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Original Article

Usefulness CT-guided F.N.A.C. in the Diagnosis of Mediastinal Lesions

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ABSTRACT

Objective: To evaluate the diagnostic accuracy of the percutaneous fine needle aspiration cytology (FNAC) for mediastinal lesions by using histology or follow-up clinical diagnosis as gold standard.
Patients and Methods: CT-guided percutaneous FNAC was performed on 131 patients with mediastinal lesions. Helical CT was used with 3–10mm image thickness range and low radiation dose (40mAs, 120kV). Samples were immediately examined by a cytologist to determine if they were representative. Histological samples were obtained by means of biopsy or resection specimens in 73 patients and clinical follow-up in 50.
Results: The material was satisfactory for diagnosis in 126 patients (95.2 %), in whom 103 lesions (78.6%) were considered malignant (62 primary tumours and 41 metastases) and 23 (17.6%) benign. In the 123 patients with clinical monitoring or pathological diagnosis, using FNAC led to the identification of malignancy with a sensitivity of 95.2 % (95%CI: 89.2–97.9%), specificity 84.2% (95%CI: 62.4–94.5%), positive predictive value 97.1% (95%-CI: 91.7–99.0%), negative predictive value 76.2% (95%CI: 54.9–89.4%), likelihood-ratio positive 6.03 (95%CI: 2.13–17.05) and accuracy 93.5% (95%CI: 87.7–96.7%). Pneumothorax was the most frequent complication (3 cases). There was good agreement between the cytological findings and the histological findings, not only for malignant lesions (kappa coefficient: 0.641) but also for benign (kappa 0.607).
Conclusions: CT-guided percutaneous FNAC is a safe and effective technique for the diagnosis of the mediastinal masses, with a high diagnostic yield for malignancy depicting.

Utilidad de la PAAF guiada por TC en el diagnóstico de lesiones mediastínicas

Palabras clave:
Lesiones mediastínicas
Tomografía computerizada
Punción aspiración con aguja fina
Citología
Sensibilidad
Especificidad

RESUMEN

Objetivos: Evaluar la validez diagnóstica de la punción aspiración con aguja fina (PAAF) percutánea en lesiones mediastínicas considerando la biopsia o el seguimiento clínico como patrón de referencia.
Pacientes y métodos: Se realizó PAAF percutánea guiada por TC a 131 pacientes con lesiones mediastínicas. Se usó un TC helicoidal con cortes de 3–10 mm y baja dosis de radiación (40 mAs, 120 kV). Las muestras fueron examinadas in situ por un citólogo para determinar su validez. Se obtuvo comprobación histológica mediante biopsia o estudio de pieza quirúrgica en 73 pacientes y seguimiento clínico en 50, comparándose los resultados globales y en subgrupos.
Resultados: En 126 pacientes (96,2%) el material fue válido para diagnóstico. Ciento tres lesiones (78,6%) fueron consideradas malignas (62 tumores primarios y 41 metástasis) y 23 (17,6%) benignas. En los 123 pacientes de los que se dispuso de seguimiento clínico o patológico, la PAAF permitió identificar malignidad con una sensibilidad del 95,2% (IC95%: 89,2–97,9%), especificidad 84,2% (IC95%: 62,4–94,5%), valor predictivo positivo 97,1% (IC95%: 91,7–99,0%), valor predictivo negativo 76,2% (IC95%: 54,9–89,4%), razón de verosi-

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militud positiva 6,03 (IC95%: 2,13–17,05) y exactitud 93,5% (IC95%: 87,7–96,7%). La complicación más frecuente fue el neumotórax (3 casos). La correlación citohistológica fue elevada tanto en las lesiones malignas (kappa 0,641) como en las benignas (kappa 0,607).
Conclusiones: La PAAF percutánea guiada por TC es una técnica segura y eficaz para el diagnóstico de masas mediastínicas con alta rentabilidad para la detección de malignidad.

Introduction

The mediastinum is a large thoracic space that contains many organs and, therefore, where a large variety of histological lesions may be found. Accessing the mediastinum is difficult and involves considerable risk of damaging the large vessels, the heart and the main airway, which in all cases would be potentially lethal. However, currently imaging techniques are used as a guide for mediastinal punctures, whatever the calibre of the needle used, which minimises the risk of complications, reduces the number of very invasive techniques and allows maximum diagnostic yield.[1-11] Since X-rays were first used to guide FNAC procedures in the mediastinum by Rosenberger and Adler[12] in 1978, practices have evolved from conventional fluoroscopy to CT for transthoracic punctures[7-18] and the use of ultrasound for NAFC and percutaneous[6,19] and endoscopic[1,2,20,21] biopsies. Before the use of imaging techniques to obtain samples from mediastinal lesions, much more aggressive procedures were used with a higher percentage of complications and greater cost, such as anterior mediastinotomies, thoracotomies, thoracoscopies and mediastinoscopies.[12,13] Subsequently, intermediately aggressive techniques such as minimediastinotomies[14] and, lastly, transthoracic (transsternal[15,16] and transpleural[6-14,17-19]) and endoscopic (transbronchial[3-5] and transoesophagic[9-11,17,18,22,23]) punctures. This evolution in approaching lesions, together with continuous advances in cytology techniques, have made it possible to achieve a definitive diagnosis in most cases. Procedures have evolved from using thick needles to increasingly finer needles that allow the retrieval of sufficient amounts of tissue with minimally invasive techniques.

The existence of such a great variety of materials and techniques for the diagnosis of mediastinal lesions and the generalisation of imaging techniques for guiding punctures led us to plan this study in order to estimate diagnostic validity of CT guided percutaneous FNAC for the detection of malignant lesions of the medastinum. We also analyse the sensitivity and specificity of the test in different subgroups of patients and the cytohistological concordance of the mediastinal lesions.

Patients and Methods

We included in the study all patients with mediastinal lesions consecutively referred to the Radiodiagnostic Service of the Hospital Universitario La Paz for spiral CT guided percutaneous FNAC from June 2003 until July 2006.

The indication for puncture-aspiration was to confirm the malignant or benign characteristics of lesions. All types of lesions were included, solid or cystic, from small 9 mm nodules to large masses measuring several centimetres located in any mediastinal compartment. Exclusion criteria were contraindications for this procedure. The only absolute contraindication was lack of patient collaboration, whereas relative contraindications were haemorrhages with INR >1.3 or <50.000 platelets, medication with anticoagulant effects (dicoumarine or acetylsalicylic acid) and difficulty in maintaining the position necessary for the procedure.

All patients signed an informed consent form approved by the ethics committee of our centre and used routinely in daily clinical practice for surgical procedures.

The punctures were performed in the CT room in ambulatory patients, with the exception of those patients who were hospitalised. Once in the CT room, the steps of the procedure were explained to the patient so they could collaborate appropriately.

Images were obtained using spiral CT (Somaton Plus 4, Siemens, Erlangen, Germany) with the minimum radiation dose that made it possible to assess the needle position in relation to the lesion (40 mAs, standard 120kV). Section width was determined based on the size of the lesions, so that the maximum was less than half the diameter of the lesion (3-10 mm, standard 3 mm). No iodine contrast was given intravenously, nor was any type of contrast administered orally. All patients had complied with a 6 hour fasting period before the procedure in case of complications. The patients were placed in a supine position, prone or on their sides according to the location of the lesion, its size and the tolerance of the patient. The needles used were 23–25 G BD Spinal Needle (Becton Dickinson, San Agustín del Guadalix, Madrid, Spain) and Gallini Medical Devices (Gallini, Mantova, Italy). These measured 9, 11 or 15 cm, according to the distance from the skin to the centre of the lesion. A Chest Radiology Specialist or a Radiology Resident under their supervision carried out the planning of the punctures and needle placement. Aspirations were taken by a cytopathologist with wide experience who immediately stained the samples with Diff-Quik® to determine, using a microscope, if there was sufficient appropriate material for a cytological diagnosis. If the sample was insufficient, new aspirations were made up to a maximum of 3. Part of the material was fixated in alcohol for subsequent Papanicolau staining and, if necessary, the use of additional techniques (immunocytochemistry and genetic studies). Once the procedure was ended, a CT section was obtained on expiration to rule out pneumothorax, haemorrhage or other complications.

Subsequently, the cytological diagnosis of benign or malignant was made with the corresponding type and subtype classifications. Non-specific lesions with absence of malignant cells were accepted as "benign" as long as the tip of the puncture needle had been within the lesion, samples had been taken from different areas of the lesion, there was a sufficient number of cells present and radiological follow-up of the lesion showed that this had not increased in size.

Histological studies were carried out on the samples obtained by percutaneous or endoscopic biopsy, mediastinoscopy, mediastinotomy or surgical procedure. The samples were fixated in 4% formaldehyde and stained with haematoxillin-eosin. Subsequently, other histochemical and immunohistochemical techniques were applied to obtain a more precise diagnosis in certain cases.

Histological diagnosis was considered the procedure of reference and, in those cases where there was no biopsy or surgical specimen, the diagnosis in the patient's clinical history during a 2 year follow-up after the FNAC. In this sense, we included 50 cases with a cytological diagnosis not confirmed by histological studies in our analysis, because these were diseases that required medical treatment

such as lymphomas or tumours in non-surgical stages or lesions that only required follow-up such as cysts or other benign lesions.

Statistical Analysis

The document is presented according to STARD standards. Quantitative variables are expressed as mean±standard deviation and qualitative variables as percentages. We analysed sensitivity, specificity, positive and negative predictive values, probability, accuracy, certain values and 95% CI in 2 × 2 tables. The degree of cytohistological concordance was determined using the Cohen kappa coefficient. To compare qualitative variables the chi square exact statistical Fischer test was used. Values of $p < 0.05$ were considered significant. Analysis was performed using the SPSS program.

Results

We studied 131 patients with mediastinal lesions, 71 men (54.2%) and 60 women (45.8%) with a mean age of 53±19 years (interval: 8–84 years). 54.5% of the patient was under 60 years. Lesions were located in any of the 3 mediastinal compartments, 88 (67.2%) in the anterior mediastinum, 15 (11.4%) in the middle mediastinum and 22 (16.8%) in the posterior mediastinum (Figs. 1 and 2). In 6 patients (4.6%) the lesion affected more than one compartment: in 5 cases it was located in the anterior and middle mediastinum, whereas in

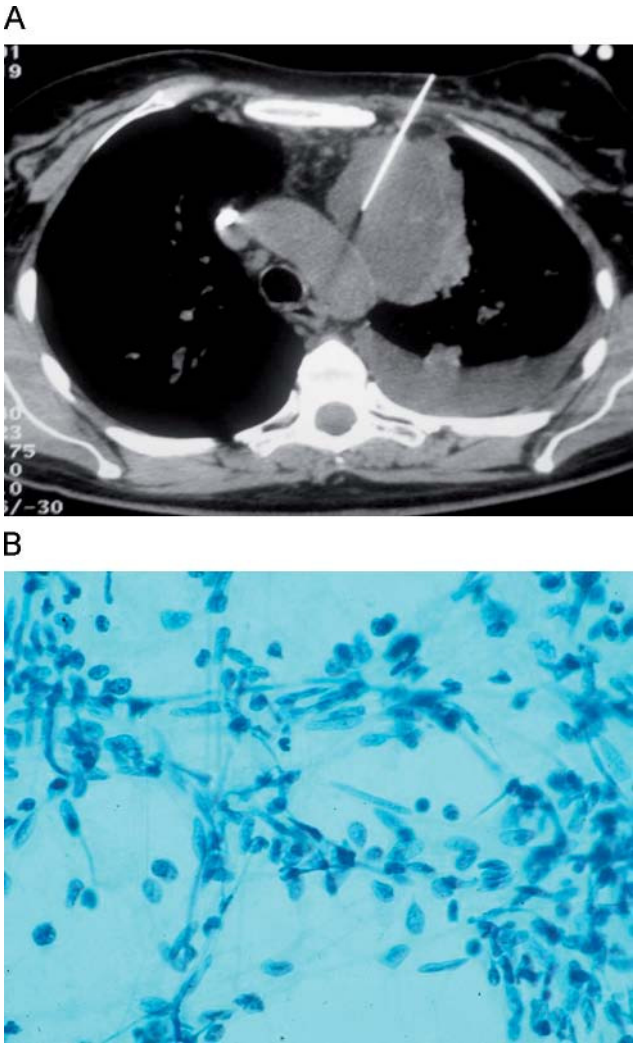

Figure 1. Thymus tumour. A) FNAC in supine position of a homogeneous mediastinal mass in the prevascular space. B) Papanicolaou stain showing a spindle cells epithelial component and a lymphoid component.

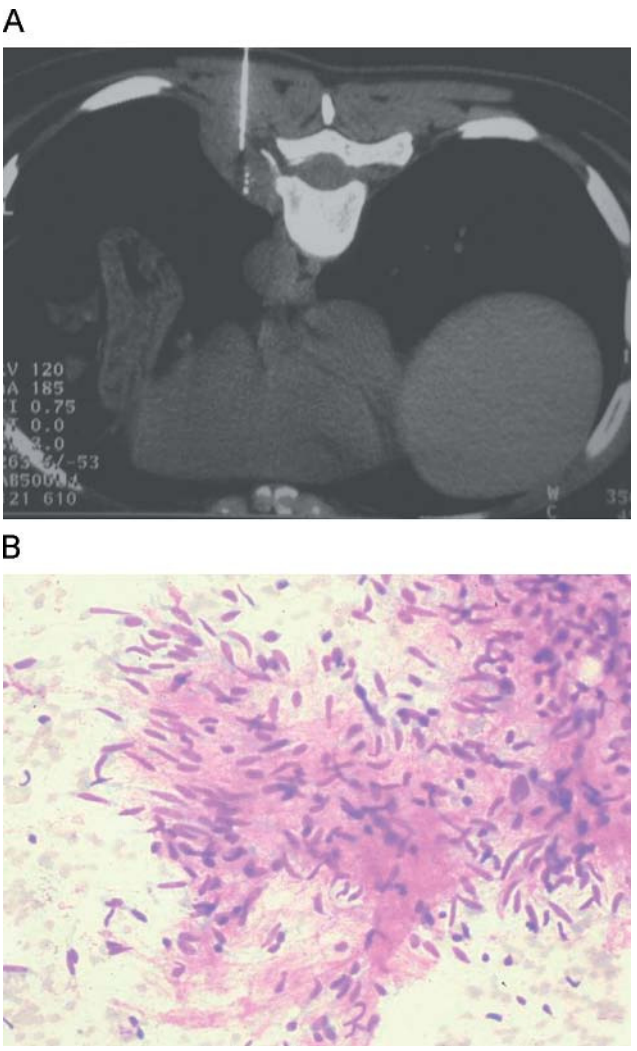

Figure 2. Malignant Schwannoma A) Puncture in prone decubitus of a spindle shaped homogeneous left paravertebral mass. B) Diff-Quik® stain of the sample obtained showing lax groups of spindle shaped cells with moderate atipia in a fibrilar stroma.

Table 1
Percutaneous FNAC yield in the diagnosis of malignancy of mediastinal lesions in relation to the definitive diagnosis.

	Malignant Lesion		Benign Lesion	95% CI
FNAC: malignant	99		3	
FNAC: benign	5		16	
Total		123		
Sensitivity		95.2		89,2–97,9
Specificity (%)		84.2		62,4–94,5
PPR		6.03		2,13–17,05
NPR		0.06		0,02–0,13
PPV (%)		97.1		91,7–99,0
NPV (%)		76.2		54,9–89,4
Accuracy		93.5		87,7–96,7
Prevalence		84.6		

FNAC: Fine needle aspiration cytology; NPR: Negative probability ratio; PPR positive probability ratio; NPV: Negative predictive value; PPV: Positive predictive value.

another it also affected the posterior mediastinum. In 10% of the cases, the size of the lesion was ≤ 2 cm.

Of the 131 patients in the initial series, 5 were discarded from statistical analysis because no definitive diagnosis was available (2 of these did not have samples valid for cytology) and another 3 were discarded because it was impossible to obtain a sample that could be assessed cytologically. As a result, a total of 126 patients had definitive diagnosis and of these123 had definitive diagnosis and valid FNAC procedures and were, therefore, considered for statistical analysis. Of the 5 non-assessable smears obtained, 2 were haemorrhagic, 2 had an insufficient number of cells and the remaining one had discordant X-ray and cytology diagnoses. A second puncture was carried out next day on these 5 patients unsuccessfully. The diagnostic validity of percutaneous FNAC for identifying malignancy with reference to the definitive diagnosis established after histological study and clinical follow-up can be seen in Table 1.

Of the 126 cases with cytological diagnosis (NFAC had a yield of 96.2%), 73 histological samples were available (Table 2). A high degree of cytological and histological concordance was attained, both for malignant lesions (kappa coefficient: 0.641; p < 0.001) and for benignant lesions (kappa coefficient: 0.607; p < 0.001). In the 12 cases with discordance between cytological and definitive diagnosis (Table 3), 5 false negatives were found, 3 false positives and 4 typing errors for malignant lesions.

There were 5 cases of post-puncture complications (3.8%): 3 pneumothorax (2.3%) that did not require drainage tubes and 2 haematomas (1.5%) with self-limiting bleeding.

The frequency of benign and malignant lesions was calculated in population groups according to sex, age (<60 years and ?60 years), size of lesion (≤ 2 cm and > 2 cm) and location (anterior, middle and posterior compartments) (Table 4), but we did not have all data available from all the patients that underwent FNAC (age was registered in 123 patients and size of lesion in 50). Therefore, in the subgroup analysis of the total number of patients with definitive diagnosis, the size of the subgroups by age and size of lesion was reduced (118 and 49 patients, respectively). Although a slightly greater percentage of malignant tumours were seen in women than in men (85.0 vs. 76.1%) and in those over 60 years of age than in those

Table 2
Cytological and histological diagnostic results

Malignant lesions	Cytology (103 [81.7%])	Biopsy (60 [82.2])	Benign lesions	Cytology (23 [18.3%])	Biopsy (13 [17.8%])
Primary lesions	62 (49,2%)	53 (72,6%)	*Non tumour lesions*	18 (14,3%)	9 (12,3%)
Thymus tumours	20	18	Cysts	3	3
Thymus carcinoma		1	Thyroid lesions	4	
Thymus carcinoid		1	Colloidal goitre	3	
Hodgkin's lymphoma	8	8	Follicular nodule	1	
Non-Hodgkin lymphoma	13	11	Inflammatory material	3	
Lyposarcoma	2	2	Tuberculosis	1	2
Seminoma	2	1	Polymicrobial abscess		1
Immature teratoma	1		Reactive lymphocytosis	4	2
Soft tissue sarcoma	1	1	Normal condroid tissue	1	1
Endodermal sinus tumour		1	Organized haematoma	2	
Myeloma	1		*Benign tumours*	5 (4%)	4 (5.5%)
Oesophageal adenocarcinoma		1	Haemangioma	1	1
Poorly differentiated adenocarcinoma	2	1	Inflammatory pseudotumour		1
Schwannoma	1	2	Immature teratoma	1	1
Ganglioneuroblastoma	1		Myelolypoma	1	
Neuroblastoma	1	1	Paraganglioma	1	1
Non differentiated neurogenic tumours	2		Ganglioneuroma	1	
Non lymphoid malignant tumour	6				
Undifferentiated malignant tumour		1			
Large cell carcinoma		1			
Undifferentiated carcinoma	1	1			
Epidermoid carcinoma		1			
Metastatic lesions	41 (32,5%)	7 (9,6%)			
Lung cancer	36	1			
Large cell carcinoma	16	1			
Small cell carcinoma	12				
Epidermoid carcinoma	5				
Poorly differentiated carcinoma	3				
Breast cancer	3	3			
Gastric adenocarcinoma	2	2			
Thyroid follicular carcinoma		1			

Table 3
Diagnostic errors of percutaneous FNAC

Cytology	Definitive diagnosis	Mediastinal compartment
Reactive lymphocytosis	Malignant tumour	Anterior
Organized haematoma	Malignant tumour	Anterior
Inflammatory material	Malignant tumour	Anterior
Benign ganglineuroma	Malignant ganglioneuroma	Posterior
Benignant adenopathy	High grade T non-Hodgkin lymphoma	Anterior
Immature teratoma	Benign teratoma	Anterior
Ganglioneuroblastoma	Inflammatory pseudotumour	Posterior
Lymphoproliferative process	Tuberculosis	Middle
Non-Hodgkin Lymphoma	Thymus tumour with lymphocytic predominance	Anterior
Neurogenic tumour	High grade B non-Hodgkin lymphoma	Posterior
Non lymphoid malignant pleomorphic tumour	Nodular sclerosis type non-Hodgkin lymphoma	Anterior
Non lymphoid malignant pleomorphic tumour	Non-Hodgkin anaplastic lymphoma	Anterior

Table 4
Frequency of benign and malignant lesions in different sample subgroups according to the reference pattern and FNAC

	Definitive diagnosis (n = 126)			FNAC (n = 131)			
	Benign N (%)	Malignant N (%)	P	Benign N (%)	Malignant N (%)	Non representative N (%)	p
Men	14 (20.6)	54 (79.4)	0.426	12 (16.9)	57 (80.3)	2 (2.8)	0.780
Women	7 (12.0)	51 (87.9)		11 (18.3)	46 (76.7)	3 (5.0)	
< 60 years	13 (20.3)	51 (79.7)	0.386	15 (22.4)	50 (74.6)	2 (3.0)	0.516
≥ 60 years	6 (11.1)	48 (88.8)		8 (14.3)	46 (82.1)	2 (3.6)	
Age not registered	2 (25)	6 (75)		0 (0.0)	7 (87.5)	1 (12.5)	
≤ 2 cm	2 (40.0)	3 (60.0)	0.390	2 (40.0)	3 (60.0)	0 (0.0)	0.451
> 2 cm	7 (15.9)	37 (84.1)		8 (17.8)	34 (75.6)	3 (6.7)	
Size not registered	12 (15.6)	65 (84.4)		13 (16.0)	66 (81.5)	2 (2.5)	
Anterior mediastinum	14 (16.1)	73 (83.9)	0.117	13 (14.8)	71 (80.7)	4 (4.5)	0.010
Middle mediastinum	1 (6.7)	14 (93.3)		1 (6.7)	14 (93.3)	0 (0.0)	
Posterior mediastinum	6 (33.3)	12 (66.7)		9 (40.9)	12 (54.6)	1 (4.5)	
Several compartments	0 (0.0)	6 (100.0)		0 (0.0)	6 (100.0)	0 (0.0)	

Table 5
Analysis of diagnostic FNAC yield in the identification of malignity of mediastinal lesions based on the location of the lesions and the sex and age of the patients

	N	Sensitivity (95% CI), %	Specificity (95% CI), %	PPV (95% CI), %	NPV (95% CI), %	MRP (95% CI), %
Location						
Anterior	84	94.4% (86.6–7.8%)	75.0% (46.8–1.1%)	95.8% (88.3–8.6%)	69.2% (42.4–7.3%)	3.78 (1.42–0.08%)
Middle	15	100.0% (78.5–00.0%)	100.0% (20.7–00.0%)	100.0% (78.5–00.0%)	100.0% (20.7–00.0%)	
Posterior	18	91.7% (64.6–8.5%)	100.0% (61.0–00.0%)	100.0% (74.1–00.0%)	85.7% (48.7–7.4%)	
Sex						
Men	67	98.1% (90.2–9.7%)	76.9% (49.7–1.8%)	94.6% (85.4–8.2%)	90.9% (62.3–8.4%)	4.25 (1.58–1.48)
Women	56	92% (81.2–6.8%)	100.0% (61.0–00.0%)	100.0% (92.3–00.0%)	60.0% (31.3–3.2%)	
Age group						
< 60 years	67	96.2% (87.2–9.0%)	85.7% (60.1–6.0%)	96.2% (87.2–9.0%)	85.7% (60.1–6.0%)	6.74 (1.86–4.33)
≥ 60 years	49	93.3% (82.1–7.7%)	100.0% (51.0–00.0%)	100.0% (91.6–00.0%)	57.1% (25.0–4.2%)	

PPR: positive probability ratio; NPV: Negative predictive value; PPV: Positive predictive value.

under this age (85.7 vs. 76.1%), none of these differences were statistically significant. However, in the benign and malignant classification according to lesion FNAC in the different mediastinal compartments statistically significant differences were reported, the lesions located in the anterior and middle compartment (80.7 and 93.3%, respectively; p=0.032) were predominantly malignant.

The diagnostic yield or performance of percutaneous FNAC was analysed according to lesion location and patient sex and age (Table 5) but no statistically significant differences were found based on location, sex or age. The subgroup of lesions located in several mediastinal compartments was not considered because they were few and the analysis based on age was only performed in 116 patients, since this information was not available in all cases.

Finally, we assessed the yield of FNAC in the diagnosis of malignancy in comparison with biopsies in 73 patients that had histological samples available. In this subgroup, FNAC had a sensitivity of 94.9% (95% CI: 86.1–98.3%), a specificity of 71.4% (95% CI: 45.4–88.3%), a positive predictive value (PPV) of 93.3% (95% CI: 84.1-97.4%), a negative predictive value (NPV) of 76.9% (95% CI: 49.7–91.8%), a positive probability ratio of 3.32 (95% CI: 1.45–7.62) and an accuracy of 90.4% (95% CI: 81.5-95.3%).

Discussion

Percutaneous spiral CT guided FNAC is a useful and effective procedure for the diagnosis of mediastinal lesions as has been shown in our study. A correct diagnosis was obtained in 94.5% of cases with only 5 false negatives, 3 false positives and 4 errors in histological typing. In our series the diagnostic yield was (95.2% sensitivity, 97.1% PPV and 93.5% accuracy) which was slightly greater than what was reported by previous studies (sensitivity and PPV 85–87% and 78–97%, respectively).[11,18] The sensitivity for the diagnosis of malignant lesions by CT guided FNAC is ? to that described for ultrasound guided endoscopic (81–96%)[1,2] or transbronchial (63–89%)[3,4,5] FNAC. Greater skill with the procedure has also increased its safety and usefulness. There has been an increase from 81% of valid samples in the first series[11] to 94% in more recent series[9] and even 96.2% in our study. In the first published series,[13] the complication rate was 21.4%, whereas in more recent series[17] complications are only seen in 2–4% of cases (3.8% in our study). However, it is necessary to consider that there are differences of 13-15% in sensitivity, usefulness and safety, since efficacy and frequency of complications depend largely on the experience of the team carrying out the FNAC procedure.

Our study had several limitations. Due to its characteristics, a selected population was assessed. That is, patients in whom it was considered appropriate to carry out this procedure, ruling out non-collaborators and lesions of < 9mm whose inclusion could have decreased diagnostic yield. So as to minimise the risk of complications we also excluded patients with significant pulmonary emphysema for transpulmonary punctures and patients with alterations of their coagulation parameters. Furthermore, 8 cases were excluded from the yield analysis (5 because we had no clinical follow-up and 3 due to insufficient material). Although this could be considered a selection bias, we considered that a non-assessable result should not be included in an efficacy study. Assessment according to the size of the lesion was ruled out since we only had this information in 50 cases (40.6%).

In our sample, lesion distribution was similar to that seen in the literature. Most of the lesions were in the anterior mediastinum, less in the posterior and very few in the middle compartment.[1,2,9,16-18] Many authors include only lesions in the anterior mediastinum,[6,11] since they are more frequent and easily accessible by the percutaneous route, making it possible to carry out ultrasound guided procedures if they are in contact with the chest wall.[19]

Usually, it is considered that most mediastinal masses are malignant, and primary lesions are the most frequent.[9,10,17,18] Our results agree with this data (84.5% malignant lesions, mostly primaries), however Assaad et al[9] and Powers et al[18] found that most malignant lesions were metastatic, so it is not clear which subgroup predominates. There is no doubt that a CT guided FNAC is indicated when malignancy of a mediastinal lesion is suspected since this procedure has a high positive predictive value (97.1% in our series and 78–97% in the literature) and a very low risk of complications, most of which are commonplace (pneumothorax and self-limiting haematomas).[8,12,13,17] Our results could have still greater clinical relevance in the case of clinical and radiological signs of benign lesions. In these lesions, FNAC has a high negative predictive value (76.2%) that is similar to that obtained in the subgroup of patients with histological diagnosis (76.9%). Although this data suggests that in these cases a clinical and radiological follow up could be justified, without need of a biopsy, more studies are needed to support this clinical attitude. Furthermore, it is necessary to be cautious when puncturing cystic lesions, which percentage in the total of mediastinal masses is not small (up to 20% according to the literature and 15.4% in this series), since there is a greater risk of infection. Thus, a number of authors recommend antibiotic prophylaxis.[22,23]

In our patients, we obtained a concordance between cytology and biopsy results as to histological type and subtype in 90.4% of the cases which is coherent with the 78–95% described by other authors.[9,17,10,11] The differences seen in studies can be attributed to diverse factors. The presence of the cytologist in the CT room is of basic importance since the immediate analysis of the validity of the sample makes it possible to indicate the need for a repeat puncture and this increases the negative predictive value.[18,24] It is also necessary to consider the complexity of the diagnosis of mediastinal lesions, since they possess great histological variability, as also the importance of the skill of the radiologist and cytologist and patient collaboration, all of which are determinant factors in the effectiveness of the procedure. Due to these frequent discordances seen in cytohistological diagnosis there is a certain controversy as to whether it is best to carry out fine needle or thick – tru cut – needle punctures. The greater amount of material obtained with a tru cut (14–18G) biopsy makes it possible to achieve greater diagnostic precision, especially in the case of carcinomas, thymus tumours or lymphatic tumours,[6,19] but this procedure also has a greater risk of complications.[6,7] Therefore, it is advisable to use fine needles for transpulmonary punctures and punctures of lesions adjacent to the large vessels or those with hypervascularity,[8] reserving tru cut punctures for those cases in which clinical or radiological findings do not agree with the results of the FNAC.[25]

Of the different errors described in the cytological diagnosis of mediastinal masses,[26-30] the most frequent is that of spindle cells that include benign non-tumour cells, benign tumours (of the thymus or neurogenic tumours) and malignant tumours (non-squamous carcinoma, melanoma, non-Hodgkin lymphoma with sclerosis or lyposarcoma).[27] Indeed, a non-Hodgkin lymphoma with sclerosis in one of our patients simulated a neurogenic tumour in cytology due to the abundance of spindle cells, an error described by several authors.[27,28] Furthermore, lymphomas and neurogenic tumours can have a pattern of small cells and simulate a carcinoid tumour or microcytic metastasis[30] and, therefore, spindle cell tumours and small cell tumours may require the use of immunohistochemical techniques for an accurate diagnosis.[28] On the other hand, a thymus tumour with a predominance of lymphoid components can simulate a lymphoma[17,29] as happened in our study or, occassionally, it can be similar to a carcinoma if there is predominance of the epithelial component.[26]

In conclusion, our study confirmed that CT guided percutaneous FNAC makes it possible to carry out a diagnosis of most mediastinal lesions with a very high reliability[9-11,17,18]. This method has a high sensitivity for the detection of malignity when carried out by experts, it is well tolerated, minimally invasive, has less risk of complications than endoscopic FNAC and a lower cost. Therefore, it should be considered the diagnostic procedure of first choice when there is suspicion of malignancy of a mediastinal lesion; more aggressive techniques such as endoscopic procedures should be left for difficult cases where an adequate sample is not obtained by CT guided percutaneous FNAC.

References

1. Fernández-Esparrach G, Pellisé M, Solé M, Belda J, Sendino O, Llach J, et-al. Usefulness of endoscopic ultrasound-guided fine needle aspiration in the diagnosis of mediastinal lesions. Arch Bronconeumol. 2007;43:219-24.
2. Savides TJ, Perricone A. Impact of EUS-guided FNA of enlarged mediastinal lymph nodes on subsequent thoracic surgery rates. Gastrointest Endosc. 2004;60:340-6.
3. Sánchez-Font A, Curull V, Vollmer I, Pijuan L, Gayete A, Gea J. Utilidad de la punción aspirativa transbronquial guiada con ultrasonografía endobronquial (USEB) radial para el diagnóstico de adenopatías mediastínicas. Arch Bronconeumol. 2009;45:212-7.
4. Garcia-Olivé I, Valverde Forcada EX, Andreo García F, Sanz-Santos J, Castellà E, Llatjós M, et-al. La ultrasonografía endobronquial lineal como instrumento de diagnóstico inicial en el paciente con ocupación mediastínica. Arch Bronconeumol. 2009;45:266-70.
5. Martínez-Olondris P, Molina-Molina M, Xaubet A, Marrades RM, Luburich P, Ramírez J, et al. Punción transbronquial aspirativa en el estudio de las adenopatías mediastínicas: rentabilidad y coste-beneficio. Arch Bronconeumol. 2008;44:290-4.
6. Annessi V, Paci M, De Franco S, Cavazza A, Ferrari G, Ricchetti T, et al. Diagnosis of anterior mediastinal masses with ultrasonically guided core needle biopsy. Chir Ital. 2003;55:379-84.
7. Aviram G, Greif J, Man A, Schwarz Y, Marmor S, Graif M, et al. Diagnosis of intrathoracic lesions: are sequential fine-needle aspiration (FNA) and core needle biopsy (CNB) combined better than either investigation alone?. Clin Radiol. 2007;62:221-6.
8. De Farias AP, Deheinzelin D, Younes RN, Chojniak R. Computed tomography-guided biopsy of mediastinal lesions: fine versus cutting needles. Rev Hosp Clin Fac Med Sao Paulo. 2003;58:69-74.
9. Assaad MW, Pantanowitz L, Otis CN. Diagnostic accuracy of image-guided percutaneous fine needle aspiration biopsy of the mediastinum. Diagn Cytopathol. 2007;35:705-9.
10. Güllüoğlu MG, Kiliçaslan Z, Toker A, Kalayci G, Yilmazbayhan D. The diagnostic value of image guided percutaneous fine needle aspiration biopsy in equivocal mediastinal masses. Langenbecks Arch Surg. 2006;391:222-7.
11. Desai F, Shah M, Patel S, Shukla SN. Fine needle aspiration cytology of anterior mediastinal masses. Indian J Pathol Microbiol. 2008;51:88-90.
12. Rosenberger A, Adler O. Fine needle aspiration biopsy in the diagnosis of mediastinal lesions. Am J Roentgenol. 1978;131:239-42.
13. Adler OB, Rosenberger A, Peleg H. Fine-needle aspiration biopsy of mediastinal masses: evaluation of 136 experiences. AJR Am J Roentgenol. 1983;140:893-6.
14. Fang WT, Xu MY, Chen G, Chen Y, Chen WH. Minimally invasive approaches for histological diagnosis of anterior mediastinal masses. Chin Med J. 2007;20: 675-9.
15. Astrom KG, Ahlstrom KH, Magnusson A. CT-guided transsternal core biopsy of anterior mediastinal masses. Radiology. 1996;199:564-7.
16. Gupta S, Wallace MJ, Morello FA, Ahrar K, Hicks ME. CT-guided percutaneous needle biopsy of intrathoracic lesions by using the transsternal approach: experience in 37 patients. Radiology. 2002;222:57-62.
17. Shabb NS, Fahl M, Shabb B, Haswani P, Zaatari G. Fine-needle aspiration of the mediastinum: a clinical, radiologic, cytologic, and histologic study of 42 cases. Diagn Cytopathol. 1998;19:428-36.
18. Powers CN, Silverman JF, Geisinger KR, Frable WJ. Fine-needle aspiration biopsy of the mediastinum. A multiinstitutional analysis. Am J Clin Pathol. 1996;105: 168-73.
19. Sawhney S, Jain R, Berry M. Tru-Cut biopsy of mediastinal masses guided by real-time sonography. Clin Radiol. 1991;44:16-9.
20. De Luca L, Di Bella S, D'Amore E. Mediastinal and gastric EUS: indications and technique of examination. Minerva Med. 2007;98:423-9.
21. Catalano MF, Nayar R, Gress F, Scheiman J, Wassef W, Rosenblatt ML, et al. EUS-guided fine needle aspiration in mediastinal lymphadenopathy of unknown etiology. Gastrointest Endosc. 2002;55:863-9.
22. Wildi SM, Hoda RS, Fickling W, Schmulewitz N, Varadarajulu S, Roberts SS, et al. Diagnosis of benign cysts of the mediastinum: the role and risks of EUS and FNA. Gastrointest Endosc. 2003;58:362-8.
23. Eloubeidi MA. Antibiotics are mandatory before EUS-guided FNA in cystic or semisolid lesions of the mediastinum and the pancreas. Gastrointest Endosc. 2006;63:890.
24. Siverman JF, Finley JL, O'Brien KF, Dabbs DJ, Park HK, Larkin EW, et al. Diagnostic accuracy and role of immediate interpretation of fine-needle aspiration biopsy specimens from various sites. Acta Cytol. 1989;33:791-6.
25. Gong Y, Sneige N, Guo M, Hicks ME, Moran CA. Transthoracic fine-needle aspiration vs concurrent core needle biopsy in diagnosis of intrathoracic lesions: a

retrospective comparison of diagnostic accuracy. Am J Clin Pathol. 2006;125: 438-44.
26. Matsuura B, Tokunaga H, Miyake T, Utsunomiya S, Minami H, Onji M. A case of malignant thymoma mimicking thyroid carcinoma: a pitfall in fine-needle aspiration. Endocr J. 2004;51:237-41.
27. Slagel DD, Powers CN, Melaragno MJ, Geisinger KR, Frable WJ, Silverman JF. Spindle-cell lesions of the mediastinum: diagnosis by fine-needle aspiration biopsy. Diagn Cytopathol. 1997;17:167-76.
28. Singh HK, Silverman JF, Powers CN, Geisinger KR, Frable WJ. Diagnostic pitfalls in fine-needle aspiration biopsy of the mediastinum. Diagn Cytopathol. 1997;17:121-6.
29. Friedman HD, Hutchison RE, Coman LJ, Powers CN. Thymoma mimicking lymphoblastic lymphoma: a pitfall in fine-needle aspiration biopsy interpretation. Diagn Cytopathol. 1996;14:165-71.
30. Geisinger KR. Differential diagnostic considerations and potential pitfalls in fine-needle aspiration biopsies of the mediastinum. Diagn Cytopathol. 1995;13: 436-42.