REV. HOSP. CLÍN. FAC. MED. S. PAULO 58(2):69-74, 2003

COMPUTED TOMOGRAPHY-GUIDED BIOPSY OF MEDIASTINAL LESIONS: FINE VERSUS CUTTING NEEDLES

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FARIAS AP de et al. – Computed tomography-guided biopsy of mediastinal lesions: fine *versus* cutting needles. **Rev. Hosp. Clín. Fac. Med. S. Paulo 58**(2):69-74, 2003.

PURPOSE: To report the experience of a radiology department in the use of computed tomography guided biopsies of mediastinal lesions with fine and cutting needles, describing the differences between them. The results of adequacy of the sample and histologic diagnoses are presented according to the type of needle used.

METHODS: We present a retrospective study of mediastinal biopsies guided by computed tomography performed from January 1993 to December 1999. Eighty-six patients underwent mediastinal biopsy in this period, 37 with cutting needles, 38 with fine needles, and 11 with both types (total of 97 biopsies).

RESULTS: In most cases, it was possible to obtain an adequate sample (82.5%) and specific diagnosis (67.0%). Cutting-needle biopsy produced a higher percentage of adequate samples (89.6% versus 75.5%, $P = 0.068$) and of specific diagnosis (81.3% versus 53.1%, $P = 0.003$) than fine-needle biopsy. There were no complications that required intervention in either group.

CONCLUSION: Because they are practical, safe, and can provide accurate diagnoses, image-guided biopsies should be considered the procedure of choice in the initial exploration of patients with mediastinal masses. In our experience, cutting needles gave higher quality samples and diagnostic rates. We recommend the use of cutting needles as the preferred procedure.

DESCRIPTORS: **Mediastinal masses. Tomography, computed axial. Needle biopsy.**

INTRODUCTION

Image-guided percutaneous needle biopsy is a reliable technique for the diagnosis of thoracic diseases, particularly for the assessment of mediastinal lesions. Computed tomography (CT) is established as the best imaging method for needle biopsy guidance[1]; CT provides detailed images for even small lesions located in any part of the mediastinum, which allows for accurate planning, avoiding inadvertent puncture of vascular structures or the lung.

In most cases, the lesions are successfully reached, avoiding invasive procedures like bronchoscopy, mediastinoscopy, or even thoracotomy. The major concern has been the inherent risk of pneumothorax, reported to occur in as many as 10% to 23%[2,3] of procedures, although this complication usually requires treatment in only 1% of cases.

There are variations in needle biopsy technique among institutions, the most important difference being the type of needle used. While fine-needle biopsy (FNA) uses cytological techniques for analysis, cutting-needle biopsy provides larger tissue samples that are suitable for histologic study.

The present study evaluates the results of CT-guided biopsy of mediastinal lesions, as well as its impact on final diagnosis and management, comparing fine-needle and cutting-needle biopsies.

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Received for publication on June 10, 2002.

METHODS

We reviewed all biopsies of mediastinal masses performed between January 1993 and December 1999. Eighty-six patients underwent mediastinal biopsy during the study period, 38 with fine needles, 37 with cutting needles, and 11 with both types (total of 97 biopsies). Some authors recommend cutting needles according to the suspected diagnosis[1]. In our practice, the size and the relationship of the lesion to adjacent structures determine the type of needle chosen. We use cutting needles when the lesion is larger than 20 mm and there is a low possibility of puncture of the lung or vascular structures.

The study included 43 women and 43 men, ranging in age from 1 to 95 years (median = 34 years). We did not repeat biopsies in the same patient. Masses from all parts of mediastinum were included. The size of the lesions ranged from 12 to 140 mm (median = 35 mm), and the distance from the skin ranged from 18 to 140 mm (median = 50 mm).

The biopsies were performed with the CT scanners GE Pace Plus and GE Pro Speed. Lesions were localized with contiguous scans 5 or 10 mm thick. The best path was displayed on the computer monitor, and electronic cursors were used to measure the distance from the skin and from a body marker, information that allowed calculation of the degree of inclination needed. The location for needle entry was marked on the patient's skin by correlating the light beam from the CT scanner. After preparation of skin with antiseptic solution, local anesthesia was performed on this site using 1% lidocaine. Children under 5 years of age underwent general anesthesia. The biopsy needle was then introduced, and new scans were obtained to modify or confirm the needle position.

The fine-needle biopsies were performed with 22-gauge Chiba needles. The aspiration sample was smeared onto glass slides and immersed in 90% alcohol. A new puncture was performed when the sample obtained was judged insufficient. One to five aspirations were performed in each individual case and were then sent to the pathology department.

The cutting-needle biopsies were performed with an 18-gauge Tru-Cut® (*MD Tech)* needle. When the tissue was obtained, it was placed in formalin and sent to the pathology department for final histological diagnosis.

For pathologic analysis, the sample was stained in hematoxylin-eosin and classified as adequate or inadequate by the pathologist. The results of cytology and histology of the adequate sample were designated by the pathologist as the specific diagnosis, or when this was not possible, as positive or negative for malignancy.

The rates of adequate sampling and specific diagnosis for the 2 different needle types were compared using the chi-square test, and the results were considered significant when $P < 0.05$.

RESULTS

Adequate sampling for diagnosis was obtained in 80 biopsies (82.5%). The final diagnoses were 65 specific diagnoses, and 7 classified as positive and 8 negative for malignancy. The specific diagnoses of these procedures are listed in table 1.

In the group undergoing cutting-needle biopsy (n = 48), there were 43 (89.6%) with an adequate sample and 5 with inadequate samples (10.4%). The sample tissue provided for 39 (81.3%) specific diagnoses, as well as for 2 classified as positive and 2 negative for malignancy. In the group with specific diagnoses, lymphoma was the most frequent diagnosis (18 cases), followed by lung cancer, teratoma, seminoma, normal thymus, and mesenchymal neoplasms. In the 2 cases classified as positive for malignancy, the diagnoses were later confirmed as lymphoma and metastatic adenocarcinoma. For the 2 biopsies classified as negative for malignancy, further investigation established the diagnosis of ganglioneuroma and lymphoma. In 5 cases of inadequate sampling, the patients underwent thoracotomy, which revealed 3 cases of lymphoma, 1 bronchogenic cyst, and 1 mesothelioma.

The fine-needle biopsies (n = 49) produced 37 (75.5%) adequate sample punctures. There were 26 (53.1%) specific diagnoses. Lymphoma was the most common histologic diagnosis, followed by lung cancer and others (thymoma, liposarcoma, seminoma, and metastasis). All 5 cases classified

Table 1 - Distribution of specific diagnoses in 80 fine- or cutting-needle biopsies of mediastinal tumors.

Lymphoma	22	Thymic hyperplasia	2
Lung carcinoma	10	Neuroendocrine tumor	1
Metastasis (lung and breast cancer)	7	Fibrosis	2
Thymoma	3	Liposarcoma	1
Seminoma	2	Mesenchymal neoplasm	1
Teratoma	2	Hürthle cell tumor	1
Normal thymus	2	Esophageal carcinoma	1

as positive for malignancy were confirmed as lymphoma or lung cancer. There were 6 cases classified as negative for malignancy, with 3 of them later confirmed as benign tumors, while the other 3 were actually malignant disease (lymphoma). In the 12 cases of inadequate sampling, subsequent investigation led to diagnosis of 5 cases of lymphoma, 3 of lung cancer, and 1 of bronchogenic cyst. In 3 other cases of this category, clinical diagnosis of benign masses was suspected, and they are still being followed up with no evidence of malignancy.

The results of all punctures, including those for which specific diagnosis was not possible and those of inadequate sampling, are described according to the needle type and shown in tables 2 and 3. Cutting-needle biopsy was more successful. There was a statistically significant difference in the rate of specific diagnosis (P = 0.003), and there were more adequate sample punctures (P = 0.068), although these did not reach statistical significance.

There were no complications that required any kind of intervention in the patients of both groups. However, minor complications such as small pneumothorax and hematoma could be underestimated in our series, because this is a retrospective study, and this information could be incompletely recorded in the radiology reports or subsequent clinical evaluations.

DISCUSSION

The potential for malignancy and the possibility of severe complications, such as respiratory or circulatory compression, mandate the fast and sometimes urgent diagnosis and treatment for mediastinal masses. Exploratory thoracotomy, mediastinoscopy, and anterior mediastinotomy are still widely used, despite potential morbidity and even mortality associated with these procedures. With dedicated and experienced pathologists, percutaneous biopsies can provide adequate diagnosis in most cases, independent of the type of needle used, whether fine or cutting. Either needle type is an adequate alternative that is well tolerated by the patients.

Table 2 - Adequacy of results with cutting- vs fine-needle biopsy.

	Adequate	Inadequate
Cutting needle (n=48)	43 (89.6%)	5 (10.4%)
Fine needle (n=49)	37 (75.5%)	12 (24.5%)
Total (n=97)	80 (82.5%)	17 (17.5%)

P = 0.068

Table 3 - Specific diagnosis: Comparison between cutting- and fine-needle biopsies.

	Specific diagnosis	Nonspecific diagnosis
Cutting needle (n = 48)	39 (81.3%)	9 (18.8%)
Fine needle (n = 49)	26 (53.1%)	23 (46.9%)
Total (n = 97)	65 (67.0%)	32 (33.0%)

P = 0.003

These procedures are cost effective because they shorten the period from admission to diagnosis, decrease the number of surgical operations, and shorten the time of hospital stay, which reduces overall treatment costs[4].

Unfortunately, some contraindications exist that preclude the use of percutaneous biopsies in every case. The absolute contraindications include uncontrollable cough and suspicion of hydatid cyst, whereas relative contraindications include bleeding diathesis, vascular lesions, pulmonary hypertension, uncooperative patient, and advanced emphysema[4].

Fluoroscopy, CT, and more recently ultrasound can guide the punctures[5,6]. The last method has the advantage of real-time imaging, but is limited in the evaluation of parts of mediastinum hidden by bone or air. Computed tomography can show more details than fluoroscopy, and provides complete evaluation of the thoracic cavity.

Our success rate for adequate sampling (82.5%) and specific diagnosis (67.0%) was similar to the rates reported in the literature, ranging from 72% to 100%[4,7,11]. Our high rate of malignancies is probably due to the patient population referred to our cancer hospital.

As expected, we found more cases of adequate sampling in the cutting-needle group (89.6% versus 75.5%). The tissue samples obtained with these needles also resulted in more specific diagnosis than in the fine-needle group (81.3% versus 53.1%).

Fine-needle biopsy has long been recognized as useful because it is easily performed and provides adequate samples from deeply seated lesions. Fine-needle biopsy has a high sensitivity and specificity for metastatic disease[11,12]. Morrisey et al.[10] reported a slightly higher sensitivity of cutting-needle biopsy (96%) for diagnosis of metastatic carcinoma comparing to the

90% sensitivity of FNA. Fine-needle biopsy is also useful for cystic masses[13] and germ cell tumors[8]. However, cytopathology with FNA samples requires a considerable amount of experience from the pathologist in order to obtain an accurate diagnosis based on few aspirated cells.

On the other hand, the quality of the tissue sample provided by cutting-needle biopsy is superior compared to that by FNA. Because more tissue is available, histologic diagnosis can be made and further pathologic investigations can be performed if necessary[9]. This technique is also useful for other histologic types, such as lymphoma, thymoma, and benign tumors. With the sample obtained by FNA, a pathologist may suspect these diagnoses but may not be able to differentiate among them. Recent reports describe the higher accuracy of cutting-needle biopsy for the diagnosis of lymphoma[14,15], with the possibility of also determining the histologic subtype in most cases[16], which is fundamental information required to determine the subsequent treatment modality.

A disadvantage of cutting-needle biopsies is local pain due to the larger gauge. Nowadays, the number of punctures is reduced, and the rapid sampling with the biopsy gun decreases the likelihood of pain.

Our results confirm the advantages of cutting-needle biopsy for histologic diagnosis, but in some cases, we recommend the use fine needles instead. Fine needles are preferable when there is pulmonary parenchyma between the tumor and the chest wall, when the lesions are located adjacent to great vessels, and when highly vascular lesions are suspected. In these cases, and if metastatic carcinoma is suspected, FNA should be the initial method[1,11,17].

The safety of these procedures was confirmed by the low incidence of complications in both groups, which concurs with reports from the literature[10]. The absence of complications in our series also can be associated with the low number of punctures through the lung parenchyma or pleura, which can be avoided in most cases by using CT guidance.

In conclusion, because they are minimally invasive, safe, cost effective, and have a high rate of success in providing adequate tissue sample, percutaneous needle biopsies guided by CT should be considered as the procedure of choice in the investigation of mediastinal masses. Both types of needle produced satisfactory results, but the higher quality sample of cutting needles provided more histologic diagnoses. The use of the cutting-needle biopsy can lead to more specific diagnosis without an increased incidence of complications; therefore, we recommend cutting-needle biopsy as the preferred method whenever possible.

RESUMO

FARIAS AP de e col. - Biópsia de massas mediastinais guiadas por Tomografia Computadorizada: agulhas finas versus cortantes. **Rev. Hosp. Clín. Fac. Med. S. Paulo 58**(2): 69-74, 2003.

OBJETIVO: Apresentar a experiência de um serviço de radiologia na prática de punções biópsias de massas mediastinais guiadas por tomografia computadorizada com agulhas finas ou cortantes, descrevendo as diferenças entre elas. Os resultados referentes a material suficiente e diagnóstico histológico são apresentados de acordo com o tipo de agulha utilizado.

MÉTODOS: Apresentamos um estudo retrospectivo de biópsias mediastinais guiadas por tomografia computadorizada realizadas em nosso hospital no período de janeiro de 1993 a dezembro de 1999. Oitenta e seis pacientes foram submetidos a biópsia mediastinal neste período, sendo 37 realizadas com agulhas cortantes, 38 com agulhas finas e 11 com ambas, (total de 97 biópsias).

RESULTADOS: Na maioria dos casos foi possível se obter material adequado (82.5%) e diagnóstico específi-

co (67 %). As agulhas cortantes apresentaram maior porcentagem de material suficiente (89.6% versus 75,5%, P=0,068) e de diagnóstico específico (81,3% versus 53,1%, p=0,003) do que as agulhas finas. Não houveram complicações que requisessem intervenção em nenhum dos grupos.

CONCLUSÃO: Pela praticidade, segurança e grande probabilidade de diagnóstico acurado sem procedimentos mais invasivos, as biópsias guiadas por imagem devem ser consideradas como a primeira etapa na investigação de massas mediastinais. Pela nossa experiência as agulhas cortantes fornecem material de maior qualidade e maior taxa de diagnóstico. Nós recomendamos o uso das agulhas cortantes como procedimento preferencial.

DESCRITORES: **Massa mediastinal. Biópsia por agulha. Tomografia computadorizada.**

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