Original Research Article

Role of computed tomography in characterization of renal masses at a tertiary center

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Abstract

Background: Accurate assessment of the morphology of renal tumors, perinephric space, regional lymph nodes, major vessels and adjacent organs can guide clinician to correct treatment from the available options. In present study, we assessed role of computed tomography in characterization of renal masses at a tertiary center. **Material and Methods:** Present prospective, observational study was conducted in patients of any age group, with suspected renal mass on clinical examination, confirmed on USG examination or an incidental renal mass diagnosed on USG/CT examination. **Results:** During study period 43 patients with renal mass underwent radiological evaluation in present study. Mean age was 51.6 ± 11.4 years. 27 patients were male and 16 were females and mean longest diameter of renal mass was 5.7 ± 1.9 cms with range of 3.8 – 8.7 cms. Most of renal masses were malignant (86.84 %) while benign lesions were less (13.16 %). Renal cell carcinoma (74.42 %) was most common diagnosis of renal mass in present study. Other diagnosis were renal angiomyolipoma (9.3 %), transitional cell carcinoma (4.65 %), Wilms tumor (4.65 %), metastasis (4.65 %) and Bosniak II cyst (2.33 %). Out of 38 malignant lesions, common local extent noted were beyond perirenal fascia (28.95 %), perinephric extension (23.68 %) and pelvicalyceal involvement (13.16 %). Other less common local extent were regional lymphadenopathy (13.16%), renal vein thrombus (10.53%), IVC thrombus (7.89 %) and ipsilateral adrenal involvement (5.26 %) **Conclusion:** Computed tomography is a very important tool for assessment of renal masses either for diagnostic purpose or for preoperative evaluation.

Keywords: computed tomography, renal masses, renal carcinoma, contrast CT

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INTRODUCTION

Several renal lesions are frequently encountered in clinical practice. Improvement in imaging modalities continues to have a large impact on the diagnosis and treatment of solid renal masses. Benign tumours account for approximately 20% of all solid renal cortical tumours, and renal oncocytoma is the most common solid tumour type.[1] Non-neoplastic renal masses include inflammatory pseudotumours with and without abscess formation, renal infarct, haematoma and replacement lipomatosis with coexistent xanthogranulomatous pyelonephritis.[1,2] Overall, up to 66% of the small renal masses <4 cm are incidentally found.[2] Because up to 20% of the solid small renal masses <4 cm are benign, warranting conservative management, preoperative imaging should aim to differentiate benign from malignant tumors.[2,3] The wide range of radiological investigations in the evaluation of renal lesions varies from plain abdominal radiograph,

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excretory urography, ultrasonography, radionuclide imaging, angiography, CT and MRI. Ultrasonography are the most commonly used technique worldwide owing to its convenience, low cost, and portability, allowing its use in the operating room.[4] For various treatment modalities of renal masses (surgical resection, interventional techniques like arterial embolisation, chemotherapy, radiotherapy or combinations) correct preoperative evaluation of renal tumors is very important. Accurate assessment of the morphology of renal tumors, perinephric space, regional lymph nodes, major vessels and adjacent organs can guide clinician to correct treatment from the available options. In present study, we assessed role of computed tomography in characterization of renal masses at a tertiary center.

MATERIAL AND METHODS

Present prospective, observational study was conducted in the department of Radiodiagnosis, at Department of Radiology, MGM Medical College, Aurangabad. Study duration was of 1 year (from July 2019 to June 2020). Present study was approved by institutional ethical committee.

Inclusion criteria

Patients of any age group, with suspected renal mass on clinical examination, confirmed on USG examination or an incidental renal mass diagnosed on USG/CT examination, willing to participate in study

Exclusion criteria

Patients with post renal surgery patients, pregnant women, history of allergy to intravenous contrast agents, patients with deranged kidney function tests, Study was explained and written informed consent was taken from all patients. Demographic data, clinical history, examination findings, laboratory investigations were noted. Ultrasonography using 3MHz convex transducer TOSHIBA AQUILLON 64 SLICE followed by Computed tomography. A plain tomogram was taken as a guide/reference from diaphragm to pelvis. Images were acquired with 1- to 3-mm collimation, and a pitch of up to 2:1 to allow coverage of the area of interest in single breath-hold. CT protocol for evaluation of the kidneys consists of both non-enhanced and contrast-enhanced CT scans obtained in suspended respiration, to overcome the motion artifact. After taking unenhanced CT scan, oral as well as intravenous contrast was used for the study. For intravenous contrast Iopamidol 300 was used, as 300 mg of iodine/kg body weight, intravenously in a bolus dose (about 80ml) in adults. In children Iopamidol 300 was given in the dose of 1.6ml/kg body weight intravenously. Oral contrast given about 1-2 hours prior to the CT examination. About 1000-1500 cc. of diluted solution of flavored iodinated water-soluble contrast was given to orally, followed by 250 cc. of the same solution orally, immediately before the CT scanning. Data was collected and entered in Microsoft excel. Statistical analysis was done using descriptive statistics.

RESULTS

During study period 43 patients with renal mass underwent radiological evaluation in present study. Mean age was 51.6 ± 11.4 years. 27 patients were male and 16 were females and mean longest diameter of renal mass was 5.7 ± 1.9 cms with range of 3.8 – 8.7 cms.

Table 1: General characteristic

Variable	Present study
No. of patients	43
Age range (years)	16 – 71
Mean age (years)	51.6 ± 11.4
Male/female	27 / 16
Longest diameter of renal mass (mean in cms)	5.7 ± 1.9
Range (in cms)	3.8 – 8.7

Most of renal masses were malignant (86.84 %) while benign lesions were less (13.16 %). Renal cell carcinoma (74.42 %) was most common diagnosis of renal mass in present study. Other diagnosis were renal angiomyolipoma (9.3 %), transitional cell carcinoma (4.65 %), Wilms tumor (4.65 %), metastasis (4.65 %) and Bosniak II cyst (2.33 %).

Table 2: Diagnosis of renal mass

Diagnosis on CT	Number of cases (n=43)	Percentage
Renal cell carcinoma	32	74.42
Renal Angiomyolipoma	4	9.3
Transitional cell Carcinoma	2	4.65
Wilms tumor	2	4.65
Metastasis	2	4.65
Bosniak II cyst	1	2.33

Out of 38 malignant lesions, common local extent noted were beyond perirenal fascia (28.95 %), perinephric extension (23.68 %) and pelvicalyceal involvement (13.16 %). Other less common local extent were regional lymphadenopathy (13.16 %), renal vein thrombus (10.53%), IVC thrombus (7.89 %) and ipsilateral adrenal involvement (5.26 %)

Table 3: Evaluation of local extent

Local Extent	Number of cases (n=38)	Percentage
Beyond perirenal fascia	11	28.95
Perinephric extension	9	23.68
Pelvicalyceal involvement	5	13.16
Regional Lymphadenopathy	5	13.16
Renal vein thrombus	4	10.53
IVC thrombus	3	7.89
Ipsilateral adrenal involvement	2	5.26

DISCUSSION

CT has a profound impact on diagnostic uroradiology among all modern modalities. It has proven useful for imaging the complete spectrum of renal and ureteral disorders. It allows studies in patients who have dense renal calcification or in whom USG is technically difficult. Helical CT is highly sensitive in diagnosing and staging of renal masses. CT is done in four phases viz., unenhanced, corticomedullary, nephrographic and excretory phase especially in cases of malignancy while benign conditions like angiomyolipoma, abscess evaluation with unenhanced and single-phase post contrast in portovenous phase is sufficient.[5] The corticomedullary phase (CMP; 25–40 seconds after injection) is used to assess tumor enhancement. During the nephrogenic phase (NP; 100–200 seconds after injection), the tumor contrast washout becomes visible and provides information on possible tumor thrombus in the renal and caval vein. CT is capable of detecting tumor invasion of perinephric fat and adjacent muscles, which cannot usually seen by ultrasound. While both CT and ultrasound demonstrate venous and retroperitoneal tumor extension, CT is more reliable.[6] Swarupa Rani[7] studied 33 cases of renal masses between age group of 22-82 years. There were 19 males and 13 females. 16 patients presented with hematuria, 11 patients with loin pain, 4 patients with weight loss, 1 with fever and 1 patient was asymptomatic. 33 lesions were detected in 32 patients. Of these, 30 lesions were neoplastic lesions of which majority of the neoplastic lesion comprised of Renal cell carcinoma (22 cases), Transitional cell carcinoma (3 cases), Angiomyolipoma (1 case), Renal oncocytoma (1 case), Renal metastasis (1 case), Renal abscess (1 case) and 3 lesions were cystic lesions. Similar findings were noted in present study. In study by NVK Sundeep *et al.*,[8] out of 40 cases, 70% were diagnosed to be malignant and 30% cases were diagnosed benign. The most common renal mass was renal cell carcinoma accounting for 60% of all the renal masses and 85% of the malignant renal masses. Overall there were male to female ratio was 1.85:1. MDCT was able to differentiate a benign from malignant lesion with Sensitivity of 100%, Specificity of 85.71%, Positive predictive value of 92.85% and Negative predictive value of 100% was achieved. The characteristics of malignant renal mass such as perinephric extension, invasion of Gerotas fascia, renal vein / IVC, lymph node extension, extension to adjacent organs and distant metastases can be exactly identified by MDCT with various reconstructions which is very useful for staging of lesions. In study by Satish Patil,[9] attenuation values and enhancement pattern of renal masses during unenhanced, corticomedullary and nephrographic phases were analysed. No statistically significant differences ($p > 0.05$) in enhancement were noted for the radiologically benign cysts when the corticomedullary and nephrographic phases were compared. The normal renal cortex demonstrated greater enhancement in nephrographic phase (mean - 137 ± 9 HU) than in corticomedullary phase (mean -122± 15 HU). They concluded that MDCT protocol for evaluation of renal masses should include unenhanced, corticomedullary and nephrographic phases for better detection and characterization of renal masses. Differentiation of renal lesions is limited for non-enhanced CT due to its low soft-tissue contrast. The use of contrast agents improves the detection and discrimination of different RCC subtypes using multiphasic CT[10] and magnetic resonance imaging (MRI). [11] As the most used diagnostic modality, CT is able to differentiate the most common type of angiomyolipoma from malignant entities. Larger tumors can usually be identified as clear cell renal cell carcinoma (ccRCC), and when appearing as typical lesions, papillary RCC may be differentiated from ccRCC.[12] MDCT with good reformatting techniques has excellent sensitivity and specificity in the detection, characterization and staging of renal masses.[8] General limitations of CT are the use of ionizing radiation and nephrotoxic iodine contrast agents; however, a recently published meta-analysis suggests that not the administration of contrast agents, but other patients- and illness-level factors contribute to the development of AKI after CT.

CONCLUSION

Dedicated diagnostic renal imaging is important for characterization of renal tumors to facilitate treatment planning. Computed tomography is a very important tool for assessment of renal masses either for diagnostic purpose or for preoperative evaluation.

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