Imaging of different subtypes of solid renal tumors

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Introduction:

Renal cell carcinoma is the most common (85 percent) malignant neoplasm of the kidney, which can be histopatholocically subdivided into 5 subtypes, namely clear cell (75 – 85%), chromophilic (10 – 15 %), chromophobic (5 – 10 %), and Bellini duct carcinoma. Other renal masses include oncocytoma, angiomyolipoma and seldom mesenchymal tumors like fibroma or lipoma. Applying different MR sequences including fat suppressed and opposed-phase sequences in most instances renal masses may be clearly differentiated based on tissue specific imaging findings. In case of a renal cell carcinoma, however, further differentiation of the histological subtype cannot be stated neither on unenhanced nor on contrast enhanced MR images.

The aim of the study was to evaluate whether the perfusion kinetics in contrast-enhanced MRI allow for further characterization of solid renal masses.

Material and Methods:

33 patients (age range from 33 to 88 years) with ultrasonographically detected solid renal masses underwent MRI using a 1.5 T MR system (Vision, Siemens, Erlangen, Germany). Pulse sequences included unenhanced T2w HASTE, T2w TSE, T1w Flash 2D with and without fat suppression and opposed phase techniques covering the whole kidneys. MR perfusion studies were performed acquiring a turbo-flash sequence with three slices (TR: 24.5 ms; TE: 4.1 ms; FA: 30°; FOV: 500 mm; Matrix: 256 x 128; slice thickness 6 mm, acquisition time 3 sec) covering the detected renal mass. Gd-BOPTA (Braccö, Milan, Italy) was applied at a dose of 0.1 mmol / kg BW using an automatic injector at a flow rate of 2,5 ml/sec followed by a saline chaser. After CM injection in addition T1w and T1w fs sequences were acquired in axial, coronal and sagittal orientation.

Sequences were interpreted by two experienced radiologists in terms of tumor size, growth characteristics, and presence of cystic, necrotic and fatty areas. In addition the perfusion pattern over time was measured by manual placement of a region of interest (ROI) within the tumor.

After MRI, all patients underwent surgery for tumor resection with subsequent histopathological analysis.

Results:

Histological analysis revealed 24 clear cell carcinoma, 3 chromophilic carcinoma, 2 chromophobic carcinoma, 2 oncocytoma, 1 duct bellini carcinoma and 1 angiomyolipoma.

The measurement of the perfusion showed no significant differences between the different tumor entities. Only a tendency towards higher signal intensities in clear cell carcinoma was seen (Fig. 1).

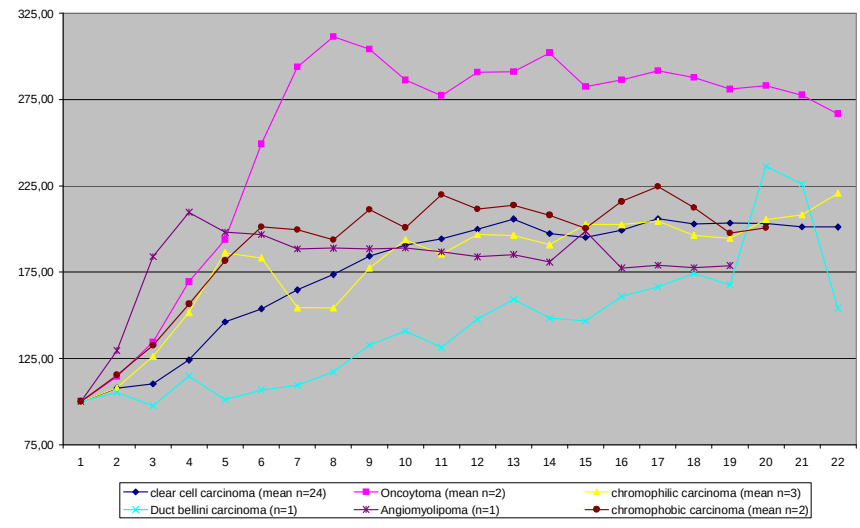

Fig. 1: Measurement of the perfusion of different renal cell carcinomas. (x: Number of sequence, time between sequences 3 sec.; y: Increase of Enhancement in percent (100% before contrast media injection))

In oncocytoma, the typical stellate central area was seen and perfusion was higher as compared with other tumors.

As expected, angiomyoliopoma was easily identifiable due to the fatty tissue.

Regarding the presence of cystic, necrotic and fatty areas, a heterogeneous distribution was found (Table 1) which did not allow for differentiation of the different histologic entities.

	Clear Cell (n=24)	Chromophobic (n=2)	Chromophilic (n=3)	Duct bellini (n=1)	Angiomyolipoma (n=1)	Onkocytoma (n=2)
Fatty	1				1	
Cystic	7		1			
Necrotic	8	1				1
Infiltrative growth	4	1		1		
Blood	3					
Size (mean, cm)	4,65		2,07	3	1,6	4,15
Size (range, cm)	1,2 - 10,0		1,1 - 2,1	-	-	2,2 - 6,1

Tab. 1: Distribution of fatty, cystic, necrotic areas in different renal cell carcinomas.

Conclusion:

The perfusion kinetics of various solid renal masses did not show any significant differences in contrast-enhanced MRI and therefore did not allow for specification of the tumor entity. Similarly, other criteria like presence of cystic areas, necrosis and even fat within the lesion did not give sufficient information to accurately differentiate the underlying histologic subtype of renal tumors.

Only in oncocytoma a tendency towards higher perfusion was noted, however due to the small number of oncocytoma in our series a final statement on this observation can not be made.