



ROLE OF IMAGING IN ASSESSMENT AND CHARACTERIZATION OF RENAL MASSES

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ABSTRACT

Early diagnosis of renal masses is essential for appropriate case management, differentiating benign from malignant renal masses and also identifying masses which need surgical intervention. Sonography is the first imaging modality to detect a renal mass lesion but it is operator dependent and should be followed by MDCT or MRI. The accuracy of Contrast Enhanced Multiphase Multidetector Computed Tomography in detecting and characterizing renal lesions is high with good sensitivity and specificity. However non-contrast MRI is the favoured modality because of lack of ionising radiation and can be used in patient with deranged renal function. In conjunction with conventional sequences and with added new sequences like DWI, MRI may provide qualitative and quantitative information which helps in confident and accurate diagnosis of renal lesions.

KEYWORDS : USG, MDCT, MRI, Renal cell carcinoma

Introduction

The incidence of renal masses has risen significantly over the past years with the increasing use of radiological imaging modalities. Majority of renal masses are renal cell carcinoma which account for 80 to 85% of primary renal tumours and approximately 3% of all malignancies in adults.^{1,2} Early detection of renal masses is essential for appropriate case management, differentiating benign from malignant renal masses and also identifying masses which need surgical intervention.³

The renal masses could be well characterized on USG and their extension can be assessed. Colour Doppler and Power Doppler imaging is performed to categorize the lesion further as this provides valuable information in diagnosis.⁴ Ultrasound has limitations, like lack of specificity and poor characterization of lesions, it cannot well delineate the renal vein / IVC involvement and supradiaphragmatic extension which is essential for staging.⁵

Multidetector Computerized tomography with iodinated contrast agents is the most common and valuable imaging modality for the evaluation of renal masses.^{6,8} Though definitive diagnosis can be confidently posed for many renal lesions by MDCT, a number of them remain indeterminate. Demerits of CT in renal imaging are that it cannot differentiate inflammatory masses which can give false impression of malignancy on CT Imaging.

Magnetic resonance (MR) imaging is a comprehensive modality for assessing the morphology and characteristics of renal lesions. It has advantages of being a multi-planar modality, uses no ionizing radiation, and can be used even in patient with deranged renal function. Accurate characterization of renal masses is essential to ensure appropriate case management and to assist in staging and prognosis. Correlating the anatomic findings and MR imaging signal intensity characteristics with the clinical features allows optimal diagnosis. MR imaging can be used to facilitate clinical management in patients with renal masses by depicting certain lesions that do not require treatment and suggesting specific surgical approaches for others.⁹

Accurate characterisation of patients with renal masses is essential to ensure appropriate clinical management, staging and prognosis. The purpose of our study was to evaluate role of USG, MDCT and MRI in assessment and characterization of renal lesions.

MATERIAL AND METHODS

This prospective study was done in the Department of Radiodiagnosis & Krsna diagnostic centre of M.G.M. Medical College, Indore, Madhya Pradesh after getting approval by our Institutional Scientific Review Board. A total of 50 patients referred to our department with strong clinical suspicion of a renal lesions were evaluated on ultrasound, CECT abdomen and MRI abdomen. The final study group comprised of 40 patients as some patients were excluded from the study because they lost follow up or lacked histopathology correlation.

USG Equipment

The USG was performed with Seimens Acuson equipped with convex probe (2-5 Hz).

CT Equipment

CT examination was performed on GE 128 multi slice CT scanner. Scan was done in plane arterial, corticomedullary, nephrographic and delayed phases and reformations were done in coronal sagittal and oblique section.

MRI Equipment

MRI examination was performed on 3 TESLA, 97 CHANNEL MAGNETIC RESONANCE IMAGING equipment using a dedicated body coil for imaging the kidneys. The sequences used were Axial T1W, Axial T1W fat sat, Axial T2W, Axial T2W fat sat, Coronal T2W, DWI and 3D LAVA.

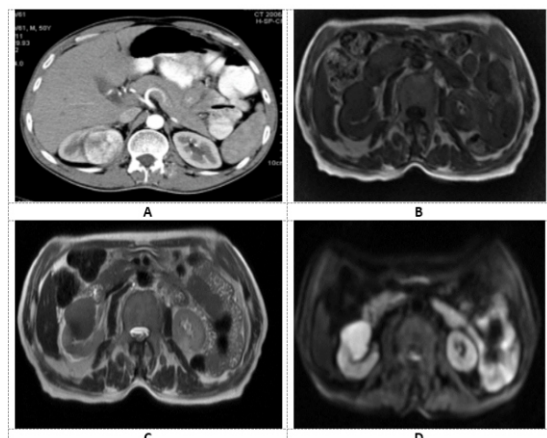


FIG: 1 Axial CECT and MRI images in a 50 year old male shows a lesion in right kidney. Axial Contrast enhanced CT shows homogeneously enhanced mass lesion (A). Axial MRI images shows a well-defined lesion in right kidney which is hypo-intense on T1 and T2WI (B and C) and shows restricted diffusion on DWI (D). Diagnosis- Renal Cell Carcinoma

Result

In our study most common age group of patients was 50-59 years (35%) with mean age of 50.7 years. The mean age of patients with benign lesions was 43.8 years and of patients with malignant lesions was 54.3 years. Majority of patients were males (26) constituting 65% of cases. 75% of patients in our study had unilateral lesions.

Table: 1 Classification of patients at various scans and follow up

S. No	Lesions	Ultrasound	MDCT	MRI	Follow Up
1.	Inflammatory	12% (5)	10% (4)	8% (3)	8% (3)
2.	Benign	33% (13)	30% (12)	22% (9)	27 (11)
3.	Malignant	55% (22)	60% (24)	70% (28)	65% (26)

On ultrasonography, less number of inflammatory lesions in our study can primarily be attributed to the fact that very few diagnosed cases in ultrasonography warranted further evaluation by MDCT and MRI examination.

On MRI, among the inflammatory lesions there were two cases (5%) of abscess and one of pyelonephritis. Angiomyolipoma was the most common benign lesion constituting 13% (5). Renal cell carcinoma was the most common malignant neoplasm (63%).

Follow up of all patients was done with surgery and histopathological correlation with either biopsy or FNAC and final diagnosis was made.

Discussion

The most common age group of patients was 50-59 years (35%). The mean age of patients with benign lesions was 43.8 years and of patients with malignant lesions was 54.3 years. Majority of patients were males (26) constituting 65% of cases. Thus majority of the malignant renal neoplasm (RCC, TCC, metastases) occurred after the age of fifty, especially in the sixth decades of life and are more common in males.

In our study out of the 5 lesions diagnosed as inflammatory in USG, 3 turned out to be actual inflammatory lesions. 2 cases of RCC was misdiagnosed as Renal Abscess on USG because they were very well defined and had more of necrotic component. Most of the malignant lesions on USG appear heterogeneously hypoechoic. Few of them show pseudocapsule which appeared as hypoechoic halo. 2 cases of malignant lesion were falsely diagnosed to be benign on USG. This gave a sensitivity of 73% for USG in predicting malignancy and specificity of 78% in detecting malignant lesions. The positive and negative predictive values of USG for predicting malignancy was 86% and 61% respectively.

On MDCT RCC was diagnosed as hypodense or mixed density lesion with post contrast enhancement with or without calcification or necrosis. On MDCT evaluation of these cases, Out of the 4 lesions diagnosed to be inflammatory on MDCT, 1 was benign complex cyst on follow up. While 2 cases of RCC's were missed by MDCT. The MDCT had a very good sensitivity and specificity of 84% and 86% for detecting malignancy. The positive and negative predictive values for predicting malignancy turned out to be 91% and 75% respectively.

On MR Imaging, renal abscesses show hypointensity on T1 weighted images and hyperintensity on T2-weighted images and shows restricted diffusion on DWI. Their walls are thick and show significant surrounding edema. There were 2 cases of abscess in our study.

On MRI simple cystic renal masses appeared homogenous, thin walled, hypointense on T1 and hyperintense on T2 weighted images. Complex cysts appeared thick walled and demonstrated internal septations, calcification or solid components. We had 3 complex cyst in our study out of which one was hemorrhagic complex cyst.

Angiomyolipoma was the most common benign lesion in our kidney constituting 13% (5) of lesions. On MRI lesions were hyperintense on T1 and T2-weighted images due to high lipid content and low signal intensity on fat-suppression sequence. Opposed-phase imaging shows a characteristic India ink artifact at the interface between the mass and the normal renal parenchyma⁴¹. There were 25 RCCs diagnosed on MRI, majority of lesions were isointense to hypointense on T1 weighted, heterogeneous on T2 weighted images and most of them showed restricted diffusion on DW MRI. Transitional cell carcinoma appeared iso to hypointense on T1 weighted images. T2 weighted images shows a hypointense filling defect in renal collecting system. Associated hydronephrosis is also noted. There were 2 cases of TCC in our study. Renal metastasis appeared hypointense on T1 and hyperintense on T2-weighted images with marked diffusion restriction. Only one case of renal metastasis was seen in our study with known primary of carcinoma lung.

On MRI Renal Vein thrombosis was seen in 12% (5) cases of RCC which was further confirmed on follow up. However MDCT was able to demonstrate Renal Vein thrombosis in 10% (4) cases and USG in only 3% (1) case. Nodal Metastasis was seen in 30% (12) cases on USG, 40% (16) cases on MDCT and 45% (18) cases on MRI. Liver metastasis was seen in 8% (3) cases on USG, while MDCT and MRI showed liver metastasis in 12% (5) cases. Other associated findings like lung metastasis could not be assessed on USG but MDCT and MRI shows equal results that is 12% (5) of cases.

The morphological characteristics of T1W and T2W images with DWI, The sensitivity, specificity, PPV and NPV of non-contrast MRI was 96%, 78%, 89% and 92% respectively. In conjunction with conventional sequences and with added new sequences like DWI, MRI may provide qualitative and quantitative information which helps in confident and accurate diagnosis of renal lesions.

Conclusion

Sonography is the first imaging modality to detect a renal mass lesion. It is widely available, uses no ionizing radiation, is relatively inexpensive and quick to perform, but is operator dependent and should be followed by MDCT or MRI. The accuracy of Contrast Enhanced Multiphase Multidetector Computed Tomography in detecting and characterizing renal lesions is high and it should be considered in the imaging work up of any patient with renal complaint. However non-contrast MRI is the favoured modality because of lack of ionising radiation and can be used in patient with deranged renal function. MRI helps in pre-operative characterisation of renal neoplasms into benign/malignant. It is imperative to establish a correct preoperative diagnosis to reduce the unnecessary surgeries for benign renal lesions, and also to avoid missing a malignant lesion.

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