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The role of transbronchial needle aspiration in the diagnosis of peripheral lung masses or nodules

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ABSTRACT: The purpose of this study was to evaluate the role of transbronchial needle aspiration (TBNA) in the diagnosis of peripheral lung lesions.

We attempted to perform TBNA in 37 patients referred to our hospital for diagnostic evaluation of radiographically evident peripheral masses (23 cases) or nodules (14 cases). None of them had bronchoscopic evidence of endobronchial lesion. The aspirations were performed under fluoroscopic guidance, through a fibreoptic bronchoscope, employing a 21-gauge, 1.3 cm aspirating needle. They were preceded by bronchial brushing and followed by transbronchial biopsy (TBB) of the peripheral lesion. In two cases, the apical nodules were not accessible by any of these procedures. Bronchial washings were also collected immediately after each procedure (brush, TBNA and TBB).

TBNA was diagnostic in 23 of 37 patients (62%) rendering the TBNA yield considerably higher than washing (24%), brushing (27%) or TBB (38%). The addition of TBNA to the combination of TBB, brushing and washing, significantly increased the yield of fibreoptic bronchoscopy in our series from 46% to 70%. No significant complications, such as pneumothorax or major bleeding, occurred either with TBNA or TBB.

In conclusion, our findings suggest that transbronchial needle aspiration is a safe procedure, that can improve the diagnostic yield of bronchoscopy in the diagnosis of peripheral lung masses or nodules.
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Lung tumours often present as peripheral masses or nodules situated beyond the range of even new-generation fibreoptic bronchoscopes. The low diagnostic yield of the standard combination of wash, brush and transbronchial biopsy (TBB) in these abnormalities often requires the use of higher risk procedures, such as percutaneous needle biopsy [1]. In order to improve the yield of bronchoscopy for diagnosis of peripheral masses, the transbronchial needle aspiration (TBNA) technique is being employed in several centres [2–4]. TBNA has been shown to be useful in the diagnosis of primary pulmonary lesions [4–8], in addition to its use as a staging procedure in patients with lung cancer and mediastinal adenopathy [6, 8–13].

In this study, we evaluated the diagnostic yield and the complication rate of TBNA in the diagnosis of lung tumours presenting as peripheral lesions. We also compared TBNA with the standard procedures of wash, brush and TBB in the same group of patients.

Material and methods

Thirty seven consecutive patients (33 males and 4 females) referred to the 2nd Department of Pulmonary Medicine, Sismanogleion Hospital, between January 1991 and September 1992 with undiagnosed peripheral pulmonary lesions on chest radiograph, were included in this prospective study. The age range was 44–78 yrs. Thirty one of the 33 male and one of the four female patients were smokers. During the study period a total of 942 patients underwent bronchoscopy in this department for several reasons. Twenty three patients had pulmonary masses (greater than 3 cm in diameter) whilst 14 patients had nodules (less than 3 cm). We have not included any cases with concomitant endobronchial lesion, nor cases already diagnosed by other means (sputum cytology, sputum microbiology, *etc*). All patients in our series had at least two negative sputum cytological examinations prior to bronchoscopy.

The aspirating needle apparatus employed (Olympus NA-1C) consists of a needle (21-gauge, 1.3 cm length) attached to an inner Teflon catheter housed in a flexible metal sheath into which the needle can be retracted. A 20 ml syringe attached to the proximal end of the inner catheter was used in order to apply suction.

Following premedication, a flexible bronchoscope was introduced transnasally. Provided no endobronchial lesions were identified, the peripheral lesion was approached

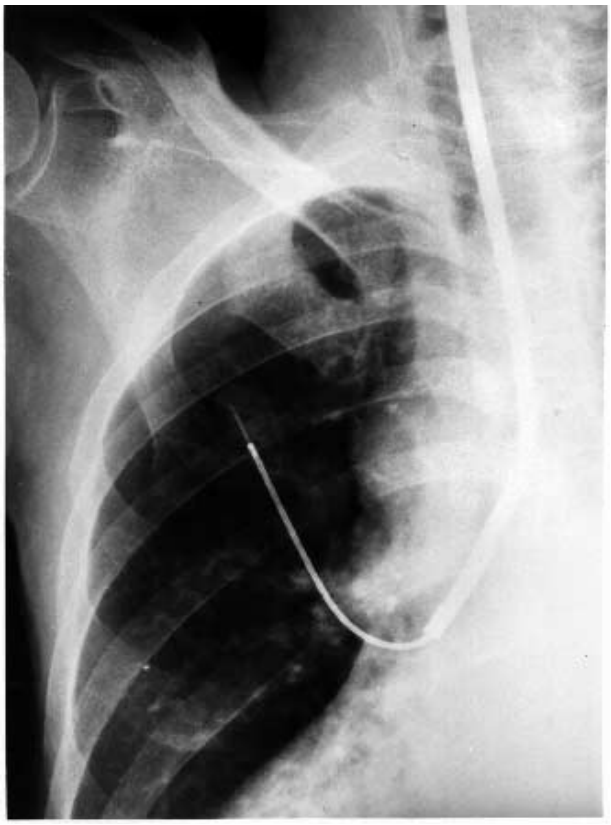

Fig. 1. – Needle aspiration of a peripheral lymph node (2 cm in diameter) situated in the right upper node.

first by brush and then by TBNA and TBB. All procedures were carried out under fluoroscopic guidance by the same team of two endoscopists. The localization of the needle, brush and biopsy forceps was controlled by moving the patient in different positions. Between two and four passes were performed at each lesion with TBNA, and an equal number with brush as well as with biopsy forceps. Bronchial washings were collected immediately after each procedure (brush, TBNA and TBB) by administering and aspirating normal saline *via* the corresponding segmental bronchus.

To perform TBNA, the bronchoscope was inserted into the selected bronchial branch, the needle apparatus was passed through the biopsy channel and advanced under fluoroscopic guidance, until it reached the periphery of the target. The needle was subsequently passed to the lesion and negative suction was applied with the syringe, whilst moving the needle back and forth within the lesion (fig. 1). The needle was then removed and the specimens thus obtained were smeared on glass slides, immersed in 95% alcohol, and sent for cytological processing (Papanicolaou method). The overall duration of the bronchoscopy was less than 25 min in all cases. All patients had a chest radiograph taken 3–4 h after bronchoscopy.

Cytological specimens found to be suspicious for malignancy were considered negative in the data analysis. We compared the proportions of positive results using the χ^2 test.

Table 1. – Yield of TBNA, wash, brush and TBB (n=37)

Procedure	Positive cases	%
TBNA	23	62
Wash	9	24
Brush	10	27
TBB	14	38
TBB + brush + wash	17	46
TBNA + brush + wash	25	68
TBNA + TBB + brush + wash	26	70

TBNA: Transbronchial needle aspiration; TBB: transbronchial biopsy. χ^2 test: TBNA *vs* wash, $p<0.005$; TBNA *vs* brush, $p<0.005$; TBNA *vs* TBB, $p<0.05$; TBB + brush + wash *vs* TBNA + TBB + brush + wash, $p<0.05$.

Results

We attempted to perform TBNA in 37 consecutive patients with radiographically evident peripheral lesions, ranging 1.8–7 cm in diameter. Twenty three patients had masses, *i.e* exceeding 3 cm in size (mean±SD: 5.2±1.2 cm) whereas 14 had nodules, *i.e* less than 3 cm (2.6±0.5 cm). Two patients from the latter group had lesions smaller than 2 cm (1.8 and 1.9 cm). In two other cases, the nodules (2.5 and 2.8 cm), located in the apical segment of the right upper lobe, were inaccessible due to the fact that the brush, biopsy forceps and needle could not be inserted through the apical segmental bronchus.

In 36 patients, a diagnosis of malignancy was finally established (34 bronchogenic and two metastatic carcinomas), whilst one patient had aspergillosis. Diagnosis was obtained by bronchoscopy in 26 patients (the one case of aspergillosis included), by percutaneous needle biopsy in eight patients, and by thoracotomy in three patients. The 26 (70%) patients diagnosed by bronchoscopic procedures included 19 of 23 (83%) with masses and 7 of 14 (50%) with nodules; the difference being nonsignificant ($p>0.5$). TBNA provided diagnostic specimens in 16 out of 23 (69%) patients with masses and 7 out of 14 (50%) patients with nodules; the difference being similarly nonsignificant ($p>0.5$). Thirteen lesions were located in the right upper lobe, nine in the right lower lobe, nine in the left upper lobe and six in the left lower lobe. Diagnosis was established by bronchoscopy in 13 of 22 (55%) upper lobe lesions and 13 of 15 (87%) lower lobe lesions; the difference being nonsignificant ($p>0.5$). The 25 cases of malignancy diagnosed by bronchoscopic procedures included 16 cases in stage I and II, five cases in stage IIIa, three cases in stage IIIb, and one case of small-cell carcinoma in stage II. Epidermoid carcinoma was bronchoscopically diagnosed in 11 patients, adenocarcinoma in six, undifferentiated non-small-cell in five, large-cell in two, and small-cell carcinoma in one patient. There was no difference in cell type between specimens obtained by TBNA, TBB, brush and wash.

The results are summarized in table 1. Cytological examination of TBNA was positive for malignancy in 62% as opposed to 24% for wash ($p<0.005$), 27% for brush ($p<0.005$), and 38% for transbronchial forceps biopsy

($p<0.05$). In nine (24%) patients, TBNA was the only procedure that provided a diagnosis.

The combined yield of TBB, brush and wash was 46%, while the yield of TBNA, brush and wash amounted to 67%. The addition of TBNA to the combination of TBB, brush and wash significantly increased the yield to 70% ($p<0.05$). There were no cases with a negative TBNA and a positive TBB, except for one case of aspergillosis diagnosed by transbronchial biopsy.

No significant complications, such as pneumothorax or major bleeding, occurred in our series with either TBNA or TBB. Insignificant bleeding episodes (less than 10 ml) associated with TBNA stopped without treatment.

Discussion

Transbronchial needle aspiration was first performed by Schieppati in 1958 [8] using a rigid bronchoscope to aspirate mediastinal nodes. Since then, numerous studies have been published on the contribution of TBNA in the diagnosis and staging of lung cancer [14–16]. In 1983, SHURE and FEDULLO [2] were the first to report on the use of a 20-gauge, 1 cm needle for diagnosis of cancer in peripheral masses, and concluded that the yield of bronchoscopy can be considerably increased (69% *versus* 48%) if TBNA is added to the standard combination of TBB, brush and wash.

In 1984, WANG *et al*. [3], having performed TBNA in peripheral lesions with a 22-gauge, 1.3 cm needle, reported a 48% yield, considerably higher than TBB, brush or their combination. When confined to malignant peripheral lesions only, the sensitivity of TBNA was over 69%. SCHENK *et al*. [4] in 1987 reported a 40% yield for TBNA in patients with peripheral lesions. Our study using a 21-gauge, 1.3 cm needle confirmed the utility of TBNA in the diagnosis of peripheral lung masses or nodules. The diagnostic yield of TBNA was 62%, higher than for the other techniques. The addition of TBNA to the standard combination of TBB, brush and wash significantly increased the yield of bronchoscopy in our series from 46 to 70% ($p<0.05$).

Diagnostic yield of TBNA is determined mainly by the accessibility (size, relationship between the airway and the lesion) and the nature of the abnormality. It is obvious that if the bronchoscopist cannot reach the lesion, no diagnosis can be established. In two cases with right apical nodules, it was impossible for the brush, needle and biopsy forceps to enter the apical segmental bronchus; therefore, those lesions were not accessible for needle aspiration, brushing or TBB. As far as the size of the abnormality is concerned, the yield of TBNA is lower for lesions less than 2 cm in diameter compared with those greater than 2 cm [3]. It has also been reported that the yield of TBNA in lesions 2 cm or greater is 50% higher than TBB [2]. Only two of our patients had lesions less than 2 cm in diameter, and in both cases specimens obtained by all procedures were nondiagnostic. The overall yield of TBNA, TBB, brush and wash in our series was not significantly affected by the size of the lesion (83% in masses *versus* 50% in nodules; $p>0.5$). The difference was similarly nonsignificant for TBNA alone (69% in masses *versus* 50% in nodules; $p>0.5$).

The relationship between the airway and the lesion is similarly of great importance [17]. In cases where, due to extrinsic compression either by the lesion itself or by lymphadenopathy, the airway is displaced or obstructed, conventional sampling techniques with brush or TBB cannot obtain diagnostic specimens. In such cases, TBNA can provide invaluable advantages owing to the fact that the needle can pierce the bronchial wall and, thus, reach the lesion. SHURE and FEDULLO [2] reported that in 10 patients with lesions of this type, TBB, brush and wash were negative in all cases, whereas TBNA was positive in eight cases (80%).

Yield is also affected by the nature of the abnormality. WANG *et al*. [3], in a series of 20 patients had three cases with benign nodules (all aspergillosis), none of which was diagnosed by TBNA or any other bronchoscopic procedure. In our single patient with a benign lesion (also aspergillosis) diagnostic information was supplied by TBB; transbronchial needle aspiration was merely "negative for malignancy", failing to determine the nature of the lesion. It should be pointed out that although we have not excluded cases with suspected benign lesions, a great many patients in our series were referred to us from other hospitals or doctors for suspected malignancy after initial clinical and laboratory evaluation. Moreover, most of them were smokers (32 out of 37) belonging to the high risk age group. This might account for the scarcity of benign lesions in this study.

The lack of serious complications, such as pneumothorax or major bleeding, in our series corresponds to the worldwide experience on TBNA of peripheral lesions [2–4] and mediastinal nodes [4–6, 8–13]. The safety of the procedure relates to the small size of the needle, the small size of peripheral pulmonary vessels and the avoidance of pleural surface [3]. Selective bronchoalveolar lavage, whilst it seems to have a rather high yield, often fails to demonstrate the correct cell type [18]. Percutaneous needle biopsy, the main alternative procedure for diagnosis of peripheral lesions, appears to have a higher yield (75–90% in centres with a high degree of experience) but it is associated with a considerable complication rate [19–21]. Pneumothorax, the most common complication, is reported to occur in 20–30% of patients. In our series, the yield of bronchoscopy with the addition of TBNA exceeded 70%, whilst virtually no complications occurred, our findings confirming those from earlier studies.

We conclude that transbronchial needle aspiration is a safe procedure that can improve the diagnostic yield of fibreoptic bronchoscopy in the diagnosis of lung cancer presenting as a peripheral mass or nodule.

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