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Radio Diagnosis

ROLE OF MULTI DETECTOR COMPUTED TOMOGRAPHY IN EVALUATION OF RENAL MASSES

Dr. Roja Dwarampudi* Post graduate, Deparment of Radiodiagnosis, Asram Medical college, Eluru-534004 *Corresponding Author

Dr. S. Venkateswar Rao Professor & HOD, Department of Radiodiagnosis, Asram Medical college, Eluru-534004

ABSTRACT

Introduction: Renal cell carcinoma is the most common malignancy of kidney. This tumor accounts for 2% of all cancer diagnoses in humans. Early detection and characterization is required with cross sectional imaging modalities as renal cell carcinoma remains resistant to the chemotherapy and radiotherapy. MDCT with its speed, easy availability and multiplanar reformatting capabilities has emerged as the single most useful tool for characterization of renal masses. This study is an attempt to evaluate role of MDCT in characterization and diagnosing renal masses.

Objectives: 1. To characterize benign vs malignant renal lesions based on CECT image analysis 2. To stage wherever possible

Materials and methods: This study of multi detector computed tomographic evaluation of suspected renal masses was conducted on 100 patients at Department of Radio diagnosis, ASRAM medical college, ELURU. All scans in this study were performed using CT scanner GE Revolution ACT.This study was carried out for a period of 2 years from July 2018 to March 2020

Results: MDCT was able to differentiate benign and malignant lesion with Sensitivity of 100% and Specificity of 71%

KEYWORDS : CT- computed tomography, MDCT- multi detector computed tomography

INTRODUCTION

Detection of malignant renal masses and their differentiation from benign masses is extremely important, especially when these masses are small. CT is the most sensitive imaging modality for detection of renal masses, and it also plays an effective role in characterizing renal masses as solid lesions, simple cysts, or complex cysts. Although the effectiveness of conventional axial renal CT is well established, a variety of problems can be encountered. Variations in patient respiration can cause motion artifacts or gaps in scanning.

Advantage of helical CT over conventional CT is rapid continuous scanning allows an entire sequence to be obtained during a single breath hold. Scanning during a single breath hold also prevents misregistration, eliminating the chance that portions of the kidneys (and therefore renal masses) might not be imaged.

The rapid scanning time of helical CT also permits renal imaging during any of the three phases of renal parenchymal contrast material enhancement: cortical phase, nephrographic phase or excretory phase.

Intravenous contrast should be judiciously administered since there is always a risk of anaphylactic reaction or even death.

In patients with renal dysfunction, there is also the risk of contrast-induced nephrotoxicity, which may result in temporary renal insufficiency, permanent renal failure, or even death[2].

The selection of intravenous contrast also has several considerations. For many years, high-osmolar contrast was the standard of care. Research demonstrated reduced nephrotoxicity of low-osmolar contrast compared with high-osmolar agents[3]

The major advantages of the multiple detector-row computed tomography (MDCT) technology allows for acquisition of different image thicknesses from the same acquisition data set. The high-spatial resolution of MDCT leads to an improvement in the detection and characterization of small kidney lesions[1]

METHODOLOGY

Study population: All patients referred to department of radio diagnosis, asram with suspected renal mass, in a period of 18 months from july 2018 to march 2020 were subjected for study.100 cases of renal masses were studied

Inclusion criteria: All patients with clinically suspected renal masses

Exclusion criteria:

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

RESULTS

Maximum number of patients are between 60-69 years

There was a male preponderance in my study

Majority of the complaints are hematuria, pain and abdominal discomfort Renal cell carcinoma is the most common malignant renal mass and most common calcified renal mass in my study Most of the renal masses are seen on right side

CT DIAGNOSIS	NO OF CASES
Renal cell carcinoma	62
Wilms tumor	14
Renal abscess	04
Renal metastases	06
Renal cyst	06
Renal pelvis transitional cell carcinoma	04
Multilocular cystic nephroma	02
Renal oncocytoma	02
Total	100

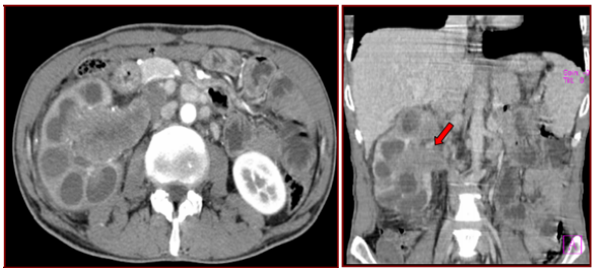
Sensitivity and specificity of MDCT for renal masses

Diagnosis	True positive	False positive	False negative	True negative	Total patients
Renal cell carcinoma	62	4	0	34	100
Wilms tumor	14	0	0	86	100
Abscess	04	0	0	96	100
Metastases	06	0	0	94	100
Cyst	2	0	0	98	100
Renal pelvis TCC	6	2	0	92	100
MLCN	2	0	0	98	100
Oncocytoma	2	0	0	98	100

CT appearance of Renal pelvic TCC

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 pelvis 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

CECT shows enhancing soft tissue density mass filling the entire right pelvicalyceal system(red arrow) causing proximal hydronephrosis.



DISCUSSION AND ANALYSIS

100 patients with renal masses are evaluated.
Age of the patients ranged from 1 year to 69 years.
Male predominance is seen.

Hematuria and abdominal pain are most common complaints.

In our study, out of total 100 cases studied, 64 males and 34 females, there were 86(86%) malignant and 14(14%) benign renal masses.

Renal cell carcinoma(n=62) accounted for 62% of all renal masses and 72% of malignant renal masses, Transitional cell carcinoma(n=04), Wilm's tumour (n=14), Metastases(n=06), Cysts (n=06) including one complex Renal cyst, Abscess(n=04), MLCN (n=02) and Oncocytoma(n=02).

Smith et al [4] successfully scanned 17 consecutive patients (10 men and seven women) 38-78 years old with suspected renal masses. Renal masses were confirmed by surgery, renal biopsy or follow-up. The final diagnoses included renal cell carcinoma (***n***= 10), transitional cell carcinoma ***(n =1).*** angiomyolipoma *(n =1)*. Complicated renal cyst **(*n*** = 2) and pyelonephritis **(*n*** = *1*).

Renal cell carcinoma is the most common calcified renal mass in my study. Calcification was present in 22 out of 62 cases of RCC(35%)

Renal transitional carcinoma when, located in the renal pelvis and ureter, was associated with hydronephrosis(50%).

Necrosis is more in malignant renal masses when compared to the benign renal masses(58% in RCC and 100% in Wilms tumor).

Renal vein invasion was seen in 19.5% cases of RCC and, in 2 out of 14(14%) cases of Wilms tumor both were malignant masses, whereas none of the benign renal masses showed renal vein invasion.

4 out of 62(58%) cases of RCC showed inferior venacaval thrombosis.

Lymph nodes are the most common site of metastases from renal cell carcinoma (41.9%)followed by lungs16.1%) and Appendicular skeleton(09%)

The most common site of metastases from Wilms tumor was to lymph nodes(28%) and lungs(14%)

Involvement of Renal vein, adrenals, lungs and, Appendicular skeleton was not present in benign masses.

Verhoest G et al[6] in their study have found that the incidence of renal cell carcinoma was 6% in <40y,38.5% in 40-60y,52.3% in 60-80y and 3.2% in >80y . This correlates well with our study where the maximum percentage of patients were seen in 60-69y.

Zagoriaet al reviewed the CT appearances of 78 pathologically proven RCCs. Of the 61 RCCs larger than 50 mm (78%) there was imaging evidence of extrarenal spread (87%), intratumoral necrosis (61%) and differential growth rates within the tumor (64%).

Tumors 50 mm or smaller often had a "benign" appearance with sharp, rounded margins (88%), homogeneous density (65%), and distinct interface with the kidney (82%). The significance of these lesions should not be underestimated. Although RCCs often showed transient marked enhancement after bolus contrast material injection (41%), during the infusion phase 97% were hypodense compared with the kidney regardless of tumor size. Calcifications were visible in 31% of RCCs. Although 22% of RCCs were predominantly cystic, none fulfilled all CT criteria of simple renal cysts[5]

In my study, on pre contrast scans the benign renal masses had an attenuation value of 16.8HU whereas, the malignant renal masses showed a higher attenuation value of 28HU.

Mean attenuation value of benign renal masses in corticomedullary phase was 25.29HU and that of malignant masses was 56.02HU

Mean attenuation value of benign renal masses in Nephrographic phase was 35.57 HU and, that of malignant masses was 73.70 H U.

Benign renal masses showed a mean increase of 8.5 HU in the corticomedullary phase, whereas malignant renal masses showed a significant increase of 28.02HU.

Benign renal masses showed a mean increase of 16.8 HU in the nephrographic phase, whereas malignant renal masses showed an increase of 45.69 HU.

CONCLUSION

Out of 100 cases, 86 are malignant (86%), and 14 cases are benign(14%).The most common renal mass was renal cell carcinoma accounting for 62% of all renal masses and 72% of all malignant renal masses Overall there were 66 (66%) males, and 34 (34%) females, the male to female ratio was 1.9:1. Thus renal neoplasms are seen more commonly in males.

MDCT differentiates benign and malignant lesion with Sensitivity of 100%, Specificity of 71% and Accuracy of 96% when the images were assessed in unenhanced, corticomedullary and nephrographic phases.Renal cell carcinomas showed heterogenous contrast enhancement with an increase of more than 20HU. The maximum difference in density is seen between unenhanced and nephrographic phase than unenhanced and corticomedullary phase which indicate that malignant renal masses show significant enhancement in corticomedullary and nephrographic phase due to their high vascularity.

The advantages of MDCT include : (a) the use of contiguous single breath- hold data acquisition, thereby decreasing or eliminating respiratory motion artifacts *(b)*the ability to perform thin-section scanning with small-interval reconstruction, which decreased partial volume artifacts and increased sensitivity of lesion detection.

The minor limitations noted in the current study are limited number of cases evaluated, resulting in significant reduction (71%) in achieving the higher specificity. Thus, MDCT with good reformatting techniques has excellent accuracy in the detection and charaterisation of renal masses.

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