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Value of Tru-cut lung biopsy in focal and diffuse lung disease

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ABSTRACT The results of 382 consecutive Tru-cut lung biopsies were reviewed to evaluate this investigation. The age of the patients ranged from 16 to 84 years (median 63 years); 284 patients suffered from focal and 98 from diffuse lung disease. Of the 206 patients with focal disease in whom the final diagnosis was a malignancy, 161 (78%) had a correct biopsy diagnosis. Of the 78 patients in whom the final diagnosis was non-malignant disease, 60 (77%) had a correct biopsy diagnosis. In diffuse pulmonary disease the histological diagnosis was correct in 75 of 98 patients (77%). In focal benign disease and in diffuse disease the reliability of the diagnosis increased with the specificity of the diagnosis. Where the biopsy diagnosis was not in accordance with the final diagnosis, histological examination usually showed normal lung tissue (with or without non-specific inflammation), necrotic tissue, or no tissue at all. Two patients died from the procedure. Minor complications occurred in 18%. It is concluded that the usefulness of Tru-cut biopsy is not confined to malignant focal disease; it is also reliable in benign focal disease and diffuse pulmonary disease when a specific diagnosis is obtained.

Introduction

Percutaneous lung biopsy is now a common procedure in pulmonary medicine and several different techniques are in use. Most common has been the use of a fine needle, yielding an aspirate for cytological evaluation. With the trephine needle or drill material may be obtained for histology and this also applies to the Tru-cut needle. The indications for these techniques overlap those for the more recently developed transbronchial biopsy.

The main difference between fine needle aspiration and the other procedures is the difference between the value of cytology and histology. Procedures providing material for histology will inevitably provide more information than cytological methods. In diffuse pulmonary disease fine needle aspiration is of little value.

The value of needle biopsy in the diagnosis of malignant disease is well established, whereas its reliability in benign focal disease is less well documented. In diffuse disease the number of reported biopsies with the Tru-cut needle is small.

In this paper we evaluate the results of 382 consecutive percutaneous lung biopsies performed with the Tru-cut needle and focus on its value in benign focal disease and diffuse lung disease.

Methods

The disposable Tru-cut needle we used is commercially available. We chose the 11·4 cm long needle, which is able to give a tissue specimen with a maximum size of 20 × 2 × 2 mm.

INDICATIONS

In focal pulmonary disease with infiltrates no more than 5 cm from the chest wall Tru-cut biopsy was our first diagnostic choice.

In diffuse disease non-invasive methods were used so far as possible before Tru-cut biopsy. Thus a combination of clinical findings, bacteriological examination of sputum, sputum cytology, spirometry, biochemical tests on blood, and in some cases liver biopsy and bronchoscopy had given no definite diagnosis in patients with signs and symptoms indicating a possible need for treatment. The presence of clotting abnormalities or shortness of breath at rest were regarded as contraindications to Tru-cut biopsy.

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Table 1 *Means of establishing a final diagnosis in 382 patients undergoing Tru-cut lung biopsy*

Follow up	Focal disease	Diffuse disease	Total
Necropsy	165	34	199 (52%)
Died, no necropsy	16	1	17 (4%)
Alive, thoracotomy	28	1	29 (8%)
Alive, thoracoscopy and/or bronchoscopy	28	11	39 (10%)
Alive, no further investigations	47	51	98 (26%)
Total	284	98	382

Preoperative investigations comprised lateral and posteroanterior chest radiographs; measurement of clotting and bleeding times and of factors II, VII, and X; and a platelet count. Two 500 ml units of blood were cross matched.

PROCEDURE

The Tru-cut needle was inserted under local anaesthesia guided by fluoroscopy. Usually this was only one dimensional but on occasion it was bidimensional. After the procedure pneumothorax was looked for by fluoroscopy. The patient was permitted to eat if no complications were present, allowed out of bed after two hours, and discharged from hospital the next day. A chest radiograph was obtained only if the patient had some complication; most often this was shortness of breath.

Results

In the period from 1 January 1977 to 30 November 1985 382 consecutive first time percutaneous Tru-cut biopsies were performed. The median age at the time of biopsy was 63 (range 16–84) years. The biopsies were performed by one of two investigators. The 382 biopsies were divided into focal and diffuse lung disease and details of the method of follow up are shown in table 1. The frequency and the type of complications are shown in table 2.

In 206 patients with focal disease in whom the final diagnosis was a malignancy a correct diagnosis was obtained in 161 (78%). The predictive value of a malignant biopsy diagnosis was 1·00.

Table 2 *Number (%) of complications in 382 Tru-cut lung biopsies*

Complications	Focal disease	Diffuse disease	Total
Death	1	1 (1)	2 (0·5)
Bleeding with need for transfusion	1	0	1
Pneumothorax with drainage	15 (5)	9 (9)	24 (6)
Minor complications	49 (18)	21 (22)	70 (18)
None	218 (77)	67 (68)	284 (75)
Total	284	98	382

Table 3 *Diagnoses in the 78 patients with benign focal disease*

Diagnosis at follow up	Biopsy diagnosis: Correct	Biopsy diagnosis: Incorrect or none
Lung abscess	13	1
Pulmonary tuberculosis	9	1
Pulmonary infarction	4	0
Hamartoma	3	0
Eosinophilic granuloma	1	1
Acute pulmonary infection	23	8
Non-specific pulmonary infiltrate	7	7
Total	60	18

In 78 patients in whom the final diagnosis was a non-malignant disease (table 3) a correct biopsy diagnosis was made in 60 (77%). In cases with a specific biopsy diagnosis this was reliable to a very high degree (30 of 33), whereas the biopsy diagnosis was less reliable in cases where the final diagnosis was acute pulmonary infection or non-specific infiltrate (30 correct out of 45). The latter diagnosis was used for cases in which we never reached a definite diagnosis, but in which the infiltrate eventually disappeared.

Table 4 shows the final diagnosis and the results of the biopsies in 98 patients with diffuse lung disease. The biopsy diagnosis proved to be correct in 75 (77%).

The distinction between fibrosing alveolitis and non-specific pulmonary fibrosis was made by judging the degree and type of inflammatory cells in the alveoli. Those classified as non-specific fibrosis showed little or no inflammation and could represent end stages of several pulmonary diseases. The diagnosis of scleroderma (systemic sclerosis) was established after the diagnosis of lung fibrosis.

In 86 of the 382 patients investigated the result of biopsy disagreed with the final diagnosis. The results

Table 4 *Diagnoses in the 98 patients with diffuse lung disease*

Diagnosis at follow up	Biopsy diagnosis: Correct	Biopsy diagnosis: Incorrect or none
Sarcoidosis	17	2
Non-specific pulmonary fibrosis	14	1
Cryptogenic fibrosing alveolitis	13	3
Pneumonia	8	1
Eosinophilic infiltrates (Loeffler)	5	0
Pneumoconiosis	3	1
Pulmonary fibrosis in systemic sclerosis	2	0
Miliary tuberculosis	2	0
Alveolar proteinosis	1	0
Emphysema	1	0
Fungal pneumonia	0	1
Carcinomatosis	7	7
Non-specific pulmonary infiltrate	2	7
Total	75	23

in these cases are shown in table 5. In 17 patients no tissue was obtained or the biopsy specimen was lost. In 50 patients the lung tissue showed no pathological changes and in 17 patients the appearances were of necrotic tissue or non-specific inflammation. In only two patients was a more specific diagnosis given by the pathologist—non-specific pulmonary fibrosis.

In our investigation we did not find any significant difference between the complications occurring in patients with focal disease and in those with diffuse lung disease (χ^2 test, $p > 0{\cdot}10$).

Two patients died as a consequence of percutaneous lung biopsy (table 1). Both patients died during the procedure, one from massive bleeding and the other, a patient with idiopathic fibrosis, from air embolism.

Twenty five patients (6·3%) needed intercostal tube drainage.

Discussion

Percutaneous lung biopsy is a simple investigation, which is not time consuming and can be performed by a single person with an assistant. The most frequent indication for percutaneous lung biopsy is focal lung disease with suspected malignancy. Its value in this context is well documented [1-5] and is confirmed in this study. The Tru-cut needle provides material for a histological diagnosis and is in this respect superior to the fine needle. Our results are in accordance with two recent series of Tru-cut lung biopsies.[4 5] In both series there was a high proportion of patients with malignant disease and in both the diagnostic yield was satisfactory.

The value of a non-malignant diagnosis from the biopsy in focal lung disease is more dubious. We have found no surveys which clarify this question. The predictive value of a non-malignant diagnosis can be established only by a thorough follow up of the patients. In our study we found the predictive value of a non-malignant diagnosis from the biopsy high if a specific histological diagnosis was obtained. The accuracy is so high that treatment or observation, according to the specific diagnosis, is justified. On the other hand, the diagnosis is unreliable if it is non-specific, most often "normal lung tissue, non-specific inflammation" or necrotic tissue. These biopsy findings were common in cases with false results and warrant further investigations or very close follow up.

Table 5 *Biopsy diagnoses in patients with focal malignant disease, focal benign disease, and diffuse lung disease where the biopsy did not confirm the final diagnosis*

	Focal malignant disease	*Focal benign disease*	*Diffuse disease*
Biopsy diagnosis	*not confirmed at follow up*		
Lung tissue with no pathological changes	26	9	15
Necrotic tissue	5	4	0
Lung tissue with non-specific inflammation	0	3	5
Non-specific pulmonary fibrosis	1	0	1
No tissue	12	1	1
Biopsy lost	1	1	1
Total	45	18	23

In diffuse lung disease a specific biopsy diagnosis had likewise a great predictive value. Active cryptogenic fibrosing alveolitis could be diagnosed because the number of alveoli containing cells in the biopsy specimen was sufficient. The diagnosis of non-specific fibrosis probably includes the end stage of several diseases, but we found no way of differentiating further in this diagnostic group.

In patients with carcinomatosis and those with a non-specific pulmonary infiltrate we had little success. In the first group this is hard to explain, as the disease was disseminated. In the group of patients with non-specific infiltrates which, after follow up, were thought to be due to the slowly resolving effects of infection the results were equally poor. This is probably due to the histological non-specificity of the infiltrates, which made the pathologist hesitate to make any diagnosis at all. In the remaining cases we have found the diagnosis sufficiently accurate to rely on it.

From the results of our study a specific biopsy diagnosis seems very unlikely to be false. A specific "false" diagnosis was found in only two cases. After review the diagnoses were regarded as probably correct but not relevant. In most cases a biopsy diagnosis not compatible with the final diagnosis would call for a further investigation.

Two patients died during the procedure. One patient with focal disease died of haemorrhage and one with diffuse disease died of air embolism. Both deaths occurred without warning and so quickly that resuscitation was not possible. In retrospect we found no characteristics in these patients which in the future would make us exclude certain patients from biopsy. We found relatively few complications needing treatment. Much the most frequent of these was pneumothorax, which appeared within the first few hours and always within the first 24 hours.

Despite the small number of complications demanding treatment, we find them so severe that percutaneous lung biopsy ought to be performed during a 24 hour admission to hospital, and not as an outpatient procedure as others have proposed.[6] Our unconfirmed impression is that, for obtaining good results and a low complication rate, the procedure should be performed by a limited number of investigators. In other studies the frequency of complications that need treatment varies from 10% to 17%.

The mortality of 0·5% in our study is the same as that derived from 12 previous studies by Zavala and Bedell.[1]

In a review of published reports McEvoy *et al*[4] found that most deaths from Tru-cut lung biopsy occurred in patients with diffuse pulmonary disease. In particular, death from haemorrhage was seen more often in this group.

An alternative to the Tru-cut needle is the trephine needle. This, however, is more complex in its application and can penetrate the lung only to a depth of 4 cm. In diffuse lung disease an alternative invasive investigation is transbronchial lung biopsy. Previous investigations,[7] however, have shown that this method gives a correct diagnosis in only 40% of cases. This is most probably due to the relatively small amount of tissue obtained.

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