

Transbronchial needle aspiration with fiberoptic and rigid bronchoscope in the diagnosis and staging of lung cancer

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In the prospective study from May 1992 till March 1994, the sensitivity of transbronchial needle aspiration (TBNA) performed means of Olympus flexible NA-2C and Storz rigid 10436 or 10438 needles was compared. Fourty patients were included into the study, 14 with already confirmed central lung cancer for the purpose of staging, and 26 patients because central lung cancer had been suspected.

Thirty patients had lung cancer and five had metastases of extrapulmonary malignant tumours to the lung and mediastinal lymph nodes. In 5 patients no cancer was found. TBNA of the carina was performed 30 times, of the trachea 7 times and of the right upper lobe bifurcation 8 times. In five patients, minor bleeding occurred after TBNA with a rigid needle.

The sensitivity of TBNA for cancer with Storz needle was 64 % (21 positive out of 33) and 45 % with the Olympus needle (15 positive out of 33). The difference between the two needles was statistically not significant. In 12 patients the TBNA was false negative.

A satisfactory histological sample was obtained in 18 patients with Storz needle. In 6 patients the histologic diagnosis was carcinoma, in 4 nonspecific inflammation and in one patient tuberculosis. TBNA with a rigid needle gives some additional information in comparison with a flexible one. TBNA helps establishing the diagnosis and staging of central lung cancer and improves the bronchoscopic diagnosis. Its sensitivity is satisfactory and complications are few.

Key words: lung neoplasms-diagnosis; biopsy, needle-methods, bronchoscopy; neoplasms staging

Introduction

The transbronchial needle aspiration biopsy (TBNA) of mediastinal lymph nodes was first

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described by Schieppati.¹ The method was further developed and introduced into practice in the USA² and Europe.³ It became commonly used with the introduction of flexible needles suitable for TBNA through fiberoptic bronchoscope.⁴ The fiberoptic bronchoscope has largely replaced the rigid one and only a few authors still report cytological^{5,6} or histological⁷ examinations of TBNA by rigid bronchoscope. The efficiency of TBNA with fiberoptic broncho-

scope is comparable with the results that had been previously obtained by the rigid instrument.⁸

TBNA can often replace the surgical methods of staging, i.e. cervical mediastinoscopy and anterior mediastinoscopy in patients with lung cancer. In general, it is agreed that those patients, in whom malignant cells are found on TBNA are considered to be inoperable.^{6,9,10} The patient is certainly inoperable if the metastasis has overgrown the capsule, if the metastases are multiple or are present on the contralateral side of the mediastinum.¹¹⁻¹³ If only one micrometastasis into a mediastinal lymph node is present, the prognosis of patients who underwent surgery is better.⁹

TBNA is used also in the diagnostics of necrotic endobronchial tumours in whom frequently only necrosis is obtained by forceps biopsy.¹⁴ In submucously growing bronchial tumours TBNA is successful as well.¹⁵⁻¹⁶ Good results were obtained also in the diagnostics of peripheral tumours.¹⁷ Even better results in the diagnostics of peripheral tumours were obtained by the use of needle brush.¹⁸ TBNA is successful also in the diagnostics of pulmonary metastases from extrapulmonary malignant tumours.¹⁹

False positive results of TBNA are rare; they may be due to the aspiration of malignant cells from bronchial secretion.^{20,21} Transtracheal needle aspiration biopsy of a tumour of the right upper lobe has been described.^{2,23} Complications such as pneumothorax after TBNA of peripheral lesions,¹⁷ haemomediastinum,²⁴ bacteriemia²⁵ or smaller bleedings into the bronchi²⁶ are rare.²⁷

The frequent false negative findings represent the greatest problem of TBNA.²⁸

In our study we tried to establish the sensitivity of TBNA with both a flexible and a rigid needle. We wanted to find out which of them provides better results, and whether TBNA improves the bronchoscopic diagnostics and staging of patients with central lung cancer and metastases of extrapulmonary malignant tumours into the lungs and mediastinal lymph nodes. TBNA related complications were studied as well.

Material and methods

The prospective study of TBNA was approved by the ethic commission of the Institute for Respiratory Diseases Golnik.

From May 1992 till March 1994, 40 patients were included into the study. In 26 patients clinically and roentgenologically a central lung cancer was suspected (tumour visible by fiberoptic bronchoscope), while in 14 patients with confirmed central lung cancer staging was necessary prior to the planned surgical intervention. Thirty-two males and 8 females with the mean age of 53 years were included into the study.

Prior to bronchoscopy, posteroanterior and lateral X-rays of the thorax were performed. In patients, candidates for surgical treatment, computed tomography (CT) of the thorax was performed as well, mostly after bronchoscopy.

Bronchoscopy was performed with a fiberoptic bronchoscope Olympus 20 D and a Storz bronchoscope No. 8. Premedication was Atropini sulphas 1 mg subcutaneously. We used local anaesthesia with Xylocain 4% 5 ml in drops or transtracheally, together with the application of narcotic analgetic fentanyl citrate 0,1 mg intravenously. In 16 patients, diazepam was given intravenously as an additional premedication. During the procedure, up to 20 ml of 2% Xylocain was added through the working channel of the bronchoscope, and the patient received 3 L of oxygen min by nasal catheter.

Fiberoptic bronchoscope was introduced through the nose, through the mouth with an orotracheal tubus or through the channel of a rigid bronchoscope. TBNA was performed first with an Olympus NA-2C flexible needle. This 21 gauge, needle is 13 mm in length, with a side hole. In every site of aspiration biopsy the needle was introduced three times to the area of 1 to 2 cm. Afterwards aspiration biopsy of the same sites was performed also by a rigid straight needle 10436 of by a curved needle Storz 10438. This needle is of 22 mm length with 17 gauge. The carina was aspirated with the straight needle, and the trachea and the right upper lobe bifurcation with the curved

needle. The flexible needle was introduced by a shaft through the working channel. When we had seen the top of the shaft, the needle was protruded from the shaft and advanced by a quick thrust between two cartilages. Sometimes the patient helped the advancing of the needle by coughing. Even if this manoeuvre had not been successful, the needle was fixed on the upper part of the working channel of the bronchoscope, and both the needle and the bronchoscope were advanced.

The rigid needle was thrust into the wall between two cartilages and to the shaft. We aspirated by a 20ccm syringe. TBNA was technically easier with the rigid needle. Then we examined the entire tracheobronchial system and obtained the forceps biopsy and brushing. The patients were monitored for 24 hours after bronchoscopy for possible complications. X-ray was not made routinely.

The first and the second aspirations were expelled from the needle on to a glass slide. The third aspiration was rinsed in Haemacell (Hoechst) and the smears from Haemacell were prepared by cytocentrifuge (Shandon Cytospin II). The smears were stained by May Grünwald Giemsa and Papanicolaou. The aspirations in which the elements of lymph nodes were found together with a few epithelial cells were considered as satisfactory. This criterion was suggested by Baker.²⁹ All three aspirations obtained by one needle were considered as a single result. The particles of the tissue obtained by the rigid needle, were fixed in the 10% formalin and examined by standard histological methods.

The sensitivity was calculated as the quotient of the number of TBNA with malignant cells in all patients with metastases in the mediastinal lymph nodes. The sensitivity of TBNA with both flexible and rigid needle was compared by Chi square test.

Results

From May 1992 till March 1994 TBNA was performed in 40 patients by fiberoptic and rigid bronchoscopy. Thirty patients had primary lung cancer, while 5 had metastases of extrapulmo-

nary malignant tumours into the lungs and mediastinal lymph nodes (Table 1). In 5 pa-

Table 1. Diagnoses of patients with malignant tumours included into the TBNA study.

Lung cancer		Metastatic lung lesions	
Small cell	7	Adenocarcinoma-breast	1
Large cell	4	Adenocarcinoma-pancreas	1
Adenocarcinoma	7	Adenocarcinoma-unknown origin	1
Squamous cell	12	Hodgkin's Disease	2
Total	30	Total	5

tients nonmalignant lung diseases were found as follows: tuberculosis, sarcoidosis and connective tissue disease, and pneumonia in two patients, but no cancer.

The site of the aspiration biopsy was the main carina in 30 patients, the carina of the right upper lobe in 8 and the trachea in 7 patients. In 3 patients the TBNA was done both through the main carina and through the trachea, and in two patients through the main carina and through the carina of the right upper lobe.

TBNA with a Storz needle was positive in 60% (21 of 35) and with an Olympus needle, at the same sites, in 43% of patients (15 of 35). One of the aspirations obtained by the Olympus needle was cytologically suspicious. In the assessment of sensitivity it was included among the negative findings. There were no statistically significant differences between the sensitivity of TBNA performed with either Storz or Olympus needles. In 6 patients, malignant cells were found in TBNA by the Storz needle only. In no case the malignant infiltration of mediastinal lymph nodes was confirmed by the Olympus needle alone (Table 2).

Table 2. Comparison of Storz and Olympus needle TBNA results in 33 patients with metastatic mediastinal lymph nodes.

		Storz Needle	
		+	-
Olympus needle	+	15	0
	-	6	12

The sensitivity of TBNA in patients with lung cancer and extrapulmonary malignant tumours with metastatic mediastinal lymph nodes is presented in Table 3.

Table 3. Sensitivity of TBNA in lung cancer and extrapulmonary malignant tumours with metastatic mediastinal lymph nodes.

Tumour	Positive TBNA Sensitivity (%)	
Small cell	6 of 7	86
Large cell	3 of 4	75
Adenocarcinoma	5 of 7	71
Squamous cell	5 of 10	50
Lung cancer – total	19 of 28	68
Extrapulmonary malignant tumours	2 of 5	40
Total	21 of 23	64 %

In the bronchoscopic diagnostics, the forceps biopsy and brushing were used. The sensitivity was 77 % (27 of 35). In two patients with small cell lung cancer and in one patient with adenocarcinoma, TBNA was the only bronchoscopic method confirming the malignoma and increasing the sensitivity of bronchoscopic methods to 86 %.

In 7 patients with no mediastinal involvement TBNA was negative. There were no false positive findings, the specificity being 100 %.

Among the patients with positive TBNA, 17 had bronchoscopic signs of extrinsic pressure on the trachea, carina or on the right upper lobe bifurcation at the site of TBNA. Only 4 patients had a normal bronchoscopic finding in the site of TBNA (Table 4).

Table 4. Frequency of positive TBNA in relation to bronchial extrinsic compression.

	TBNA positive	TBNA negative
Extrinsic compression	71 % (17 of 24)	29 % (7 of 24)
Without compression	36 % (4 of 11)	64 % (7 of 11)
Total	60 % (21 of 25)	40 % (14 of 35)

Tissue for histological examination was obtained by Storz needle only in 40 % of patients (14 of 35) with malignant lung tumours. In 6

patients histology confirmed metastases while in 8 patients it was negative. The histological and cytological type of malignoma were consistent in 5 cases; in one patient the histological diagnosis was large cell carcinoma while the cytological one was adenocarcinoma. In three TBNA with histological signs of inflammation, malignant cells were found only cytologically.

Histologically, five patients had TBNA with no malignant tissue and aspiration with no malignant cells. In these patients, cartilage and other parts of bronchial wall were found histologically. These samples were deemed unsatisfactory.

In 14 patients TBNA was without malignant cells. In 6 of these, the mediastinal node metastases were not found on surgery in 2.

Other 12 (34 %) cases were considered to have false negative TBNA.

Mediastinal lymph node metastases were found in 4 patients; in 2 by pneumonectomy, in one by explorative thoracotomy and in one by left lower lobectomy. In two of them, the affected lymph nodes had not been accessible by TBNA: one in paraesophageal – N₈ and the other in the lymph nodes of pulmonary ligament – N₉.

In 8 patients, metastases in the mediastinal lymph nodes were confirmed: once by transthoracic needle aspiration and twice by mediastinoscopy. In 5 patients we indirectly estimated metastatic involvement of the mediastinal lymph nodes, which were roentgenologically enlarged. Two patients had Hodgkin's disease, one patient had small cell lung cancer and two patients had distant metastases in the brain and parietal pleura.

In one patient, right pneumonectomy was performed even though TBNA of the right upper lobe bifurcation revealed malignant cells. TBNA of the main carina was not performed. Metastases in the carinal lymph nodes were found on pneumonectomy.

In patients with benign lung diseases in 4 cases (80 %) tissue was obtained by a Storz needle. In one patient tuberculous lymphadenitis and in the other nonspecific inflammation was found. In the third patient the cytological

examination showed epitheloid cells and lymphocytes. In this patient transbronchial lung biopsy showed nonnecrotising granulomas, which was consistent with the diagnosis of sarcoidosis.

After TBNA with a Storz needle in 5 patients, minor bleeding was observed which ceased spontaneously. Hemorrhage was observed 4 times after TBNA of the main carina and once after TBNA of the right upper lobe bifurcation. Twenty-four hours after the intervention no other complications were observed.

Discussion

In our study the efficiency of TBNA (64%) is similar to that obtained by other authors: 34%,⁸ 46%,²⁶ 71%.¹⁶ We consider that, in addition to the technical performance of TBNA, the selection of patients is of great importance. In our patients the sensitivity was established only in those patients who had central lung cancer visible by fiberoptic bronchoscope, and in whom roentgenograms showed enlarged lymph nodes in the mediastinum where metastases were confirmed or strongly suspected. The sensitivity in our study is therefore approaching that achieved by Shure and Fedullo,¹⁶ whose criterion for inclusion into the study was submucous growth or peribronchial tumour. Even greater sensitivity may be reached if the presence and site of enlarged lymph nodes in the mediastinum were proved by computed tomography.²² According to the success in our patients, CT is not considered to be essential prior to TBNA. Other authors are of the same opinion.³¹ Malignant cells were most frequently found in TBNA in patients with signs of external pressure on the bronchi. This finding was in agreement with those of other authors confirming malignant cells in TBNA of such patients in 33%,⁸ 53%³¹ or even 62%.²⁶ The lowest sensitivity of TBNA, only 7%, was described by British authors,³² probably because TBNA was applied during routine bronchoscopies and performed by a needle for sclerosation; only samples with abundant malignant cells were considered positive.

We found that TBNA increased the bronchoscopic diagnosis of lung cancer by almost 9% (3 of 35). TBNA showed a similar improvement of bronchoscopic diagnosis also in other authors: by 7%,³¹ 14%³³ or even 18%.³⁴ TBNA significantly improves the bronchoscopic diagnostics by forceps biopsy, brushing and washing.³⁵ The sensitivity of TBNA with Storz needle was insignificantly higher from that with Olympus needle. Despite that, in 6 patients malignant cells were confirmed by aspiration with Storz needle only.

We think that TBNA with a rigid bronchoscope has been abandoned because it requires general anaesthesia, while local anaesthesia is considered more inconvenient for the patient,³⁶ and not because it would be less efficient. The results of TBNA with rigid and fiberoptic bronchoscope were comparable.^{3,8} We had similar results. By application of sedatives and modern narcotic analgetics, the patient can tolerate bronchoscopy either with a rigid or flexible instrument.

We find it important that in 40% of patients also samples of tissue for histological examination were obtained by Storz needle which enabled the diagnosis of malignoma in 6, and of nonmalignant disease in 2 patients. The sensitivity of 20% (8 out of 40) cannot be compared with that to new flexible needles for histological examination: 72%,³⁷ 80%³⁸ or even 85.5%.³⁹ The histological examination of the tissue in TBNA enables the differentiation of bronchial wall or peribronchial tissues involvement, especially lymph nodes. Possibly, rare false positive results could be excluded as well.

We are not quite sure that there were no false positive results among our TBNA findings because the involvement of mediastinal lymph nodes in TBNA positive patients was not verified by the most reliable methods of surgical staging,⁹ the final test being the follow up. To prevent possible aspiration of malignant cells from the bronchial secretion, we have followed the principles of other authors³³ and performed TBNA first, and only afterwards on examination of the bronchial system and forceps biopsy were performed together with brushing. Since

false positive TBNA are rare, this method often allows omission of surgical staging.³⁹

However, the greatest problem is encountered with patients who have had negative finding of TBNA; there were 14 (40%) such cases among our patients. In these patients, surgical staging is necessary if they are potential candidates for resection.

By obtaining six aspirations from the same site, in each patient the efficacy of the method was improved. The expelling of the sample on a glass slide had been used as recommended by Ndukwu.⁴⁰ According to our experience, washing of the needle with Haemacell is equally or even more efficient; namely in the third aspiration we frequently found malignant cells and they were more abundant. Due to technical reasons, the cytologist was unable to examine the material immediately so that in the case of negative aspiration the bronchoscopist might repeat TBNA immediately as it had been recommended by Davenport.⁴¹

Mediastinal metastases were found by TBNA most frequently in patients with small-cell lung cancer, followed in descending order, by those with large cell, adenocarcinoma and squamous cell lung cancer. This is in agreement with most other studies.³¹

As was found by other authors,^{6,31,33} also in our patients only minor bleedings during TBNA occurred. They were more abundant after aspiration biopsy by Storz needle, as it had been expected since this needle is longer and broader. We avoided aspiration biopsies of the posterior tracheal wall and the right main bronchus since the biopsy in these sites is more hazardous.⁴²

The sensitivity of TBNA by Olympus needle is satisfactory and comparable with TBNA performed by Storz needle. Histological diagnosis of malignant and benign diseases is sometimes possible by Storz needle. TBNA improves the bronchoscopic diagnosis of pulmonary malignant tumours and in many patients enables the staging of lung cancer in an easy, cost-effective and safe way.

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