Research Article

Study to find the efficiency of multi-detector computed tomography in evaluation of renal masses

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Abstract

Introduction: Detection of malignant renal masses and their differentiation from their benign counterparts is extremely important, especially when these masses are small. Although the effectiveness of conventional axial renal CT is well established, a variety of problems can be encountered. The major advantages of the multiple detector-row computed tomography (MDCT) technology over conventional CT is that it allows for acquisition of different image thicknesses from the same acquisition data set. Thus the present study was undertaken to study the efficiency of MDCT in diagnosing renal masses. **Aims and Objective:** To find out the efficiency of Multi-detector Computed Tomography in the evaluation of renal masses. **Materials and Method:** The study was conducted over a period of two years on 50 patients with clinically suspected Renal mass or patients who were diagnosed to have renal mass on ultrasound and were referred to CT for further characterization. **Results:** Overall there were 33 (66%) males and 17 (34%) females; the male to female ratio was 1.9:1.thus renal neoplasm was seen more commonly in males. MDCT was able to differentiate a benign from malignant lesion with Sensitivity of 100, Specificity of 71 %, and Accuracy of 96 %. When the images were assessed in unenhanced, corticomedullary and nephrographic phases. **Conclusion:** Multi-detector Computed Tomography can be used as an efficient tool with high degree of accuracy in diagnosing renal masses.
Keywords: renal masses, Multi-detector Computed Tomography, Sensitivity, specificity, accuracy.

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INTRODUCTION

Detection of malignant renal masses and their differentiation from their benign counterparts is extremely important, especially when these masses are small. Despite recent advances, most renal adenocarcinomas are relatively unresponsive to chemotherapy and radiation therapy. Surgery of low stage lesions remains the only hope for long term survival or cure. Although the effectiveness of conventional axial renal CT is well established, a variety of problems can be encountered. The major advantages of the multiple detector-row computed tomography (MDCT) technology over conventional CT is that it allows for acquisition of different image thicknesses from the same acquisition data set. Moreover, its increased speed, thin collimation, large volume, and extreme flexibility provide additional superiority over single slice helical CT. High-quality interactive multi planar and three-dimensional (3D) image reconstructions require the generation of almost isotropic voxel achieved by the increase in spatial resolution along the *z*-axis. The speed of MDCT allows imaging of organs in clearly defined perfusion phases. The high-spatial resolution of MDCT leads to an improvement in the detection and characterization of small kidney lesions[1]. Slip-ring scanning allows acquisition of a volumetric data set in 24-32 sec, so that

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the kidneys can be imaged in a single breath hold. Misregistration because of motion is reduced because of the fast scan speed, although tube cooling considerations result in a "noisier" image than would be provided by conventional CT scanning. Overlapping intervals and the lack of Misregistration artifacts make it possible to discriminate lesions smaller than 1 cm as cystic versus solid. In addition to retrospective centering of a mass by reconstruction, helical CT also offers the option of using very thin sections (1.5-3 mm) through the lesion[2]. Thus the present study was undertaken to study the efficiency of MDCT in diagnosing renal masses.

AIMS AND OBJECTIVE

To find out the efficiency of Multi-detector Computed Tomography in the evaluation of renal masses.

MATERIALS AND METHODS

Study Design

Data for the study was collected from patients attending the department of Radio Diagnosis of teaching hospitals attached to Bangalore Medical College, Bangalore (viz. Victoria Hospital, Bowring and Lady Curzon Hospital and Institute of Nephro-Urology) with clinically suspected Renal mass. The study was conducted over a period of two years on 50 patients with clinically suspected Renal mass or patients who were diagnosed to have renal mass on ultrasound and were referred to CT for further characterization. They presented with symptoms of fever, abdominal pain, hematuria or weight loss. Patients were evaluated with Multi-detector Computed Tomography (SIEMENS SOMATOM EMOTION 6). A provisional diagnosis was suggested after the CT examination and these findings were correlated with histopathology/ surgical findings as applicable. Following inclusion and exclusion criterion was used to select the study population:

Inclusion criteria:

1. All patients with clinically suspected renal mass.

Exclusion criteria:

1. Simple cysts are not included in the study.
2. Extra renal masses invading the renal parenchyma are excluded from the study.

The finding of MDCT and demographic details of all the patients was recorded on a pre-structured proforma.

Statistical analysis:

The data obtained was tabulated accordingly. Sensitivity, specificity, positive and negative predictive value and accuracy of MDCT was calculated where ever required.

RESULTS

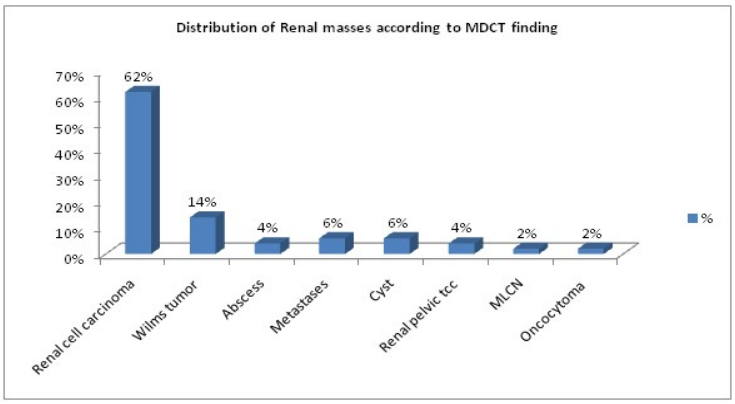
Table 1: Age distribution of patients studied

Variable	Frequency (n=50)	Percentage	
Age	<10 yrs	8	16.0
	30-39 yrs	3	6.0
	40-49 yrs	1	2.0
	50-59 yrs	11	22.0
	60- 69 yrs	27	54.0
Sex	Male	32	64.0
	Female	18	36.0

It was observed that majority of the patients were more than 50 years of age. And majority of the patients were male (64%).

Table 2: Distribution of Renal masses according to MDCT finding.

Diagnoses	Total number of patients	Percentage
Renal cell carcinoma	31	62
Wilms tumor	07	14
Abscess	02	4
Metastases	03	6
Cyst	03	6
Renal pelvic TCC	02	4
MLCN	01	2
Oncocytoma	01	2
Total	**50**	**100**



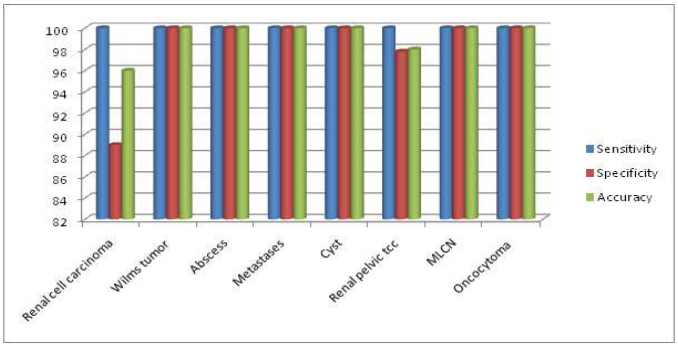
The findings of Multi-detector Computed Tomography were recorded and it was observed that renal cell carcinoma was found in 62% ceases. It was followed by wilms tumor. Metastasis and cyst was diagnosed in 6% ceases each.

Table 3: Sensitivity and Specificity of MDCT for renal masses

Diagnosis	True Positive	False Positive	False Negative	True negative	Total
Renal cell carcinoma	31	2	0	17	50
Wilms tumor	7	0	0	43	50
Abscess	2	0	0	48	50
Metastases	3	0	0	47	50

Cyst	1	0	0	49	50
Renal pelvic TCC	3	1	0	46	50
MLCN	1	0	0	49	50
Oncocytoma	1	0	0	49	50

DIAGNOSIS	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
Renal cell carcinoma	100.0	89.0	93.9	100.0	96.0	<0.001**
Wilms tumor	100.0	100.0	100.0	100.0	100.0	<0.001**
Abscess	100.0	100.0	100.0	100.0	100.0	<0.001**
Metastases	100.0	100.0	100.0	100.0	100.0	<0.001**
Cyst	100.0	100.0	100.0	100.0	100.0	<0.001**
Renal pelvic tcc	100.0	97.8	75.0	100.0	98.0	<0.001**
MLCN	100.0	100.0	100.0	100.0	100.0	<0.001**
Oncocytoma	100.0	100.0	100.0	100.0	100.0	<0.001**



In our study all the diagnosis of MDCT were confirmed by histopathology. It was observed that MDCT was 100% sensitive in diagnosing renal cell carcinoma whereas specicity was 89%. The diagnosis was accurate in 96%caess with it was statistically significant. MDCT was 100% sensitive, specific and accurate in diagnosing Wilms tumor, abscess, metastasis, cyst, MLCN and oncocytoma. In diagnosing renal pelvic transitional cell carcinoma MDCT was 100% sensitive and 97.8% specific. Accuracy of diagnosis was 98%.

Table 4: Sensitivity and Specificity of MDCT in diagnosing malignant lesion

Final diagnosis	Radiologic diagnosis		Total
	Malignant	Benign	
Malignant	43(TP)	0(FN)	43
Benign	02(FP)	05(TN)	7
Total	**45**	**5**	**50**

Sensitivity: 100 %, Specificity=71 %, PPV=95.5%, NPV=100%, Accuracy=96.0% MDCT was 100% sensitive in diagnosing the malignancy. But was only 71% specific in diagnosing malignancy with accuracy of 96%. Out of two false positive cases in our study oncocytoma was misdiagnosed as renal cell carcinoma.

DISCUSSION

The present prospective study was carried out with the objective to find out the efficiency of Multi-detector Computed Tomography in the evaluation of renal masses. In our study out of total 50 cases studied, 32 males and 18 females (age range from 4 to 69 years). The maximum percentage of patients was in the age range of 60 to 69 years (54%). Our findings are similar to the findings of Gudbjarston *et al*[3] who have described the incidence and distribution of renal cell cancer on a large population and have found that diagnosis of RCC peaks in 6th through 8th decade with a male to female ratio of 2.5:1. There were 43 (86%) malignant and 07 (14%) benign renal masses. Renal cell carcinoma (n =21) accounted for 62% of all renal masses and 72% of malignant renal masses, Transitional cell carcinoma (n=02), Wilm's tumour (n=07), Metastases (n=03), Cysts (n=03) including one complex Renal cyst, Abscess (n=02), MLCN (n=01) and Oncocytoma(n=01). Similar finding were also reported by Smith *et al*[4] and Bajwa *et al*[5] The sensitivity of MDCT in diagnosing renal masses was 100% in our study. Whereas specificity was 100% in diagnosing Wilms tumor, abscess, metastasis, cyst, MLCN and oncocytoma. In cases of renal cell carcinoma specificity was 89%. In diagnosing renal pelvic transitional cell carcinoma MDCT was 100% sensitive and 97.8% specific. Accuracy of diagnosis was 98%. Out of two false positive cases in our study oncocytoma was misdiagnosed as renal cell carcinoma due to its heterogenous pattern with increased density on unenhanced scan and significant enhancement in the corticomedullary and nephrographic phase. The other case was of complex renal cyst which was again mistaken for malignant lesion due to its higher attenuation value of 29 H U on unenhanced scan and significant contrast enhancement, the diagnosis of high attenuation complex renal cyst was confirmed on histological examination post operatively. Using the region of interest technique for differentiating benign from malignant renal masses on pre and post contrast images 100% Sensitivity, 71% Specificity, 95.5% PPV, 100% NPV and 96.0% Accuracy was achieved. Zagoria *et al*[6] reported sensitivity of 95.2%, specificity of 100 % and accuracy of 97.2% in their study. The higher sensitivity in our study is because, we compared the CMP and NP phase to the UE phase and increase in 20 HU was taken as malignant. Since the inclusion of cases was done

for suspicious lesions of malignancy and the renal pathologies of certainty of benignity were excluded the specificity of our study was lower compared to that of Zagoria *et al* study. The results of our study are very much similar to the Kopka *et al*[7] study (sensitivity=100%, specificity=95%, PPV= 96%, NPV=100% and accuracy of 96%) who have evaluated the combination of UE, CMP and NP in detection and characterization of renal masses. The lower specificity in our study is primarily due to the smaller number of cases included in our study i. e 50 and compared to that of Kopka *et al* study(*n*=173).we misinterpreted 2 benign lesions as malignant ,where as Kopka *et al* had misdiagnosed 4 cases as malignant. Garant *et al*[8] in their study reported 100% sensitivity and 88% specificity in diagnosing renal cell carcinoma. These findings are correlating with our study. In both studies RCC displayed more than 20 HU enhancements on contrast administration. The higher attenuation value in the CMP of Garant *et al* study is due to the increased volume of contrast used. Both the studies have achieved 100 sensitivity in diagnosing the renal cell carcinoma. Thus using an absolute value of 20 HU as cut off solid vascular neoplasm's can be diagnosed with 100% sensitivity on MDCT scan.

CONCLUSION

In our study we conclude that Multi-detector Computed tomography can be used as efficient tool with high degree of accuracy in diagnosing renal masses

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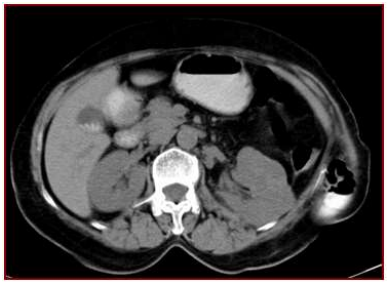

Image 1: Renal cell carcinoma (soft tissue exophytic mass in left kidney)

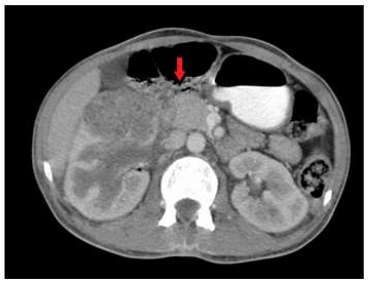

Image 2: stage III Renal cell carcinoma (Enhancement with infiltration in the 2nd part of duodenum (red arrow) and right psoas)

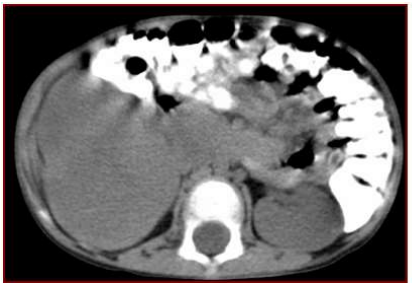

Image 3: Wilms tumor

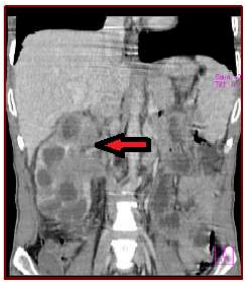

Image 4: Renal pelvic TCC

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