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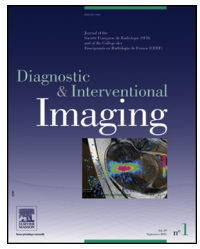

ORIGINAL ARTICLE / *Thoracic imaging*

Solitary fibrous tumor of the pleura: Can computed tomography features help predict malignancy? A series of 56 patients with histopathological correlates

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KEYWORDS
Solitary fibrous tumor;
Pleura;
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Abstract
Objective: To identify computed tomography (CT) predictors of malignancy, from a retrospective study of preoperative CT scans of patients with solitary fibrous tumors (SFT) of the pleura.
Patients and methods: The CT scans of 56 patients with histopathologically confirmed SFT (33 women and 23 men; mean age, 60 years) who underwent surgery between December 2004 and November 2012 were retrospectively analyzed by three radiologists working in consensus, blinded to the final histological diagnosis.
Results: SFT was asymptomatic and incidentally discovered in 22 patients (45.8%). Resection specimen analysis (R0 resection in all cases) revealed that 23 tumors (41%) were malignant.

Abbreviations: 18FDG, 18Fluorodeoxyglucose; MRI, Magnetic Resonance Imaging; CT, Computed Tomography; PET, Positron Emission Tomography; SFT, Solitary fibrous tumor; HU, Hounsfield Units.

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The CT features, which significantly differed between malignant and benign SFTs were tumor size ($P = 0.002$) with a discriminative threshold value of 10 cm, tumor heterogeneity before ($P = 0.02$) and after ($P = 0.03$) intravenous administration of iodinated contrast material, presence of intratumoral hydric attenuation areas ($P = 0.01$), pleural effusion ($P = 0.01$), measurable intratumoral vessels ($P = 0.02$), hypervascularization with visible intratumoral vessels and/or marked enhancement ($P = 0.001$). Presence of intratumoral calcifications ($P = 0.2$) and maximum post-contrast enhancement value ($P = 0.6$) were not significantly different between the two groups.

Conclusion: A size greater than or equal to 10 cm, hypervascularization, attenuation heterogeneity and association with pleural effusion are individual variables that suggest malignant SFT on CT.

Klemperer and Rabin [1] first described the histology of solitary fibrous tumors of the pleura in 1931, but it was only in the 1980s that immunohistochemical methods confirmed a sub mesothelial mesenchymal origin. Finally, the WHO named it solitary fibrous tumor (SFT) [2].

SFT accounts for only 5% of all tumors arising from the pleura. Due to its low age-standardized incidence rate (1.4 cases per 1 million inhabitants [3]), there are no recent series of patients who underwent surgery for SFT. Even though histological criteria of malignancy have been identified, the evolution of these tumors remains unpredictable [4]. SFTs usually have a good prognosis, but can be malignant in 10 to 20% of the cases. The pathological diagnosis of malignancy is difficult because of tumor heterogeneity and large size, and therefore depends on the number of samplings performed on the specimen. Indeed, the structure of SFTs consists of a combination of broad fibrous areas that provide little histological information, and cellular areas with densities that may vary significantly from one area to another. A small malignant islet can be found within a SFT in which the majority of cellular areas are benign, and if not identified, SFT can be falsely diagnosed as benign. Local recurrence with sometimes distant metastasis may develop during the post-surgical follow-up. Therefore, identifying CT predictors of malignancy would be important for several reasons. First, it would favor surgical resection in patients with comorbidities increasing the surgical risk. Secondly, it would highlight the necessity for 1 to 2-cm safety resection margins despite possible technical difficulties, together with the need to perform an extensive histological sampling of the specimen, to allow detection of small malignant islets. Lastly, a longer post-surgical CT follow-up would be indicated, based on the increased risk of long-term recurrence.

The purpose of our study was to identify CT imaging features, especially, vascular signs, suggestive of malignancy, based on the retrospective analysis of preoperative CT scans in patients with resected SFT.

Patients and methods

This retrospective study included 56 patients who underwent surgery for SFT between December 2004 and November 2012, at six university hospitals (CHU de Bordeaux, CHU de Grenoble, and in Paris: Hôtel-Dieu, hôpital européen Georges-Pompidou, hôpital Bichat, hôpital Saint-Joseph). We used the preoperative CT scans and the final histological report following surgical resection.

Multidetector CT scanners were used throughout the study with the following number of rows: 8 rows (1 patient), 16 rows (33 patients), 40 rows (2 patients), 64 rows (20 patients). Slice reconstruction thickness was 1-mm for lung window images and for mediastinal window images, slice thicknesses ranged from 0.625 to 1.3 mm in 28 patients, from 2 to 3 mm in 26 patients, and was of 5 mm in 2 patients. Regarding contrast administration, 14 CT examinations were obtained without injection, 19 CT examinations were obtained both before and after injection and 23 after injection only.

Besides clinical criteria such as age, gender and symptoms, we analyzed nine different CT imaging features, including tumor size (maximum diameter in mediastinal window, all views), tumor heterogeneity before injection (hypoattenuating areas compared to paraspinal muscles); tumor heterogeneity after contrast injection; intratumoral hydric attenuation areas (−20 to +20 Hounsfield units [HU)]; measurable intratumoral vessels (diameter > 1 mm); hypervascularization (marked contrast enhancement compared to that of paraspinal muscles, and/or visible intratumoral vessels); maximum attenuation value after injection; presence of pleural effusion or of intratumoral calcifications. Obvious signs of malignancy (invasion of adjacent structures, distant metastasis) were not taken into account.

CT scan readings were performed by three radiologists in consensus, blinded to the final histological diagnosis.

Follow-up information (recurrence or not) was available for nine patients. The length of follow-up ranged from 3 to 84 months (median 27 months).

Statistical analysis

With regard to the number of patients, p values were calculated with non-parametric tests: Fisher's exact test for qualitative variables and Mann-Whitney test for quantitative variables. To determine the best threshold value for