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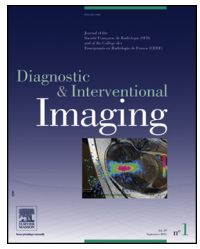

ORIGINAL ARTICLE / *Genito-urinary imaging*

Renal papillary carcinoma: CT and MRI features

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KEYWORDS
Kidney;
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Abstract
Purpose: To describe the CT and MRI appearances of papillary renal cell carcinoma.
Materials and methods: Retrospective study of 102 papillary carcinomas in 79 patients, 81 tumors examined by CT and 56 by MRI. Tumor size, homogeneity and contrast enhancement were recorded.
Results: The most common presentation of papillary renal cell carcinoma was a small homogeneous hypovascular tumor both on CT and MRI. Eighty-nine percent of lesions were hypointense on T2 weighted images compared to the renal parenchyma. Seventeen percent of the lesions did not significantly enhance with contrast on CT. All of the lesions examined on MRI had a significant enhancement percentage. Calcifications were rare and only seen in 7% of cases (CT). The second most common presentation was a bulky necrotic tumor. In addition, atypical types of disease were found which were difficult to diagnose, including infiltrating tumors and tumors with a fatty component.
Conclusion: A homogeneous hypovascular renal tumor which is hypointense on T2 weighted images should suggest a diagnosis of papillary carcinoma. Some papillary carcinomas do not enhance significantly on CT. MRI is then required to diagnose the renal tumor.

Abbreviations: PC, Papillary carcinoma; CCC, Clear cell carcinoma; CT, Computed tomography; MRI, Magnetic resonance imaging; PACS, Picture Archiving and Communication System; HU, Hounsfield unit; ROI, Region of interest; PI/OP, In phase/out of phase; AML, Angiomyolipoma.

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Introduction

Papillary carcinoma (PC) accounts for 10 to 15% of renal cell carcinomas [1]. There have been many difficulties over several years in classifying this tumor according to its histological and cytogenetic features [1] (classification into types 1 and 2 [2,3], carcinomas with MITF/TFE translocations, tubulomucinous carcinomas, etc.). Its prognosis compared to clear cell carcinoma (CCC) has been extensively debated: the ''conventional'' assumption that PC carries a better prognosis [4—7] has been contested, as studies [8,9] on large series have concluded that both histological subtypes carry a similar prognosis for the same stage and grade. Because papillary carcinomas are often multifocal and bilateral, their preoperative diagnosis is important and may lead to treatment to preserve the kidney, particularly as the current indications for partial nephrectomy are widening and percutaneous ablation techniques (radiofrequency and cryoablation) are increasingly being used.

Current findings reported in the literature suggest that the tumor is often hypovascular on computed tomography (CT) [10] and MRI [11], and is hypointense on T2 weighted imaging [11]. We have reviewed the sectional imaging of 102 tumors in order to examine the most typical features of papillary renal cell carcinoma and to identify misleading appearances which can lead to diagnostic errors.

Materials and methods

Study population

The patients were selected from pathological anatomy and radiological databases.

We searched for any CT and MRI investigations performed before surgery or biopsy. The investigations had to be available on the imaging system (Picture Archiving and Communication System [PACS]) in order to enable the various measurements to be performed (investigations which were only available on film were not included). Only tumors at least 10 mm in size were considered (microlesions under 10 mm in size were excluded in order to avoid partial volume effects when density and signal measurements were made and the stiffening effect of the CT beam [12]).

Pathological anatomy examination (surgical specimen or biopsy) was available for each patient and included both a macroscopic examination (for surgical specimens) and histology (hematoxylin-eosin-safran staining). Immunohistochemistry (in particular, anti-cytokeratin 7 antibodies, vimentin, racemase and CD 10) were performed on some tumors.

One hundred and two papillary carcinomas were found over a period of 6 years (between 2002 and 2008) in 79 patients (60 men, 19 women, sex ratio = 3.2). The average age of the patients was 61 years old (with a range of 18 to 84 years old).

CT technique

We found 81 tumors which were investigated by computed tomography using a 4-stage protocol in 75% of cases (61 patients): unenhanced, and then in the arterial phase (30 to 40 seconds after beginning the iodine contrast injection), tubular phase (90 to 120 seconds) and delayed phase (between 3 and 6 minutes), on a 4 detector helicoidal machine, Philips Mx 8000 (Marconi Medical System). All but two of the remaining 25% of patients had a 3-stage CT investigation (involving helicoidal acquisition without enhancement and then in the arterial and delayed phases), performed on an Aquilion 16 detector helicoidal machine (Toshiba).

The contrast medium used was Xénétix 350, injected intravenously into the brachial vein in the antecubital fossa (120 to 140 mL, not exceeding 2 mL/kg patient body weight; injections rate: 2.5 to 3.5 mL/s). The following features were recorded for each lesion:

- topography: number of tumors, site, size (2 perpendicular measurements in the axial plane);
- morphology: encapsulated appearance (a tumor with well demarcated boundaries deforming the contour of the kidney with a mass effect on adjacent structures) or infiltrating (poorly demarcated tumor boundaries not deforming the outline of the kidney but occasionally increasing its volume with invasion of adjacent structures); calcifications; fatty component (density less than −20 HU) within the tumor; homogeneity after iodine contrast enhancement;
- measurement of density: density in Hounsfield units (HU) before the injection and in the different stages: maximum enhancement (maximum density − density before injection); acquisition time at which the enhancement was maximal;
- locoregional extension: invasion of the renal vein; enlarged lymph nodes.

MRI technique

We found 56 tumors examined by MRI (Genesis Signal HD 1.5 T machine, General Electric Healthcare) in 38 patients. The protocol involved a single plane, usually axial (and occasionally coronal, depending on the site of the lesion), T2 weighted images with fat suppression (Fat Sat) (RT: 6,000 to 8,000 ms; ET: 90 to 106 ms), T1 weighted images (RT: 165 to 200 ms; ET: 1.5 to 1.9 ms) and a T1 weighted 3D EG ultrarapid dynamic image before and after injection of gadolinium chelate (Dotarem, 0.2 mL/kg patient body weight, 2 mL/s) in the arterial phase (30 seconds after beginning the injection), tubular phase (90 seconds) and delayed phase (3 to 6 minutes with a sequence at 10 minutes in some cases). In phase and out of phase images (IP/OP) were also available in 34% of patients (19 of 56 tumors). The following MRI features were examined:

- topography: number of tumors; site; size (two perpendicular measurements);
- morphology: encapsulated or infiltrated appearance; tumor appearance on T1 and T2 Fat Sat weighted images compared to the adjacent renal parenchyma; homogeneity; qualitative comparison of tumor image between in phase and out of phase images;
- examination of contrast enhancement: measurement of the tumor image on the dynamic sequence in the different phases; calculation of percentage enhancement ((max signal − signal without enhancement)/signal without enhancement × 100), which was defined as positive if