# Imaging Diagnosis of Renal Oncocytoma

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ABSTRACT Objective: To investigate the value of spiral CT and MR in the diagnosis and differentiatial diagnosis of renal oncocytoma. Methods :The data of CT and/or MRI of 12 patients with renal oncocytoma were reviewed retrospectively. Results :Twelve cases were performed CT scans. Eight cases showed homogeneous, three cases showed heterogeneous in pre-contrast CT scans, and one case showed annular calcification around the lesion. All of them were visualized as mild or medium enhancement, and six of them were found with central scar. Three cases were performed MRI scans. Two cases were heterogeneous iso-hypointense on $T_1$WI, and hyperintense signal on $T_2$WI. One case was isointense signal on $T_1$WI and iso-hypointense signal on $T_2$WI. Conclusion : Most of the oncocytomas showed certain characteristics, the combined examinations of CT and MRI, especially triphasic CT imaging , can provide more useful information for preoperative diagnosis.

Key words: Renal oncocytoma; Tomography; X-ray computed; Magnetic resonance imaging

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## Introduction

Renal oncocytomas are classified as benign renal neoplasms in the 2004 World Health Organization classification of renal tumours[1]. Renal oncocytoma originates from the epithelial cells of proximal renal tubules. It has an overall incidence of 3% to 7% among all renal tumors and is the second most common benign tumor after angiomyolipoma[2].The wide use of ultrasonography and computed tomography has led to an increase in the numbers of incidentally discovered renal oncocytoma[3,4]. 12 cases of renal oncocytoma about CT and MRI features were analyzed retrospectively for the purpose of providing more useful information for preoperative diagnosis. This paper presented radiological study of twelve such cases.

## 1 Material and Methods

### 1.1 Patients

Twelve patients confirmed oncocytoma by pathology in our hospital from January 2006 to July 2010(mean age, 60.1 years ; range,49-70 years), four men (mean age, 59years; range, 49-73 years) and eight women (mean age, 60.5 years; range,59-62 years), who had an oncocytoma associated renal chromophobe cell carcinoma were included in this study. Five patients had back pain，and one patient had intermittent macroscopic hematuria.

### 1.2 CT Examinations

CT examinations were performed by using 16 (Somatom Sensation 16; Siemens; Siemens [n=16]) detector row scanners. Intravenous contrast material (iopromide, Ultravist 370; Schering, Berlin, Germany) was administered at a dose of 2 mL per kilogram of body weight and at a rate of 3 mL/sec to a maximum of 150 mL by using a power injector, or at a slower rate (minimum of 2mL/sec) if required when venous access was suboptimal. All patients underwent biphasic CTimaging, which included unenhanced, CM-P (corticomedullary phase), and EEP (early excretory phase) scans. Unenhanced imaging was performed before administering the intravenous contrast agent. The scan delay times ranged from 30 to 40 seconds for CMP scans and from 120 to180 seconds for EEP scans. The scanning parameters varied for the different scanners but for all phases were in the following ranges: tube voltage, 120 kVp (constant for all); tube current, 150-250mA (depending on patient size); pitch,0.891-1.6; section thickness, 1.25-5.0mm; reconstruction interval, 2.5-5 mm, and rotation time, 0.5-0.75 second.

### 1.3 MRI Examinations

MR imaging was performed by using a 1.5-T Magnetom superconductive MR unit (GE).T1-weighted spin-echo images were obtained(TR/TE,600/15 ;image matrix,256× 256 ;two excitations). T2-weighted spin-acho images were obtained(TR/TE,2000/70 ;image matrix,256×256 ;one excitations). At 5 to 7 min after adminis - tration of gadopentetate dimeglumine. All MR images were obtained with a 7-mm section thickness and a 3-mm intersection gap. Respiratory compensation was not used.

### 1.4 Imaging Analysis

The radiologist (W.H.X)and pathologist (L.D.Y) reviewed resected specimens under various magnification levels and correlated microscopic architectural patterns with macroscopic imaging fe - atures on CT scans such as size ,parts,form,density,blood supply and margin of tumor. We measured the CT value in a area less than one square centimeter.

## 2 Results

### 2.1 CT results

Lesion position, size and form: Of these 12 lesions , six located in the upper pole of kidney, four located in kidney middle pole and two located in the low pole of kidney. The mean diameter of

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solid masses was 5.2cm (range,2.2-8.0cm). All of them were circular or oval.

Growth pattern: The 12 oncocytomas originates from the renal cortex, and focal bulging into the renal sinus was finding in 10 oncocytomas.

Lesion margin: Two oncocytomas had well differentiated margins compared with renal cortex in pre-contrast CT scans，but all had well differentiated margins in biphasic CT scans.

Enhanced performance：Twelve cases were performed CT scans. Eight cases showed homogeneous, three cases showed heterogeneous in pre-contrast CT scans, and one case showed annular calcification around the lesion.All of them were visualized as mild or medium enhancement ,and six of them were found with central scar. Lesions associated with：One oncocytoma associated with chromophobic renal cell carcinoma，two associated with polycystic kidney.

**2.2 MRI results**

Three cases were performed MRI scans. Compared with the surrounding kidney, two cases were heterogeneous iso-hypointense on T1-weighted images, and hyperintense signal on T2-weighted images. One case was isointense signal on T1-weighted images and iso-hypointense signal on T2-weighted images.

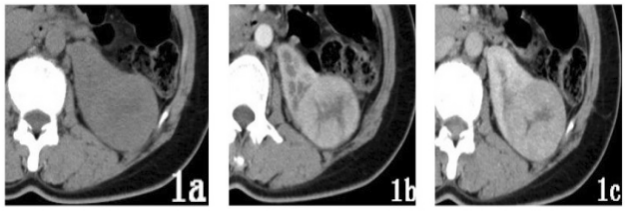


Fig.1 CT scan : a pre-contrast CT scan，tumor was isodense or slightly low density comparing with kidney; b:corticomedullary phase, medium-enhanced,CT value of lesion：28～84HU; c: early excretory phase, CT value:32~89HU

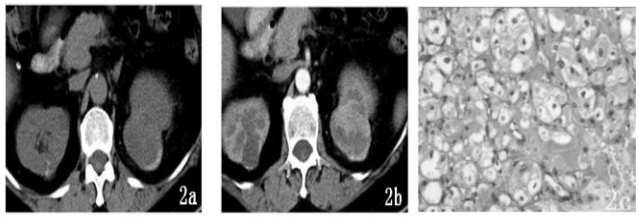


Fig.2 Oncocytoma associated with chromophobe RCC
A: pre-contrast CT scan，strip calcification around lesion margin; b: corticomedullary phase, heterogeneous enhancement;c: imaging confirmed oncocytoma associated with chromophobe RCC

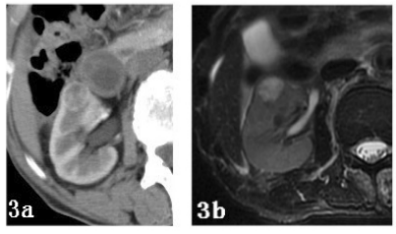


Fig.3 a：corticomedullary phase, we observed pseudocapsule of tumor enhanced annularly ；b ：T2WI-fat suppression, tumor displayed mildly uneven hyperintense signal

## 3 Discuss

**3.1 Clinical Manifestations and Pathological Features of Oncocytoma**

Renal oncocytoma patients with atypical symptoms，may be associated with hypertension, CUSHING syndrome, vague low back pain, microscopic hematuria, acute renal failure[5,6] Renal oncocytomas are almost invariably benign. Even very large, they are generally well encapsulated and are rarely invasive or associated with metastases, which is the reason why there is only one documented case of liver metastasis in literature[7].However, it has also been reported that oncocytomas may occasionally involve fat tissue in up to 20% of cases and lymphovascular structures in up to 5% [8]. Some scholars have pointed renal oncocytoma disease. A large number of unilateral or bilateral kidney were found nodules of eosinophilic cells, often a significant nodule. And some ‘special nodes’were chromophobe renal cell carcinoma but not oncocytoma, so-called renal oncocytoma disease[9]. There is a renal oncocytoma associated with chromophobe renal cell carcinoma in the group of 12 cases. Renal oncocytoma originated in the proximal renal tubule, so lesion usually located in renal cortex. Average diameter was six centimeters. Usually, they were circular or oval with a clear margin. Renal oncocytomas mostly were single, but there were few reports on the synchronous occurrence of bilateral and multiple, even associated with angiomyolipoma [10], polycystic kidney[11], small B-cell lymphoma[12] and/or renal cell carcinoma[13]. This paper described an unusual case of renal oncocytoma accompanied by an chromophobe renal cell carcinoma, that was treated by open partial nephrectomy.

**3.2 Radiological Features of Oncocytoma**

Imaging features had the following: ①Density or sign：CT scan showed isodense or slightly low density, medium-enhanced in contrast CT scans. The density of tumor in medulla phase were highest, reduced in excretory phase. The density of tumor in excretory phase was below the renal cortex, but which was still higher than that in corticomedullary phase.They were lack of hemorrhage and signs of necrosis. Some scholars found that tumor density in excretory phase below the density in corticomedullary phase [14]. The reason maybe slightly different selection of scan time. Oncocytomas are typically spheric and well-defined masses. Relative to the renal cortex, they have lower signal intensity on T1-weighted images and higher signal intensity on T2-weighted images [15,16]. ② Pseudocapsule：In this study, it was diffcult to find the tumor pseudocapsule in pre-contrast CT scan Fig3a. But it was observed ten pseudocapsule of tumors enhanced annularly in contrast scan. And a hypointense rim or pseudocapsule may be also seen on T2-weighted images. ③ Central fibrous scar: Tumor growing slowly and long-term ischemia were the main reason of central fibrous scar, so the larger the tumor the more likely scarring. Although some scholars thought both oncocytoma and chromophobic RCC were finded in scar feature [3,4,15], we should consider

oncocytoma first when find central fibrous scar. six cases of scar confirmed oncocytoma were recorded by pathology. The central scar (when present) can be seen as a stellate area of low signal intensity on T1-weighted images and high signal intensity on T2-weighted images [15]. In this study, the central scar may show delayed enhancement after the administration of gadolinium-based contrast material Fig1. ④ Calcification: It was observed calcification phenomenon in oncocytoma, but it was rarely. Some literatures reported calcification could be located in the center or around the tumor[5,14]. If calcification located in the center of scar , it should consider benign tumor first ;On the contrary,when calcification located in lesion parenchyma,malignant tumor is likely. We found one case with strip calcification confirmed oncocytoma associated with chromophobic renal cell carcinoma Fig2. ⑤Segmental Enhancement Inversion: Small renal oncocytomas (diameter less than 4 centimeters) commonly demonstrate characteristic segmental enhancement inversion on biphasic multidetect or CT images; Oncocytoma is classified as relatively highly enhanced for less-enhanced segments on corticomedullary phase images, and the relative enhancement of the two segments is reversed on early excretory phase images. Segmental enhancement inversion at biphasic multidetector CT can help discriminate between small renal oncocytoma and small renal cell carcinoma with high accuracy (97%)[17]. This paper didn't find this phenomenon in our cases of 4 small tumors.

### 3.3 Differentiate

Renal oncocytoma need to differentiate from the following tumor :①Clear cell renal cell carcinoma :hypervascular, and clear cell RCCs typically show hypervascularity on contrast-enhanced studies including computed tomography, magnetic resonance imaging, and catheter angiography . In a study that evaluated the helical CT findings of 76 clear cell RCCs, Kim found that clear cell RCC showed enhancement of more than 84 HU in the corticomedullary phase and 44 HU in the excretory phase (with a specificity of 100% and 91%, respectively)[18]. ②Papillary renal cell carcinoma : papillary RCC is more often hypovascular and homogeneous on CT than other subtypes of renal tumors. The tumor-to-aorta enhancement ratio in the vascular phase and a tumor-to-kidney enhancement ratio in the parenchymal phase of 0.25 as a good cutoff value for sensitivity, specificity [19]. In general, a tumor-to-aorta ratio or a tumor-to-kidney ratio of less than 0.25 suggests a higher degree of likelihood of papillary renal cell carcinomas, and conversely, a ratio of more than 0.25 generally excludes the possibility of a papillary renal cell carcinoma. ③Chromophobe renal cell carcinoma : oncocytomas and chromophobe RCCs share similar ontogenic features, histologic features, and some imaging findings [13]. This study described a oncocytoma associated with chromophobe RCC. To the leasion less 4 centimeters, Segmental enhancement inversion at biphasic multidetector CT can help discriminate between small renal oncocytoma and small renal cell carcinoma with high accuracy; and to the tumor more or equal 4 centimeters, Central scar as well as enhancement of the mass higher than that of renal cortex were the characteristic findings of oncocytoma to differentiate from chromophobe RCC. ④ Renal Medullary Carcinoma :Renal medullary carcinoma is almost always found in young patients; the typical age range is between 10 and 40 years (mean age, 22 years). The male-to-female ratio is 2:1. Hemorrhage and necrosis contribute to tumor heterogeneity[20]. Renal medullary carcinoma is typically associated with caliectasis. Tumors are typically hypovascular at catheter angiography ,and easily differentiate from oncocytoma.

In conclusion, most of the oncocytomas showed certain characteristics, the combined examinations of CT and MRI,especially triphasic CT imaging ,which can provide more useful information for preoperative diagnosis.

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# 肾嗜酸细胞腺瘤的影像学诊断

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**摘要** 目的:探讨螺旋 CT 和 MRI 对肾嗜酸性细胞腺瘤的诊断及鉴别诊断的价值。 方法:回顾性分析 12 例肾嗜酸性细胞瘤的 CT 和/或 MRI 表现。结果:CT 检查 12 例,平扫 8 例病灶呈均匀软组织密度影,3 例呈不均匀软组织密度影,1 例瘤体周边有环状钙化。增强后病灶轻中度强化,6 例见星状瘢痕。MRI 检查 3 例,2 例 T1WI 呈等低信号、T2WI 呈高信号;1 例 T1WI 呈等信号、T2WI 等低信号。结论:多数肾嗜酸细胞腺瘤的影像学表现具有一定特征性。CT 结合 MRI 特别是动态扫描有助于术前做出正确的诊断。

**关键词**:肾嗜酸性细胞瘤;体层摄影术,X 线计算机;磁共振成像

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