DYNAMIC MAGNETIC RESONANCE AND MULTIPHASIC CT IN THE CHARACTERISATION OF SMALL RENAL TUMOURS (< 3CM)

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Abstract

Purpose: To implement and correlate imaging dataset with the anatomical/histopathologic ones, in order to obtain a better characterization of small renal lesions, to determine valid criteria into differential diagnosis between small renal tumors and to evaluate the value of MR diffusion sequences into the study of small renal lesions.

Materials and methods: 41 patients in total (11 females and 30 males, average age 68), with a total of 63 renal lesions examined, subjected to triphasic magnetic resonance imaging and triphasic computed tomography.

Results: In about 17 cases of oncocytomas, 17 were homogeneous and deprived of the pseudo capsule; 3 lesions appeared inhomogeneous in relation to the presence of a central scar (demonstrated in tardive excretory phase), and excluded from the study. Of 17 carcinomas, 16 (94%) are inhomogeneous, of these 3 with pseudo capsule; 1 (6%) are homogeneous and without capsule.

Conclusions: The enhancement qualitative-quantitative determination of these lesions, which had been considered a potentially valid criterion, fails to give us a definite differential diagnosis of small lesions.

Key words: small renal tumors, dynamic MR, multiphasic CT.

Introduction

The retrospective study of small renal masses (≤ 3 cm) accidentally diagnosed with scanning and/or computed tomography and later studied with triphasic CT and/or triphasic dynamic magnetic resonance, subsequently confirmed histologically.

The purpose of the study has been to implement and correlate imaging dataset with the anatomical/histopathologic ones, in order to determine:

• the comparison of density-time and intensity-time curves obtained respectively with CT and MRI, in order to obtain a better characterization of small renal lesions;

• To identify possible differences in CT enhancement patterns in the cortical-medullary phase (FMC), nephrographic phase (NP) and pyelography of small renal lesions, in order to determine valid criteria into differential diagnosis between renal tumors of small dimensions, particularly between oncocytomas and renal cell carcinomas;

• To evaluate the value of MR diffusion sequences into the study of small renal tumors;

Materials and methods

The case study includes 41 patients in total (11 women and 30 men, aged between 30 to 89 years old, average age of 68 years) with a total of 63 renal lesions examined.

Inclusion criteria included patients over 18, with small renal tumors of a maximum of ≤ 3 cm diameter (average 17,6 mm +/-9,5 mm ) with histologic diagnosis after tumorectomy or nephrectomy, subjected to triphasic MRI and triphasic CT.

CT-MS images have been obtained utilising a CT multislice device (CTMS) 64 slice/rotation.
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Subsequent to a low dose CT exam directed at the higher abdomen, the following study with contrast medium intravenous, consists of 3 acquisition phases: the cortic-medullary phase (CMP), the nephrographic phase (NP) and the tardive urographic phase (TP), with delay time respectively of 45 seconds, 80 seconds and 5 minutes.

The mdc iodized organ at a concentration of 370 mg/ml (lopamiro 370, Bracco, Milan, Italy), has been bolus injected by vein at a quantity of 120-140 ml (mdc), and a flow speed of 4 ml/sec, through an anti-decubitus vein with 18 or 20 Gauge (G) cannula needle, utilising an automatic injector (Envision CT; Medrad, Italy).

The technical parameters utilised are: 2,5 mm collimation; 18,75 mm table movement; 1,25 mm reconstruction pause; 120 KVp and 200-250 mA.

The MRI exams have been carried out with 1,5 Tesla superconducting magnets, self-screened elium cooled, Philips Achieva (X series). The tomo-graph is characterized by a maximal intensity gradients (80 mT/m) and by a maximal slow-rate (200 mT/m/ms).

The study protocol considered: TSE T1 and dual sequences, TSE T2 and T1 FAT-SAT BH pre-and post Gadolinium- DTPA, dynamic 30 seconds GE T1 FAT-SAT, 80 seconds and 5 minutes after Gadolinium -DTPA bolus intravenous injection. Mdc has been injected with bolus technique at a speed of 1,5 ml/s, with a dose of 0,2 mmol/kg.

Patients series have been divided in 3 groups:
- Group 1: 15 patients with carcinoma exposed both to CT triphasic exam and dynamic RM exam, with 1,5 T device.
- Group 2: 34 patients exposed to triphasic CT and with carcinoma and oncocyotoma diagnosis.
- Group 3: 7 patients exposed to 3,0 T RM, with DWI (for a total of 14 lesions examinated).

Oncocytomas presented a diameter variable from 10 mm to 30 mm (average diameter of 22 mm), while the carcinomas presented a diameter variable between 19 mm and 30 mm (average diameter of 28 cm). In all cases histologic diagnosis has been implemented on each operative piece; considering Hale’s histochemical coloration for oncocyotoma (with colloidal iron) to which the oncocyotoma is negative, in comparison with those with chromophobe cell carcinoma and relative immunohistochemistry data.

The 15 patients of group 1 have been examined with the MR 1,5 Tesla device, with TSE T1 and T2 using standard and dynamic weights, while the 7 patients of group 3, with MR at 1,5 Tesla device, also with sequences in diffusion (DWI) obtained with values of B of 0 and 800 sec/ mm2.

The retrospective analysis of images has been implemented on one reporting and elaboration workstation of images transferred from CD-ROM or revoked from RIS/PACS system.

CT imaging analysis, predicted a qualitative evaluation of lesions according the following criteria:
- Hypovascular or Hypodense lesions: lower density than cortical;
- Hypervascular or Hyperdense lesions: same or higher density than cortical;
- Hisovascular or Hisodense lesions: intermediate density.

While the obtained images through dynamic MR have been considered in:
- Hypotensive lesions: lower density than cortical;
- Hypertensive lesions: same or higher density than cortical.

Density/time and intensity/time curves have been achieved through location of one interested region (ROI) into the lesion, in each acquisition phase.

For each lesion, the homogeneity has also been determined, the inhomogeneity and the presence or absence of one pseudocapsule. Obviously, the pseudo capsule visualisation cannot be perfectly evaluated studying only phase cortico medullary, in fact it is strongly evident in excretory phase of triphasic exam.

In the oncocyotoma diagnosis we have considered, according to histopathology, the homogeneity (hyso, hypo or hypervascular) and the absence of pseudo-capsule.

Results

In about 17 cases of oncocytomas, 17 were homogeneous and deprived of the pseudo capsule; 3 lesions appeared inhomogeneous in relation to the presence of a central scar (demonstrated in tardive excretory phase), and excluded from the study.

Oncocytomas included into the analysis, presented the following aspects:
- Hypervascular n = 7 (41%) homogeneous without capsule;
- hypovascular n = 8 (47%) homogeneous without capsule;
Of 17 carcinomas, 16 (94%) are inhomogeneous, of these 3 with pseudo capsule; 1 (6%) are homogeneous and without capsule.

Of 17 carcinomas:
- 6 are hypervascular (35%);
- 10 are hypovascular (59%);
- 1 is hysovascular (6%).

For all patients belonging to group 3, in all 14 lesions the diffusion of sequenze assessed have showed signal hyperintensity, index of restricted diffusion in relation to high cellularity.

### Discussions and conclusions

The density/time curves tendency in CT and MR, respectively in renal carcinomas evaluation, is substantially superposable, expression of analogous contrast enhancement during the different acquisition phases.

However, the observational qualitative analysis shows how the MRI study, in the hypovascular renal carcinoma evaluation, is more sensible in post contrast graphic strengthening terms. This data could be correlated to the high contrast resolution intrinsic of resonance, particularly in the vascular compartment.

Therefore, the usual dynamic MRI is preferable in the study of small renal lesions, as a conclusion of CT study, but also as a more sensible method into the hypovascular lesions characterization.

As far as the second objective of the study is concerned, the retrospective evaluation identified enhancement patterns in cortic-medulary phase (CMP), into the nephrografic phase and in pyelographic phase, both about carcinoma and small renal oncocytoa (≤ 3cm), with the purpose of determining valid criteria in differential diagnosis.

At the quantitative exam, carcinomas and hypervascular oncocytoas did not show statistically significant differences. A notable difference has been observed relative to hipovascular forms in FCM, FN and FP, albeit with superposable tendency of time/density curves.
Furthermore, in our study we established which diagnostic criterion, according to histopathology, we have to consider for oncocytoma diagnosis, the homogeneity and the capsule absence.

These aspects have been observed in all 17 cases, resulting in hipervascular (n=7), hypovascular (n=8) and hypovascular (n=2).

The semiological aspect of homogeneity and capsule absence in FCM, has been observed in 1/17 carcinomas.

In conclusion, we can confirm that the enhancement qualitative-quantitative determination of these lesions, which had been considered a potentially valid criterion, fails to give us a definite differential diagnosis of small lesions.

During our study, the evaluation of renal carcinomas with the use of diffusion ossessed sequences, constantly showed a signal hyperintensity, index of restricted diffusivity in relation to high cellularity and therefore always proposable for its absolute diagnostic sensibility.

References


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