ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 09 | September - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A STUDY FOR ROLE OF IMAGING IN RENAL MASS LESIONS IN ADULTS"

Radio-Diagnosis

Dr. Hiralben M Chaudhari* Assistant Professor, Dept. Of Radiology, Govt. Medical College, Surat. *Corresponding Author

Dr. Kaushik Chaudhari Consultant Radiologist, Horizon Scan, Zenon Complex, Khatodara.

Dr. Nishitkumar Devalia Tutor, Dept. Of Radiology, Govt. Medical College, Surat.

ABSTRACT

Renal cell carcinoma is the most common malignancy of the kidney, this tumor accounts for 2% of all cancer diagnoses in humans. There is a need for early detection and characterization with cross sectional imaging modalities as renal cell carcinoma remains resistant to the chemotherapy and radiotherapy. Ultrasound, Multi-detector computed tomography and magnetic resonance imaging has emerged as the useful tools for characterization of renal masses. This study is an attempt to evaluate role of imaging in characterization and diagnosing renal masses. **Summary:** MDCT is used as a most useful tool in the preoperative diagnosis and staging of renal masses with USG and MRI can be used as additional imaging whenever needed. Imaging will not always provide one to arrive at definitive diagnosis, attention to these findings provide a road map to guide image interpretation.

KEYWORDS

Renal cell carcinoma, Angiomyolipoma, Oncocytoma, MDCT, MRI.

INTRODUCTION

Detection of malignant renal masses and their differentiation from their benign counterparts is extremely important, especially when these masses are small.

X rays of the urinary tract can help highlight a kidney stone and x rays of chest & skeletal can help to find out metastatic lesions from the malignancy of kidney.

On IVP expansile masses causes contour abnormality, calyceal splaying, stretching and draping.

Ultrasound is easily available, inexpensive study without exposure to ionizing radiation. Ultrasound can help to differentiate solid from cystic masses of urinary tract.

CT is the most sensitive imaging modality for detection and characterizing renal masses as solid lesions, simple cysts, or complex cysts, further differentiating the last group into six categories based on the likelihood of a complex cyst being malignant.

MRI is now almost superior to CT in detecting and characterizing renal masses. However, because CT is less expensive, quicker and more generally available, renal MRI is mainly used for evaluating patients in whom CT findings are equivocal or in whom contrast enhanced CT is contraindicated because of previous reaction to intravenous iodinated contrast medium or the presence of renal failure.

Nuclear Scintigraphy: FDG PET has reported sensitivity for detection of renal malignancy in the range of 40-94 percent.

Aims And Objectives:

To find out the role of imaging in the evaluation of renal masses with respect to:

- To study the age and sex incidence of various renal mass lesions.
- To evaluate the role of radiology in diagnosis of various renal mass lesions in adults.
- To compare the sensitivity and specificity of various modalities & finding in diagnosis of renal mass lesions.
- To perform differential diagnosis.
- To arrive at histopathological diagnosis.

MATERIALAND METHODS

Data for the study was collected from patients attending the department of Radio Diagnosis of New civil hospital, Surat with clinically suspected Renal mass. A prospective study was conducted over a period of two years (July 2020 to December 2021) on 100 patients with clinically suspected Renal mass or patients who were diagnosed to have renal mass were referred for further characterization. They presented with symptoms of fever, abdominal pain, hematuria or weight loss. Patients were evaluated with conventional Xray, intravenous pyelography, Ultrasound, Multidetector Computed Tomography and MRI. A provisional diagnosis was suggested after the imaging and these findings were correlated with histopathology/ surgical findings as applicable.

Inclusion Criteria:

1. All patients with clinically suspected renal mass.
2. Renal mass lesions detected on ultrasound, CT scan and MRI.

Exclusion Criteria:

1. All patients with history of trauma and Bosniak Category I and II are excluded from my study.
2. Extrarenal masses invading the renal parenchyma are excluded from the study.

OBSERVATION AND ANALYSIS

Study Design: A Prospective correlation study to find the efficiency of spiral CT in the evaluation of renal masses.

Table 1: Renal Masses Distribution According To Age In Years

Diagnosis	Age In Years						No.	Percentage
	30-39 yrs	40-49 yrs	50-59 yrs	60-69 yrs	70-79 yrs	80-89 yrs		
MALIGNANT								
Renal Cell Carcinoma	2	7	16	24	11	2	62	62.0
Metastasis	0	2	4	7	1	0	14	14.0
Renal pelvis TCC	0	0	1	2	2	1	6	6.0
Sarcoma	0	1	1	0	0	0	2	2.0
BENIGN								
Adenoma	0	0	3	2	1	0	6	6.0
AML	1	2	1	0	0	0	4	4.0
Complex Cyst	0	0	1	1	2	0	4	4.0
Oncocytoma	0	0	0	22	0	0	2	2.0
Total	3	12	27	38	17	3	100	
	3.0	12.0	27.0	38.0	17.0	3.0	100.0	

Regarding Age Distribution Among Individual Pathologies In Our Study:

- Out of 100 cases 84 were diagnosed to be malignant (84%) and 16 cases were diagnosed benign(16%).The most common renal mass

was renal cell carcinoma accounting for 62 % of all the renal masses and 73.8 % of the malignant renal masses.
- 24 out of 62 patients (38%) of renal cell carcinomas were in the age range of 60 –69 years, the youngest patient with RCC was 35y old female patient and the oldest was 81y old male patient. The mean age was 63 yrs.
- 7 out of 14 patients (50%) of metastasis in kidney were in age group of 60- 69 yrs.
- Renal adenomas were seen in age group between 50-79 yrs.
- TCC was seen more common in the age group of 60-79 yrs.

Table 2: Renal Masses Distribution According To Gender

Diagnosis	Total No. of Patients	Gender	
		Male	Female
Renal Cell Carcinoma	62	40	22
		65 %	35 %
Metastasis	14	9	5
		64%	36%
Renal pelvis TCC	6	4	2
		67%	33%
Sarcoma	2	1	1
		50%	50%
Adenoma	6	3	3
		50%	50%
AML	4	1	3
		25%	75%
Complex Cyst	4	3	1
		75%	25%
Oncocytoma	4	1	1
		50%	50%
Total	100	62	38

In Our Study:
- Overall there were 62 (62%) males and 38 (38%) females, the male to female ratio was 1.6:1.
- There was male preponderance (65%) in case of RCC when compared to females (35%). Male: female ratio is 1.8:1.
- 4 out of 6 cases of TCC (67%) were in males.
- 9 out of 14 cases of metastases (64%) in kidney were in males.

Table 3: Distribution Of Symptoms In Renal Masses

MALIGNANT LESIONS						
RENAL MASS (NO)	**ASYMPT.**	**MASS**	**HEMATURIA**	**PAIN**	**FEVER**	**WEIGHT LOSS**
RCC (62)	13	28	38	36	15	36
	21%	45%	61%	58 %	24%	58%
METASTASIS (14)	4	0	3	4	10	8
	28%	0%	21%	28%	71%	57%
RENAL TCC (06)	0	1	6	3	5	4
	0 %	17%	100%	50%	83%	67%
SARCOMA (04)	0	2	1	2	1	2
	0%	50%	25%	50 %	25%	50%
TOTAL	17	31	48	45	21	50
BENIGN LESIONS						
ADENOMA (06)	4	0	0	0	1	1
	67%	0%	0%	0%	17%	17%
AML (04)	3	0	1	1	0	0
	75%	0%	25%	25%	0%	0%
COMPLEX CYST (04)	2	0	1	2	1	2
	50%	0%	25%	50%	25%	50%
ONCOCYTOMA (02)	2	0	0	0	0	0
	100%	0%	0%	0%	0%	0%
TOTAL	11	0	2	3	2	3

- Hematuria, pain and abdominal mass were the most common symptoms of renal masses.
- RCC being the most common malignant renal mass in our study, Hematuria was seen in 61%, pain in 58% and abdominal mass in 45% of cases.

Table 4 : USG Features Of Renal Masses

MALIGNANT LESIONS											
RENAL MASS (NO)	Calcification	Ureter	Vessels	Liver	LN	Adrenal	Spleen	Psoas	Pancreas	GB	Liver Mets.
RCC (62)	13	1	29	8	25	0	5	2	6	2	21
	21%	1.6 %	47%	13%	40%		8%	3%	10%	3%	34%
Metastases (14)	0	0	1	0	6	0	0	0	0	0	12
			7%		43%						85%
Renal TCC (06)	0	1	3	2	1	0	0	1	0	0	2
		17 %	50%	33%	17%			17%			33%
Sarcoma (02)	1	0	2	0	2	0	0	0	0	0	0
	50%		100 %		100 %						
BENIGN LESIONS											
Adenoma (06)	1	0	0	0	0	0	0	0	0	0	0
	17%										
AML (04)	0	0	0	0	0	0	0	0	0	0	0
Complex Cyst (04)		0	0	0	0	0	0	0	0	0	0
	25%										
Oncocytoma	0	0	0	0	0	0	0	0	0	0	0

- The most common calcified renal mass in our study was Renal cell carcinoma.
- Calcification was seen in 13 out of 62 cases of RCC (21%)
- Adjacent vessels involvement was seen in malignant renal masses, whereas none of the benign renal masses showed renal vein invasion.
- 21out of 62 patients of renal cell carcinoma shows liver metastases.
- Involvement of Vessels, liver, spleen, pancreas was not seen in benign masses.

Table 5: CT Imaging Features Of Renal Masses

MALIGNANT LESIONS												
RENAL MASS (NO)	Calcification	Necrosis	Ureter	Vessels	Liver	LN	Adrenal	Spleen	Psoas	Pancreas	GB	Distant Mets.
RCC (56)	18	32	4	23	6	21	10	4	8	5	1	32
	32 %	57 %	7%	41%	11%	37%	18 %	7%	14%	9%	2%	57%
Metastases (14)	0	0	0	1	0	6	0	0	0	0	0	13
				7%		43%						93%
Renal TCC (06)	0	0	1	3	0	1	0	0	1	0	0	4
			17%	50%		17%			17%			67%
Sarcoma (01)	0	0	0	1	0	1	0	0	0	0	0	1
				100 %		100 %						100 %
BE LESIONS												
Adenoma (06)	1	0	0	0	0	0	0	0	0	0	0	0
	17%											
AML (02)	0	0	0	0	0	0	0	0	0	0	0	0
Complex Cyst (04)	1	0	0	0	0	0	0	0	0	0	0	0
	25%											
Oncocytoma (01)	0	0	0	0	0	0	0	0	0	0	0	0

- The most common calcified renal mass in our study was Renal cell carcinoma.
- Calcification was seen in 18 out of 56 cases of RCC (32%)
- Malignant renal masses showed more amount of necrosis when compared to the benign renal masses (57% in RCC).
- Adjacent vessels involvement was seen in malignant renal masses, whereas none of the benign renal masses showed renal vein invasion.
- 32 out of 56 patients of renal cell carcinoma show distant metastases.
- The most common site of metastases from RCC was to liver (34%) and lungs (48%).

- Involvement of Vessels, adrenals, liver, spleen, pancreas and appendicular skeleton was not seen in benign masses.

Table 6: MRI Imaging Features Of Renal Masses

Renal masses												
RENAL MASS (NO)	Calcification	Necrosis	Ureter	Vessels	Liver	LN	Adrenal	Spleen	Psoas	Pancreas	GB	Distant Mets.
RCC (6)	1	6	1	6	2	4	2	1	2	1	1	4
	17%	100 %	17%	100 %	33%	67%	33 %	17 %	33%	17 %	17 %	67%
Sarcoma (1)	1	0	0	1	0	1	0	0	00	0	0	1
	100 %			100 %		100 %						100 %
AML (2)	0	0	0	0	0	0	0	0	0	0	0	0
Oncocytoma (01)	0	0	0	0	0	0	0	0	0	0	0	0

Adjacent vessels involvement was seen in malignant renal masses which can be better evaluated by MRI than other imaging modalities

Table 12 Sensitivity And Specificity Of MDCT For Renal Masses

DIAGNOSIS	True Positive	False Positive	False Negative	True Negative	Total
RENAL CELL CARCINOMA	54	2	0	34	90
METASTASES	14	0	0	76	90
RENAL PELVIS TCC	6	0	0	84	90
RENAL SARCOMA	1	0	0	89	90
RENAL ADENOMA	6	0	0	84	90
ANGIOMYOLIPOMA	2	0	0	88	90
COMPLEX CYST	3	1	0	86	90
ONCOCYTOMA	1	0	0	89	90

DIAGNOSIS	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
RENAL CELL CARCINOMA	100.0	94.4	96.4	100.0	97.7	<0.001**
METASTASES	100.0	100.0	100.0	100.0	100.0	<0.001**
RENAL PELVIS TCC	100.0	100.0	100.0	100.0	100.0	<0.001**
RENAL SARCOMA	100.0	100.0	100.0	100.0	100.0	<0.001**
RENAL ADENOMA	100.0	100.0	100.0	100.0	100.0	<0.001**
ANGIOMYOLIPOMA	100.0	100.0	100.0	100.0	100.0	<0.001**
COMPLEX CYST	100.0	98.9	75.0	100.0	99.0	<0.001**
ONCOCYTOMA	100.0	100.0	100.0	100.0	100.0	<0.001**

Table 7. Sensitivity And Specificity Of USG For Renal Masses

DIAGNOSIS	True Positive	FalsePositive	False Negative	True Negative	Total
RENAL CELL CARCINOMA	58	4	2	36	100
METASTASES	12	2	1	85	100
RENAL PELVIS TCC	4	2	0	94	100
RENAL SARCOMA	2	0	0	98	100
RENAL ADENOMA	4	2	0	94	100
ANGIOMYOLIPOMA	4	0	0	96	100
COMPLEX CYST	4	0	0	98	100
ONCOCYTOMA	2	0	0	98	100

DIAGNOSIS	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
RENAL CELL CARCINOMA	96.7	90.0	93.5	94.7	94.0	<0.001**
METASTASES	92.3	97.7	85.7	98.8	97.0	<0.001**
RENAL PELVIS TCC	100.0	97.9	66.7	100.0	98.0	<0.001**
RENAL SARCOMA	100.0	100.0	100.0	100.0	100.0	<0.001**
RENAL ADENOMA	100.0	97.9	66.7	100.0	98.0	<0.001**
ANGIOMYOLIPOMA	100.0	100.0	100.0	100.0	100.0	<0.001**
COMPLEX CYST	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**

Table 8. Sensitivity And Specificity Of MRI For Renal Masses

DIAGNOSIS	True Positive	False Positive	False Negative	True Negative	Total
RENAL CELL CARCINOMA	6	0	0	4	10
RENAL SARCOMA	1	0	0	9	10
ANGIOMYOLIPOMA	2	0	0	8	10
ONCOCYTOMA	1	0	0	9	10

DIAGNOSIS	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
RENAL CELL CARCINOMA	100.0	100.0	100.0	100.0	100.0	<0.001**
RENAL SARCOMA	100.0	100.0	100.0	100.0	100.0	<0.001**
ANGIOMYOLIPOMA	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**

Table 9. Sensitivity And Specificity Of Imaging For Renal Masses

Final diagnosis	Radiologic diagnosis		Total
	Malignant	Benign	
Malignant	82 (TP)	1(FN)	83
Benign	02(FP)	15(TN)	17
Total	84	16	100

Sensitivity: 98.7 % Specificity=88.2 % PPV=97.6% NPV=93.7% Accuracy=97.0%

DISCUSSION

This prospective study was carried out in New civil hospital, Surat over a period of two years (July 2020 to December 2021) on 100 patients with clinically suspected Renal mass or patients who were diagnosed to have renal mass were referred for further characterization. Patients were evaluated with conventional x ray, intravenous pyelography, ultrasound, Multidetector Computed Tomography and MRI.

In our study out of total 100 cases studied the maximum percentage of patients was in the age range of 60 to 69 years (38 %).

Out of 100 cases 86 were diagnosed to be malignant (86%) and 14 cases were diagnosed benign (14%). The most common renal mass was renal cell carcinoma accounting for 62 % of all the renal masses and 72% of the malignant renal masses.

22 out of 31 patients (71%) of renal cell carcinomas were in the age range of 60–69 years, the youngest patient with RCC was 35 y old female patient and the oldest was 81 y old male patient. The mean age was 63 y.

8 out of 14 cases of metastases were in the age group of >60y and 9 out of 14 cases were seen in male patients.

Our findings show occurrence of renal pelvis TCC between age group of 62 to 80 yrs In my study occurrence of renal adenoma between 62 to 80 yrs.

My study results incidence of complex cystic renal masses between 55 to 78 yrs .

My study shows incidence of renal angiomyolipoma more common in age group of 40-49 yrs.

In my study incidence of renal oncocytoma more common in age group of 60-69 yrs.

Regarding Gender Distribution Of Renal Masses:

In our study: Overall there were 62 (62%) males and 38 (38%) females, the male to female ratio was 1.6:1.There was male preponderance (64.5%) in case of RCC when compared to females (35.5%). Male: female ratio is 1.8:1.

9 out of 14 cases of renal metastasis (64%) were in males, 4 out of 6 cases of renal pelvis TCC (67%) were in males.

Male: Female ratio in renal pelvis TCC was 2: 1 showing male predominance.

In Benign lesions, 3 out of 4 cases of complex cyst were male patient, 3

out of 4 cases were female patient in angiomyolipoma and renal adenoma & oncocytoma has equal gender preponderance.

My study shows occurrence of renal angiomyolipoma more common in female with male to female ratio was 1: 3

In my study male to female ratio of renal oncocytoma was 1:1

My study results show incidence of complex cystic renal masses in 3 Male: 1 Female patient

My study shows occurrence of renal adenoma has equal gender distribution.

Regarding Imaging Characteristics Of Renal Masses;
The most common calcified renal mass in our study was Renal cell carcinoma, calcification was seen in 19 out of 62 cases of RCC (31%)

Malignant renal masses showed more amount of necrosis when compared to the benign renal masses (61% in RCC).

Adjacent vessels involvement was seen in malignant renal masses, whereas none of the benign renal masses showed renal vein invasion.

36 out of 62 patients of renal cell carcinoma show distant metastases.

The most common site of metastases from RCC was to liver (34%) and lungs (48%).

Involvement of Renal vein, adrenals, liver, spleen, pancreas and appendicular skeleton was not seen in benign masses.

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%). Calcifications were visible in 31% of RCCs. Although 22% of RCCs were predominantly cystic, none fulfilled all CT criteria of simple renal cysts.

My study shows most common complaint in renal pelvis TCC was hematuria.

In my study most cases of renal adenoma was asymptomatic.

Regarding The Differentiation Of Benign From Malignant Renal Masses Included In Our Study:
The involvement of renal vein, inferior vena cava, adrenals, lymph nodes, liver and appendicular skeleton was seen only in malignant renal masses.

Using the region of interest technique for differentiating benign from malignant renal masses on pre and post contrast images Sensitivity= 98.7% Specificity=88.2% PPV=97.6% NPV=93.7 % Accuracy= 97.0% was achieved.

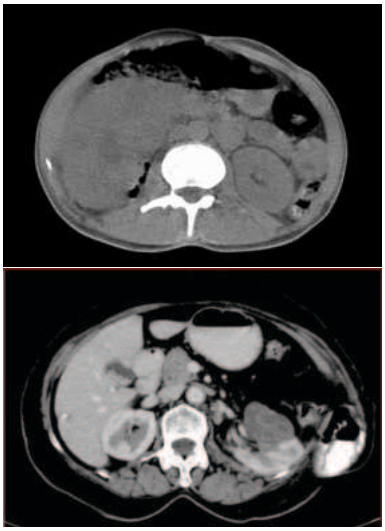

Fig 1. Renal cell carcinoma
a. NECT showing soft tissue exophytic mass in left kidney
b. Lesion shows enhancement on contrast administration
c. Another case of RCC showing areas of calcification.

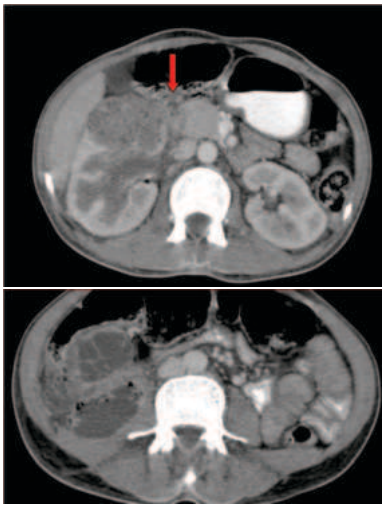

Fig 2. Stage III Renal cell carcinoma a. NECT showing soft tissue mass in right kidney with pockets of air(arrow) in the posterior pararenal space b & c. Lesion shows enhancement with infiltration in the 2nd part of duodenum(red arrow) and right psoas.

Fig 3. Stage III Renal cell carcinoma
d. Renal cell carcinoma of right kidney with enhancing retrocaval metastatic lymph node.

e. RCC with enhancing tumour thrombus in the inferior vena cava.
f. RCC with renal vein invasion

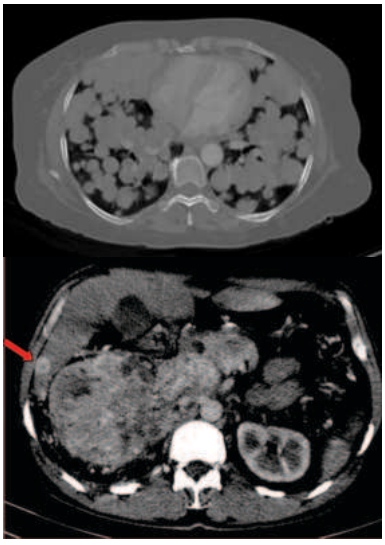

Fig 4. Stage IV Renal cell carcinoma
a. Renal cell carcinoma with canon ball pulmonary metastases.
b. RCC with hypervascular metastases to right lobe of liver (Red arrow).

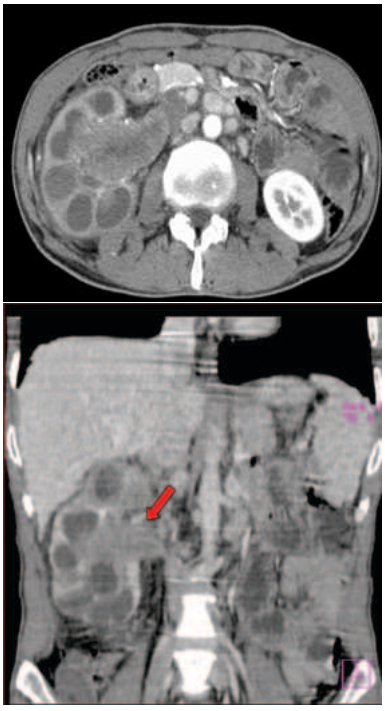

Fig 5: CT appearance of Renal pelvic TCC
a & b.CECT shows enhancing soft tissue density mass filling the entire right pelvicalyceal system (red arrow) causing proximal hydronephrosis.

Fig 6 Angiomyolipoma
a. USG features are suggestive of hyperechoic mass in the upper pole of left kidney
b. CT feature suggestive of hypodense lesion of -20 HU involving the cortex of left kidney showing minimal enhancement

Fig 7 Renal Cell Carcinoma USG
Well defined Heterogeneous lesion with internal area of necrosis.

Fig 8. CT appearance of Renal metastases
a. CECT shows bilateral renal metastases from colonic carcinoma which did not show much of enhancement.
b. Lung carcinoma metastases to left kidney, unifocal soft tissue density lesion showing heterogenous enhancement.

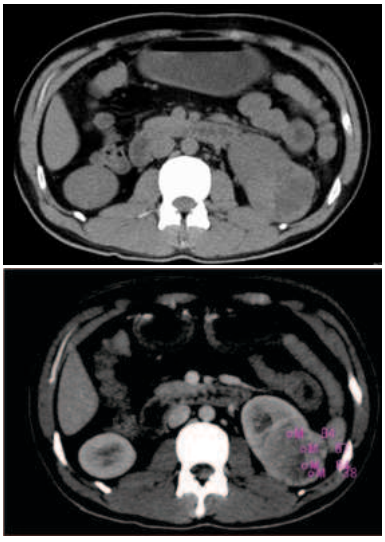

Fig 9. CT appearance of oncocytoma
a. NECT shows soft tissue exophytic mass with hypodense areas in left kidney.
b. CECT shows enhancing soft tissue mass with non enhancing hypodense area representing hypodense scar

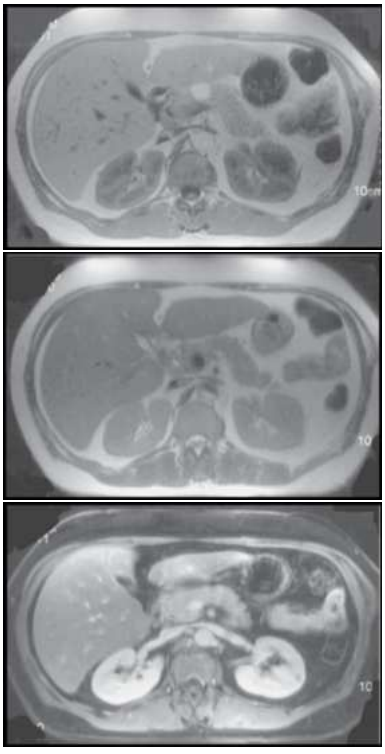

Figure 10 Normal renal MRI. A T1-weighted (gradient opposed-phase) image (A) and a T2-weighted axial image (B) demonstrate the normal appearance of the kidneys. (C) T1- weighted axial gadolinium-enhanced image reveals normal enhancing renal parenchyma. Renal vein and renal artery are also seen.

SUMMARY AND CONCLUSION

- Out of 100 cases 84 were diagnosed to be malignant (84%) and 16 cases were diagnosed benign (16%). The most common renal mass was renal cell carcinoma accounting for 62 % of all the renal masses and 73.8 % of the malignant renal masses.
- Overall there were 62 (62%) males and 38 (38%) females, the male to female ratio was 1.6:1. Thus renal neoplasm's are seen more commonly in males.
- MDCT was able to differentiate a benign from malignant lesion with Sensitivity of 98.7%, Specificity of 88.2 %, and Accuracy of 97 %.
- 24 out of 62 patients (38%) of renal cell carcinomas were in the age range of 60 –69 years, the youngest patient with RCC was 35y old female patient and the oldest was 81y old male patient. The mean age was 63 yrs. 7 out of 14 patients (50%) of metastasis in kidney were in age group of 60- 69 yrs. Renal adenomas were seen in age group between 50-79 yrs and TCC was seen more common in the age group of 60-79 yrs.
- In our study male preponderance was seen in Renal Cell Carcinoma, Renal Pelvis TCC, Metastatic lesion in kidney and complex cyst, Female preponderance seen in angiomyolipoma. However equal gender distribution seen in Renal sarcoma, adenoma and Oncocytoma.
- Hematuria, pain, weight loss and abdominal mass were the most common symptoms of renal masses.
- RCC being the most common malignant renal mass in our study, Hematuria was seen in 61%, pain in 58% and abdominal mass in 45% of cases.
- The most common calcified renal mass in our study was Renal cell carcinoma. Calcification was seen in 19 out of 62 cases of RCC (31%).
- Malignant renal masses showed more amount of necrosis when compared to the benign renal masses (61% in RCC). Adjacent vessels involvement was seen in malignant renal masses, whereas none of the benign renal masses showed renal vein invasion.
- 36 out of 62 patients of renal cell carcinoma show distant metastases. The most common site of metastases from RCC was to liver (34%) and lungs (48%).
- Involvement of Renal vein, adrenals, liver, spleen, pancreas and appendicular skeleton was not seen in benign masses.
- Out of 100 cases, 50 cases were seen on right side, 44 cases on left side and 6 cases bilateral kidneys.
- 33(53%) out of 62 cases of RCC were seen on Right side.
- Most common location for RCC was in the mid and lower pole of right kidney.

REFERENCES

1) Multidetector row CT of the kidneys. Atadan Tunaci, Ensar Yekeler European Journal of Radiology - October 2004 (Vol. 52, Issue 1, Pages 56-66.
2) Curry NS AJR Am J Roentgenol. 1995 Feb; 164(2):355-62.Small renal masses (Lesions smaller than 3 cm): imaging evaluation and management.
3) Bagi RP Jana, Jules E Harris, MD. Renal Transitional Cell Carcinoma. Medscape. Mar 27, 2014.
4) Cross sec imaging of renal masses rcna Srinivasa R. Prasad, MD, Neal C. Dalrymple, MD, Venkateswar R. Surabhi, MD).
5) Gibbs GF, Huston J 3rd, Qian Q, et al. Follow-up of intracranial aneurysms in autosomal-dominant polycystic kidney disease. Kidney Int 2004;65(5):1621-1627.
6) Chrtien Y, Paraf F, et al. Renal cell carcinoma containing fat: demonstration with CT. Radiology 1993;188: 429-430.
7) Jeong Kon Kim, Soo-Youn Park, Jeong-Hee Shon, and Kyoung-Sik Cho Angiomyolipoma with Minimal Fat: Differentiation from Renal Cell Carcinoma at Biphasic Helical CT
8) Renal cell carcinoma: prognostic significance of incidentally detected tumors. The journal of urology, volume 163, issue 2, pages 426-430. k. Tsui, o. Shvarts, r. Smith, r. Figlin, j. De kernion, a. Belldegrun.
9) Helical CT Evaluation of Renal Mass Lesions: A Prospective Study. RPS Bajwa, P Sandhu, BS Aulakh, JS Sandhu, K Saggar, A Ahluwalia Journal, Indian Academy of Clinical Medicine Vol. 8, No. 3 July-September, 2007.
10) Effect of incidental detection for survival of patients with renal cell carcinoma: Results of population-based study of 701 patients Urology, Volume 66, Issue 6, Pages 1186-1191 T. Gudbjartsson, A. Thoroddsen, V. Petursdottir, S. Hardarson, J. Magnusson, G. Einarsson.
11) Relationship between age at diagnosis and clinicopathologic features of renal cell carcinoma Verhoest G, Veillard D, Guillé F, De La Taille A, Salomon L, Abbou CC, Valéri A, Lechevallier E Eur Urol. 2007 May;51(5):1298-304; discussion. 1304-5. Epub 2006 Dec 8.