the previous studies used CT as a guiding technique; the automated biopsy devices used were different; and two studies with the better results than ours used the routine performance of two to five passes per biopsy by the coaxial method[16, 18] with frozen-section histologic examination available in one of them[18]. Despite some discrepancies, these four studies including ours suggest that automated biopsy devices provide core tissue with which the diagnosis can be amde in the absence of trained cytopathologists. As shown in our study, automated biopsy dievice provided a perfect discrimination between small cell carcinoma and non-small cell carcinoma, once the histologic diagnosis could be made. Its ability to tell the specific diagnosis of benign pulmonary lesions, the major drawback of fine-needle aspiration biopsy, was very much remarkable with the accuracy of 90 % (19/21) in our study. Our study also showed no significant difference in the diagnostic yields whether biopsy was done by the experienced or not. There is no doubt that the standardized action of atuomated device contributed to it[13].

In the present study, pneumothorax occurred in 10% (13/130) with the treatment required in only 2% (2/13). This result is superior or comparable to the reported frequency of 5%-61% with 2%-25% requiring a chest tube[24, 25]. This low frequency of pneumothorax in the present study seemed to result in part from the single, standardized action, the limited number of needle pass per biopsy (mean, 1.2), the adoption of fluoroscopic guidance, and the positional precautions after biopsy[22]. The large population (54/110, 49%) of pleural-based lesions might have contributed to it as well. As haramati and Austin[28] described, the frequency of pneumothorax was significantly higher in non-pleural-based lesions (11/70) than in pleural-based lesions (2/

60). Although hemoptysis appeared in 5% (7/130) in our study, the treatment was required in no case.

There are several types of automated biopsy device commercially available.

Although we sticked to one of them exclusively in this study, we might extrapolate the results of the animal study performed by Mladinich et al [15] who reported no significant differences in obtaining satisfactory hepatic or renal samples for histologic evaluation among the four various devices they used. We agree to their suggestion that the choice of instrument should remain one of personal preference[15].

There are several limitations in the present study. We excluded lesions smaller than 2cm because of the expected shearing-off injury to normal parenchyma after firing. Although there were 56 (51%) non-pleural-based lesions included in this study, only 13 were located centrally, too small population to construe automated biopsy as a safe procedure for the deep-seated lesions. The population of benign lesions was also small. Despite these limitations, we believe that transthoracic lung biopsy with an 18-gauge automated device is not only a highly effective procedure for the specific diagnosis of benign and malignant lung diseases but also a safe procedure with the complication rate comparable to that of fine-needle aspiration biopsy.

요 약

연구배경 :

이 연구의 목적은 자동생검장치를 이용한 경피적 폐생검의 유용성과 안전성에 대하여 알아보기 위함이다.

방 법 :

저자들은 폐종괴를 가진 114명의 환자를 대상으로 18-gauge 자동생검장치(ASAP 18, Microvasive)를 사용하여 경피적 폐생검을 시행하였다. 이중 16명에서는 1회의 반복생검을 하여 총 130예의 폐생검의 이루어졌다. 130예중 83예는 숙련된 방사건과의사에 의하여 나머지 47예는 비교적 덜 숙련된 여러명의 방사선과의사들에 의하여 생검이 시행되었다. 모든 생검은 투시유도하에 시술되었다.

결 과 :

130예중 128예(98%)에서 2mm이상의 충분한 검체를 얻을 수 있었다. 전체 114명중 97명(85%)에서 조직학적 진단을 내릴 수 있었으며, 이중 악성질환을 가진 89명중 78명(88%)과 양성질환을 가진 21명중 19명(90%)에서 특이적 진단을 얻을 수 있었다. 조직학적 진단이 가능하였던 폐암에서는 전례(74/74)에서 소세포암과 비소세포암의 구분이 가능하였다. 진단에 필요한 조직을 얻는데 숙련자와 비숙련자간의 유의한 차이는 없었다. 총 130예중 생검후 13예(10%)에서 기흉이 발생하였으나 이중 2예(2%)에서만 삽관술을 필요로 하였고, 7예(5%)에서 경미한 객혈이 발생하였으나 치료를 요한 경우는 1예도 없었다.

결 론 :

자동생검장치를 이용한 경피적 폐생검은 악성과 양성 폐질환의 특이적 진단을 내리는데 유용한 검사이며 합병증의 발생 빈도도 낮은 안전한 시술이다.

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