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Original Article

Endobronchial Ultrasound for the Diagnosis of Peripheral Pulmonary Lesions. A Controlled Study With Fluoroscopy☆

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ABSTRACT

Introduction: Fluoroscopy-guided bronchoscopy is usually performed for the diagnosis of peripheral pulmonary lesions (PPL), but the diagnostic yield varies widely among studies. Endobronchial ultrasound (EBUS) can increase the diagnostic yield of bronchoscopic diagnosis of PPL.
Objective: To compare the diagnostic yield of fluoroscopy-guided bronchoscopy and EBUS with fluoroscopy-guided bronchoscopy in the study of PPL.
Methods: All patients who underwent bronchoscopy to study PPL from January 2009 to December 2012 were prospectively included. A total of 145 consecutive patients were randomly distributed in two groups: EBUS and fluoroscopy (50 patients, 71.3±8.2 years) or fluoroscopy alone (95 patients, 68±10.5 years). The mean diameter of the lesions was 41.97±19.22 mm. Cytological brushing and transbronchial biopsies were obtained. All procedures were performed under fluoroscopic guidance with intravenous conscious sedation. EBUS was performed using an endoscopic ultrasound system equipped with a 20-MHz radial miniprobe introduced via a guide-sheath. Bronchoscopist, cytologist, study protocol, techniques and tools were the same throughout the whole study.
Results: In all, 129 (89%) patients had malignant disease. A diagnosis with bronchoscopy was established in 105 (72.4%) patients. EBUS plus fluoroscopy obtained a diagnostic yield in 78% of patients and fluoroscopy alone in 69.5% (non-significant). In contrast, for lesions smaller than 30 mm, EBUS plus fluoroscopy guidance provided significantly greater diagnostic performance than fluoroscopy alone (90% vs 52%; *P*=.05).
Conclusions: Bronchoscopy under EBUS plus fluoroscopy guidance is a technique that has become useful for the diagnosis of LPPs, especially those smaller than 30 mm in diameter.

Utilidad de la ultrasonografía endobronquial radial en el diagnóstico de lesiones pulmonares periféricas. Estudio controlado con fluoroscopia

Palabras clave:
Ultrasonografía endobronquial radial
Lesiones pulmonares periféricas
Nódulo pulmonar solitario
Cáncer de pulmón

RESUMEN

Introducción: La broncoscopia guiada por fluoroscopia se utiliza para el diagnóstico de las lesiones pulmonares periféricas (LPP), pero su rendimiento es muy variable en función de los estudios. La ultrasonografía endobronquial (USEB) radial podría incrementar el rendimiento diagnóstico de la broncoscopia para estas lesiones.
Objetivos: Comparar el rendimiento diagnóstico de la broncoscopia guiada por fluoroscopia y USEB radial con la broncoscopia guiada por fluoroscopia para el estudio de LPP.
Métodos: Se incluyeron de forma prospectiva todos los pacientes que se sometieron a broncoscopia con fluoroscopia para el estudio de LPP desde enero de 2009 a diciembre de 2012. Los 145 pacientes se aleatorizaron en 2 grupos: fluoroscopia y USEB radial (50 pacientes, 71,3 ± 8,2 años) o fluoroscopia únicamente (95 pacientes, 68 ± 10,5 años). El diámetro medio de las lesiones fue de 41,97 ± 19,22 mm. Se tomaron muestras de cepillado bronquial citológico y biopsia transbronquial. Todas las exploraciones se realizaron

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bajo control fluoroscópico y con sedación intravenosa. Para la USEB se utilizó un procesador ecográfico equipado con una ultra-minisonda ecográfica de 20 MHz que se introducía por una guía. Broncoscopista, citólogo, protocolo de estudio, técnicas y utillaje fueron los mismos durante todo el estudio.

Resultados: Ciento veintinueve (89%) pacientes presentaban patología maligna. Se obtuvo el diagnóstico por broncoscopia en 105 (72,4%) enfermos. En el grupo con fluoroscopia y USEB radial se diagnosticaron el 78% de los pacientes y en el grupo con solo fluoroscopia el 69,5% (n.s.). Sin embargo, para lesiones menores de 30 mm la fluoroscopia con USEB radial incrementaba significativamente el rendimiento diagnóstico comparado con la fluoroscopia únicamente (90 vs 52%; p = 0,05).

Conclusiones: La USEB radial asociada a fluoroscopia es una técnica especialmente útil para el diagnóstico de las LPP de un tamaño inferior a 30 mm.

Introduction

Peripheral pulmonary lesions (PPL) are focal radiographic opacities which, depending on their size, are characterized as nodules (≤3 cm) or masses (>3 cm). The prevalence of malignancy in studies evaluating patients with non-calcified nodules ranges between 2 and 82%, depending on the series.[1]

The diagnostic yield of conventional bronchoscopy in PPL is usually less than 20%,[2,3] and its sensitivity depends on the size of the lesion, its proximity to the bronchial tree and the prevalence of cancer in the studied population.[4,5] In the case of relatively large PPLs of 2.5–4 cm in diameter, diagnostic efficiency can reach 62%, but it drops below 40% for lesions smaller than 2.5 cm.[1] Moreover, the diagnostic accuracy of fluoroscopy-guided bronchoscopy varies considerably for this type of injury so, depending on the series, it may vary between 14% and 71%.[5–7] Factors potentially limiting the performance of this technique include the location and, in particular, the size of the lesion, and results are reduced to 11%–42% in minor lesions smaller than 2 cm.[5,7,8]

Radial probe endobronchial ultrasound (EBUS) is an ultrasound modality that provides a detailed picture of the bronchial wall and adjacent structures. It consists of an ultrasound miniprobe of 20 MHz frequency that, inserted through the working channel of the bronchoscope, provides a 360° ultrasound image. Herth et al.[9] were the first to use it in 2002 for PPL studies, and it has proven useful in recent years for increasing the performance of fiberoptic bronchoscopy in the diagnosis of these lesions, especially those smaller than 2–3 cm.[9–11] In this respect, a recent meta-analysis showed overall diagnostic yield of up to 73%.[12]

The main objective of this study was to evaluate in our setting the usefulness of radial probe EBUS combined with fluoroscopy-guided bronchoscopy for the diagnosis of patients with PPL, compared to the use of fluoroscopy-guided bronchoscopy alone.

Patients and Methods

The study was approved by the Ethics Committee of the institution, and the Declaration of Helsinki and local and international regulations for the development of studies in humans were followed at all times. All the patients in whom fluoroscopy-guided bronchoscopy (with or without EBUS) was performed for the diagnosis of peripheral lung injury between January 2009 and December 2012 were prospectively included. Patients were recruited from a dedicated clinical unit that is part of a rapid diagnostic circuit where patients with high suspicion of pulmonary tumor disease are seen. The patients were randomized using standard chest X-ray with the allocation sequence 1:2 (one patient for fluoroscopy with EBUS, two patients for fluoroscopy), which was also subject to the availability of an ultrasound miniprobe during the study period. PPL was considered a radiopacity surrounded by normal lung parenchyma and not visible on endoscope by bronchoscopy. The study was conducted on the basis of multidetector CT scans (Sensation 4 and Sensation 16, Siemens, Ehrlangen, Germany), after the administration of 115 ml of intravenous contrast (Ioversol, Optiray 300 Ultraject, TycoHealthcare, Sant Joan Despi, Spain). Size, expressed as major and minor diameters, location and possible existence of a sub-subsegmental bronchus with access to the lesion were specified for each lesion.

Procedure

Bronchoscopies were performed in the endoscopy room, equipped with a fluoroscopy unit (Phillips Medical System BV Bracelet; Veenpluis, Netherlands). This equipment consists of a C-arm that provides a two-dimensional image. Briefly, scans were performed after premedication with sublingual diazepam and topical anesthesia with lidocaine 2%, and were carried out under sedation with intravenous propofol and remifentanil, supervised by an anesthesiologist. In all cases, the bronchial tree was examined in both lungs down to subsegmental bronchi and bronchial aspirate (BAS) samples were collected. Olympus (Olympus, BF-180 Q Tokyo, Japan) fiber-optic bronchoscopes were used, with a working channel of 2 mm. All procedures were performed by the same bronchoscopist after obtaining informed consent from the patient and normal results in coagulation parameters [platelet >60 000/mm^3 and prothrombin time (PT)>60%].

Fluoroscopy-guided Bronchial Brushing and Transbronchial Biopsies

Bronchial brushes (disposable cytology brush Olympus BC-202D-2010) and transbronchial biopsy forceps (disposable biopsy forceps FB-231D, Olympus) were used. The number of brushings was 2–3. The sample was subsequently smeared on a microscope slide and then immersed in 96° alcohol for subsequent cytological analysis. Samples were stained by the Papanicolaou technique in the pathology laboratory. The number of transbronchial biopsies was 4, and the samples were immersed in formalin for subsequent preparation of a paraffin block.

Fluoroscopy-guided Bronchial Brushing and Transbronchial Biopsies and Radial Probe EBUS

Briefly, an ultra-miniprobe UM-S20-17S (Olympus) was inserted through the working channel of the bronchoscope. The probe had a 20 MHz ultrasound transducer inside a plastic guide (guide sheath SG-200C, Olympus) (Fig. 1) and was pushed forward in the segmental bronchus until the lesion was located by ultrasound and with the aid of fluoroscopy. Then, the ultra-miniprobe was withdrawn and a specific brush was inserted (disposable cytology brush BC-204D-2010, Olympus) through the plastic guide, followed by a transbronchial biopsy forceps (disposable biopsy forceps FB-233D, Olympus). The number of brushings was 2–3, and the number of transbronchial biopsies, 4.