Typical and atypical CT findings of benign solid renal tumors

Poster No.: C-1324
Congress: ECR 2010
Type: Scientific Exhibit
Topic: Genitourinary
Authors: C. Medar, C. Dobromir, I. Lupescu, G. Popa, M. Lesaru, S. Georgescu; Bucharest/RO
Keywords: renal onc cytoma, angiomyolipoma, cavernous hemangioma of the kidney
DOI: 10.1594/ecr2010/C-1324

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Purpose

1. Evaluation of CT examination sensitivity and specificity in assessing of preoperative solid benign renal tumors differentiation.

2. To present typical and atypical CT aspects of solid benign renal tumors.

3. To demonstrate that CT findings associated with clinical information are a mandatory step in the pre-therapeutic management of solid benign renal lesions.

Methods and Materials

Retrospective study based on the cases with renal tumors investigated by computed tomography during between January 2003 and December 2008 in the Department of Radiology and Medical Imaging of Fundeni Clinical Institute.

From 1458 cases with imaging diagnosis of renal tumors, we included in this study 84 (5,76%) patients with final diagnosis of solid benign renal tumors divided as follows: 72 angiomyolipomas (AML), 10 oncocytomas, 1 renal adenoma and 1 cavernous hemangioma.

Age and sex of patients examined were as follows: age, between 14 and 85 years (Fig. 1 on page 3) and gender ratio, male/female, 25 (29,76%)/59 (70,24%).

We analyzed CT findings and we compared them with the histopathological diagnosis; of the 72 angiomyolipomas only 7 were operated and histopathologically confirmed; for the rest of angiomyolipomas clinical decision was imaging follow-up.

CT was done using spiral acquisition (collimation 7 mm; pitch 1-1,5; reconstruction of sections 5 mm) before and after intravenous contrast injection. We used iodinated contrast agent in concentration of 350-370 mg iod/100 ml, 1 ml/kg, with a rate of 3 ml/sec. Post-contrast acquisitions were made in the arterial (corticomedulary), nephrographic (parenchymal) and urographic (excretion) phase.

We have evaluated: tumor location, number, size, shape, contour, density, structure (presence of calcifications, fat, intratumoral vessels, central scar), the existence of adenopathy or complications (intratumoral hemorrhage or tumor rupture).

In the analysis of oncocytomas we used the central scar classification proposed by Eiss D et al. in 2005. [4]
Fig. 1: Distribution by age groups.
Results

In 3 of 84 patients CT diagnosis was renal adenocarcinoma but histopathologic diagnosis established that 2 were oncocytomas and 1 renal adenoma. Other 4 tumors with no specific CT criteria, the histopathologically examination proved to be oncocytomas in 3 cases and cavernous hemangioma in 1 case (Fig. 1 on page 6).

In 8 patients bilateral renal tumors were found (all were angiomyolipomas). In 31 cases the tumor was located in the right kidney and in 45 in the left kidney (Fig. 2 on page 7).

Tumor sizes ranged between 0.3 cm and 14 cm (maximum axial diameter), 60% of them having up to 3 cm (Fig. 3 on page 7). In our study, tumors larger than 7 cm represented 11% of all renal tumors.

Complications occurred in 5 (5.95%) cases either ruptures of angiomyolipomas or hematoma. In all 5 cases the tumor size was over 7 cm.

Oncocytoma

For the 10 oncocytomas included in our study the sex distribution was 1:1, and age group distribution showed a peak incidence in the seventh decade of life (five cases out of ten).

CT's sensitivity in detection of oncocytomas was only 50%. In contrast, specificity was highest. In two cases with histopathological diagnosis of oncocytoma, the CT diagnosis was renal cell carcinoma and in the other three, the CT findings could not be classified. We found no false positive results.

Typically, oncocytomas larger than 4 cm have a central stellate scar that appears hypoattenuated post-administration of contrast medium. Eiss D et al. suggested a number of criteria required for a CT diagnosis of oncocytoma, in this typical cases: hypodense scar tissue compared with the rest of tumor tissue on nephrographic phase, stellate or polygonal scar shape according to the types proposed, homogeneous attenuation of tumor tissue that surrounding the scar, no calcification or intratumoral hemorrhage, no signs of metastatic disease. [4]

The scar types are as follows (Fig. 4 on page 8):

- Type I: Small stellate scar with scar/tumor < 50%.
- Type II A: Non stellate scar in which the corners are included in a circle.
- Type II B: Non stellate scar in which the corners are included in an ellipse.
- Type III: Large stellate scar with scar/tumor > 50%.

Following the classification proposed by Eiss D et al. I found the following types of scars: I (Fig. 5 on page 8), IIA (Fig. 6 on page 8) and III (Fig. 7 on page 9).

We had found atypical aspects of oncocytomas: cystic degeneration (Fig. 8 on page 9) and presence of calcification (Fig. 9 on page 10). The presence of calcification in solid renal tumors suggests malignancy rather than a benign lesion. [7] When encountered, cystic areas may suggest the presence of a cystic carcinoma. [8]

Differential diagnosis of oncocytomas is difficult to do if central or excentric scar are irregularly shaped which can mimic areas of necrosis from a renal cell carcinoma (Fig. 10 on page 10). [2, 3, 15]

**Angiomyolipoma**

Angiomyolipoma is a benign renal tumor composed of fat, vascular and smooth muscle elements in varying proportions. [16] CT examination is usually sufficient for diagnosis, showing that even lesions with millimeter dimensions in tumors with predominant solid component. Measurement of density less than -20 UH is edifying for the presence of fat. A native examination is sufficient to detect fat component, but for showing the vascular component is necessary to administrate intravenous iodinated contrast medium resulting in a heterogeneous enhancement (Fig. 11 on page 11). [6, 11, 13]

In our group, that included 72 angiomyolipomas sex distribution showed a ratio women: men of 2,8:1 and distribution of age groups revealed a peak incidence in the sixth decade of life with a number of 21 cases.

Tumors were in 60% of cases on left kidney. 90,47% of angiomyolipomas at the time of diagnosis had sizes up to 7 cm, only in 8 patients they exceeded 7 cm (clinically they present lumbar back pain and hematuria).

Multiple angiomyolipomas and those larger than 4 cm can present complications: post-traumatic or spontaneous rupture with hemorrhage either intratumoral or in perirenal space (Fig. 12 on page 12), hypertension and renal dysfunction. The CT findings are important for therapeutic decision: embolization, partial or total nephrectomy. [12]

In one patient with spontaneous rupture of a left renal angiomyolipoma therapeutic decision was partial nephrectomy, with postoperative favorable evolution of the remaining kidney (Fig. 13 on page 13).

Differential diagnosis of angiomyolipoma is necessary to be done with xanthogranulomatous pyelonephritis (Fig. 14 on page 14). This is a relatively rare chronic infection with Proteus, Escherichia colli, Pseudomonas, Klebsiella, associated with kidney stones, usually obstructive. The pathognomonic microscopic feature is
the lipid-laden foamy macrophage accompanied by both chronic- and acute-phase inflammatory cells. The disorder is most often unilateral. Predominant changes are chronic pyelonephritis type: decreased of parenchymal index, parenchymal calcification with irregular kidney shape, the loss of corticomedulary differentiation with decreased nephrogram, edematous infiltration of perirenal fat and perirenal fascia, decreased excretion or absent. Always associated with renal stones. [9]

**Renal adenoma**

The prevalence of adenomas increases with age. Increased incidence has been reported in patients with diabetes, hypertension and renal carcinomas. Although the adenoma is defined as a benign tumor, there is no clinical, imaging, histological or immunohistochemical criteria allowing a certain differentiation from renal cell carcinoma. Regardless the size of an adenoma, it is treated as a malign tumor found incidentally, following all the rules of cancer therapy. [1, 16] A single case was diagnosed, using histopathology examination, with renal adenoma while the CT diagnosis was renal cell carcinoma stage I (Fig. 15 on page 15).

**Cavernous hemangioma**

It is a rare mesenchymal tumor. Unlike hepatic hemangioma, with specifically enhancement in most cases on CT examination with iodinated contrast medium, renal hemangioma was described in the literature as having various aspects. [5, 10, 14, 16]

One renal cavernous hemangioma (histopathologically confirmed) was found in our lot with a nonspecific imaging findings, isoattenuated on nephrographic phase and hypoattenuated on urographic phase (Fig. 16 on page 16). The difference in density between the two phases was 23 UH. Reviewing of the CT examination images in this particular case, after histopathological diagnosis, did not allowed us to identify some imaging CT characteristic.

**Images for this section:**
Fig. 1: Correlation CT diagnosis / Histopathological diagnosis.

Fig. 2: Location of tumors in the kidney (left, right or bilateral).
Fig. 3: Renal tumor size at diagnosis.

Fig. 4: Types of scars in oncocytomas. [7]

Fig. 5: Renal oncocytoma with scar type I - right renal tumor, well defined and hypervascular, with a central stellate scar occupying less than 50% of tumor area (arrow).
**Fig. 6:** Renal oncocytoyma with scar type IIA - hypovascular left renal tumor, well-defined, in which the corners are included in a circle (arrow).

**Fig. 7:** Renal oncocytoyma with scar type III - hypervascular left renal tumor, with stellate scar occupying more than 50% of tumor area (arrow).
Fig. 8: Oncocytoma with cystic changes - right renal tumor, with cysts inclusions (arrow).

Fig. 9: Renal oncocytoma presenting a calcification - right renal tumor, well-defined, with a small calcification (arrow) localised in the stellate scar.
Fig. 10: Renal cell carcinoma versus oncocytoma - computed tomography diagnosis of left renal cell carcinoma stage I. Histopathological diagnosis was oncocytoma.
Fig. 11: Angiomyolipoma with predominant fat component - a composite tumor mass (solid - black arrow, vascular - red arrow and fat - green arrow) developed in the lower pole of left kidney.
Fig. 12: Angiomyolipoma with spontaneous rupture. Left renal tumor with fat component exceeds renal capsula and invade peri- and pararenal spaces, with a hemorrhagic component to the lower pole (arrow).
Fig. 13: Angiomyolipoma with spontaneous rupture - preoperative CT: mixed process with solid, fat and hemorrhagic content bounded by a pseudocapsule which is extending well beyond the kidney (A, B). Postoperative CT scanning is normal (C, D).
Fig. 14: Xanthogranulomatous pyelonephritis - kidney stones (red arrows), the presence of bilateral intrarenal fat density areas (green arrow), left calcification in renal parenchyma (yellow arrow) and perirenal inflammatory changes.
**Fig. 15:** Renal adenoma - well-defined right renal tumor (arrow), discrete hypodense on native examination, iso/hypoattenuated on nephrographic phase, hypoattenuated on urographic phase.

**Fig. 16:** Renal cavernous hemangioma. Well-defined solid renal tumor localized on the upper pole of right kidney, discrete hypoattenuated on urographic phase (arrow).
Conclusion

1. Results of statistical analysis of survey data shows that computed tomography examination has a sensitivity and specificity of 100% for angiomyolipomas. However, sensitivity was only 50% for oncocytomas, while specificity was maximum.

2. Imaging findings required to suggest computed tomography diagnosis of oncocytoma are: presence of scar stellate or polygonal shape, hypodense scar compared with the rest of tumor tissue on nephrographic phase, homogeneous attenuation of tumor tissue excepting the scar, no calcification or intratumoral hemorrhage, no signs of metastatic disease.

3. The presence of fat densities (# -20 UH) on a renal tumor is virtually diagnostic for angiomyolipoma. There have been rare reports of renal cell carcinoma with a fat component included, perirenal liposarcomas or xanthogranulomatous pyelonephritis that make the differential diagnosis of angiomyolipoma difficult.

4. The rarity of other types of tumors (adenomas, cavernous hemangiomas, etc.) and lack of thorough studies on larger groups of patients make the establishment of reliable imaging criteria very difficult.

References


European Society of Radiology | www.myESR.org
16. WHO Classification of Tumours - Pathology and Genetics of Tumours of the Urinary System and Male Genital Organs, IARCPess, Lyon, 2004

Personal Information

Dr. Cosmin Medar

Department of Radiology and Medical Imaging
Fundeni Clinical Institute, Bucharest, Romania
"Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania

Email: cosmin78@gmail.com