COMPUTED TOMOGRAPHIC EVALUATION OF PATIENTS PRESENTING WITH MALIGNANT RENAL MASSES

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ABSTRACT

BACKGROUND
The term renal mass includes a large number of expansile entities, which are aggregates of non-functional renal parenchyma. Renal masses can be neoplastic, non-neoplastic or normal variants.
Aims and Objectives- To study the role of computed tomography in defining the nature of renal masses.

MATERIALS AND METHODS
50 patients irrespective of age and sex, suspicious of malignant renal masses were included in this study. Toshiba 128-slice Computed Tomography Scan was used for scanning of all patients, plain and contrast both studies were performed and collected data was analysed.

RESULTS
Computed tomography was a very useful investigation for malignant renal masses, because it has got the ability to better characterise the lesions and it is accurate for pre-operative staging.

CONCLUSION
This can be concluded from our study that contrast CT scan is an investigation of choice for pre-operative staging of malignant renal masses due to its ability in demonstrating perinephric extension, invasion of renal fascia, evaluation of retroperitoneum and detection of distant metastases.

KEYWORDS
Malignant Renal Mass, Computed Tomography.

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BACKGROUND

Cell Carcinoma- It is the most common primary malignant lesion of renal parenchyma in adults. Renal cell carcinoma accounts for 80% of the tumours of kidney and male: female ratio is 1: 2.[1]

Renal cell carcinoma cases are detected incidentally in half of the total detected cases during imaging for indication other than assessment of renal cell carcinoma.

Wilms' Tumour- most common renal tumour in children representing nearly 6% - 7% of all paediatric tumours. Peak incidence is found in patients of 2 - 3 years' age group, two-thirds of cases occur before 5 years of age**.** Both kidneys are involved in 2% - 5% of cases.[2]

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Renal pelvic carcinoma- Presents as a renal mass when it infiltrates into renal substance, although most urothelial tumours present as filling defects within the renal pelvis or ureter.

Adult Polycystic Kidney Disease
Affects 1 in 1000 people, (Simons et al 2006).[3]

Angiomyolipoma
It is a benign haematoma; 80% are seen in adults between 30 to 50 years with marked female predominance (Shin NY et al 2010).[4]

MATERIALS AND METHODS

This study was carried out in the Department of Radiology, IGIMS, Patna during October 2015 - October 2016. This study was carried out on Toshiba 128-Slice CT scan machine. A total number of 50 patients with suspected renal mass were studied, irrespective of age and sex. This was followed by computed tomographic evaluation. Both plain and contrast studies were performed.

Preparation
All adult patients were routinely made to fast, except for water from night prior to the CT scan; 20 mL of 76% Urografin was dissolved in 750 mL of water; 250 mL was

given to the patient to be taken at the bedtime. Patient was asked to take another 250 mL in the morning before procedure. Another 250 mL oral Urografin was given 1 hour prior to scan for total bowel opacification.

Continuous 1 mm slices were taken. Thin sections of 0.5 mm were necessary in few patients with smaller lesions. Precontrast scans were obtained to detect any parenchymal calcification or renal, perirenal haemorrhage at the time of scan, a rapid bolus intravenous injection of non-ionic water-soluble contrast medium, Omnipaque/iohexol was administered. The main indication of intravenous use of contrast is to differentiate normal from abnormal vascular structure, to define pathological vessels to estimate the vascularity of a mass and to detect thrombus in the vein.

Study Population

50 patients of all age-groups, both male and female with history of lump abdomen, pain abdomen, fever and haematuria were included in this study.

RESULTS

Role of CT was studied in defining the nature and extent of the lesions.

Type of Lesions	Number of Cases	Percentage
Renal cell carcinoma	40	80
Wilms' tumour	10	20
Total	**50**	**100**

Table 1. Type of Renal Masses Studied

After histopathological correlation, it was found that 80% cases were those of renal cell carcinoma and rest were those of Wilms' tumour.

The youngest patient in our study was a 10-month-old child and the oldest was an 80 years old woman. This wide range had two peaks- one in the age group of 0 - 10 years and the other in the age group of 41 - 60 years; 100% of Wilms' tumour cases were below 10 years of age.

Type	Male	Female	Total
Renal cell carcinoma	24	16	40
Wilms' tumour	4	6	10
Total	**32**	**18**	**50**

Table 1. Sex Distribution of Patients

Type of Lesions	0 - 10	10 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80
Renal cell Ca. (40)	-	-	-	4	10	16	6	4
Wilms' tumour (10)	10	-	-	-	-	-	-	-
Total 50	**10**	**0**	**0**	**4**	**10**	**16**	**6**	**4**

Table 3. Computed Tomography- CT Characteristics of Renal Masses

Characteristics	RCC	Wilms' Tumour
Size (Kidney)		
Less than 3 cm	-	-
3 - 5 cms	6	-
5 - 10 cms	30	4
> 10 cms	4	6
Density		
Predominantly Solid	10	-
Predominantly Cystic	-	-
Solid with Necrosis	30	10
Texture		
Homogenous	10	2
Non-Homogenous	30	8
Margins		
Smooth	10	6
Irregular	30	4

Table 4. CT Finding- Contrast Enhancement in Renal Masses

Enhancement of more than 20 HU[3] in comparison to pre-contrast scan and if absolute value of enhancement is 50 HU or more on CT usually indicates malignancy. 5 For RCCCT has got sensitivity about 100% and specificity about 88% - 95%.[5] CT scan is a very sensitive tool to detect small asymptomatic malignant neoplasms.

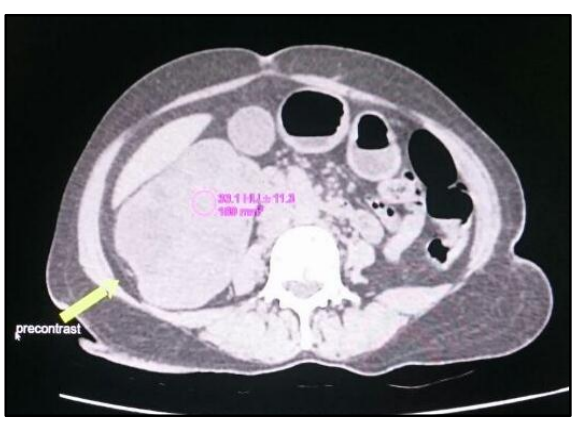

Figure 1. Pre-Contrast

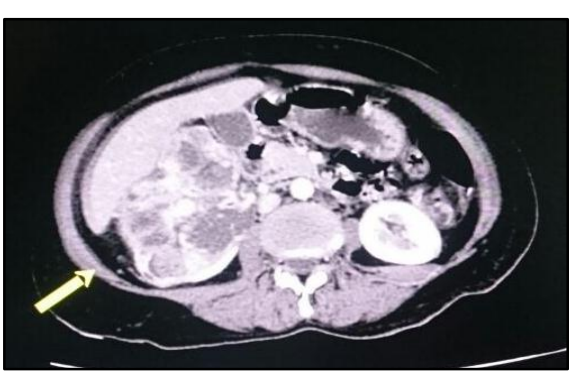

Figure 2. Post-Contrast

Renal Mass	Homoge-nous	Non-Homogenous	Peripheral	Absent
Renal Cell Carcinoma (16)	0	40	-	-
Wilms' Tumour (10)	4	6	-	-

Table 2. CT Finding- Contrast Enhancement in Renal Masses

Renal masses show difference in density in comparison to the normal renal parenchyma.[6] 100% (40/40) of renal cell carcinomas and 60% (6/10) of Wilms' tumour showed non-homogenous enhancement.

Extent	Renal Cell Carcinoma (40)	Wilms' Tumour (10)
Tumour confined to renal capsule	10	4
Perinephric extension	30	6
Renal vein involvement	8	-
IVC invasion	4	-
Regional lymph nodes	2	2
Direct invasion through Gerota's fascia into adjacent structures	8	-
Distant metastases	2 (liver)	2 (lungs)
Dist. lymph nodes	-	-
Bilateral tumour	-	-

Table 3. CT Finding- Tumour Extent

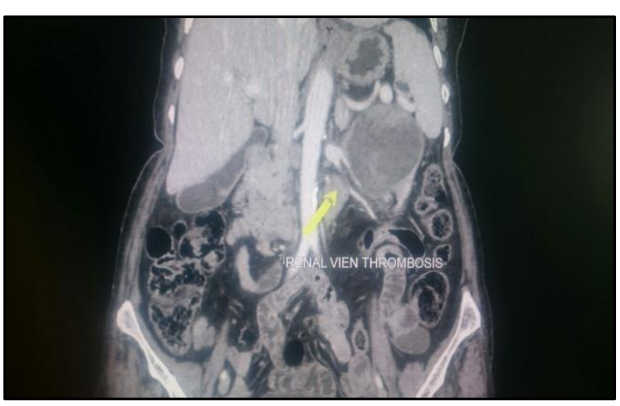

Figure 3. Renal Vein Thrombosis

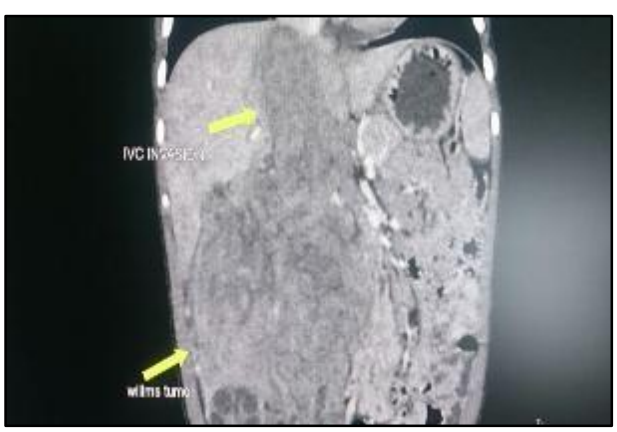

Figure 4. IVC Thrombosis

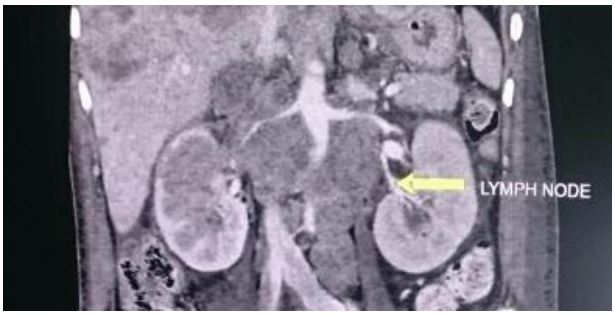

Figure 5. Metastatic Lymph Nodes

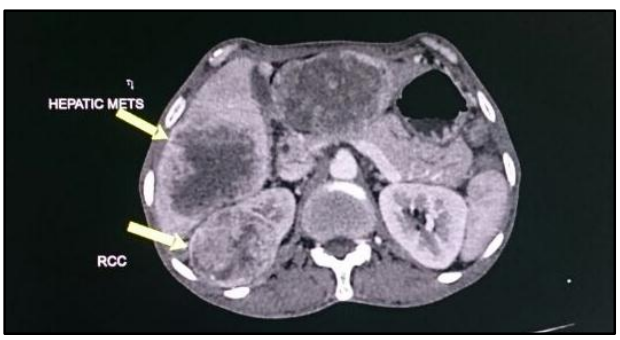

Figure 6. Hepatic Mets

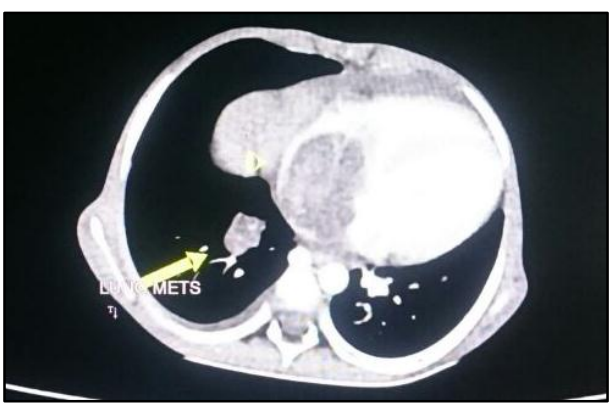

Figure 7. Lung Mets

75% (30/40) tumour of renal cell carcinoma showed perinephric extension on CT, while 25% (10/40) tumours were confined to the renal capsule. In 20% (8/40) tumours, direct invasion through Gerota's fascia was observed, 40% (4/10) Wilms' tumour was confined to renal capsule. CT detected IVC invasion by the tumour in 10% cases of renal cell carcinoma. CT detected regional lymph node enlargement (Ipsilateral para-aortic and retroperitoneal group) in 4 cases. Metastases to liver in two cases of renal cell carcinoma and metastasis to lungs in two cases of Wilms' tumour were detected on CT.

DISCUSSION

In the present study, 50 cases of renal masses were investigated using CT scan. The role of CT was specifically studied in relation to renal mass density, site, size, margins and presence of any calculus or calcification and knowing the regional or distant spread. This study was an attempt to understand and know the role of CT in diagnosis of renal masses.

Amendola et al in 1988, reported discovery of occult small renal cell carcinoma with increasing frequency in patient referred for abdominal CT scanning.

A solid mass is identified on CT as an irregular ill-defined mass, the appearance of which is enhanced by contrast, but not to the extent of renal parenchyma.

On pre-contrast CT scan, renal cell carcinomas often appear heterogeneous, demonstrating one or more low density central areas. The attenuation values range from 15 to 50 HU. If the attenuation value is 50 or more than 50, lesions are more likely to be renal cell carcinoma [Neesha S Patel et al 2008].[7]

After bolus injection, there is a rapid increase in the attenuation value of both the mass and normal parenchyma.

The absolute attenuation value of the solid tumour may be equal to more than or less than that of normal parenchyma depending on the vascularity of the tumour.

Hattery et al in their study in 1987[8] had discussed the significant advantage of CT in visualisation of the extent of the neoplasm. They observed secondary sign of a solid malignant mass (usually renal cell carcinoma) on CT done primarily to differentiate between a benign cyst and a solid tumour. These secondary signs may include detection of classification within the mass, invasion of adjacent tissues, involvement of renal vein or inferior vena cava and metastases to lymph glands, liver, lungs or bone.

The classification of stages of neoplasms according to Robson and Churchill (1968, 69)[9] method is based on identification of direct extension to adjacent structure, distant metastases, regional lymphatic involvement and renal vein invasion and histopathological grading of the tumour.

Stage 1
Tumour confined to the kidney capsule.

Stage 2
Tumour extension into perinephric fat, but confined to Gerota's fascia.

Stage 3
A - Tumour extension into renal vein or inferior vena cava.
B - Tumour extension to lymph nodes.
C - Venous and lymph node involvement.

Stage 4
A - Direct extension into adjacent organs (other than adrenal).
B - Distant metastases.

CT is used in the diagnosis and staging of metastatic RCC and followup after nephrectomy [AJR- 2012].[10] The cross-section images provided by CT help in localisation of the mass to kidney, perirenal and pararenal space.

Weyman et al in 1998[11] said that CT is more accurate and sensitive than angiography in detecting perinephric extension, more sensitive in assessing lymph node involvement and equally accurate in detecting renal vein involvement. CT approaches overall 95% accuracy in staging renal cell carcinoma.

CT has consistently been shown to be more accurate than US or angiography in staging.

Zeman et al in 1998[12] found that MRI helps to detect renal vein and vena caval invasion and they observed its ability in detecting nodal enlargement and adjacent organ involvement. These workers said that sensitivity and specificity of MRI in detecting tumour extension into the renal vein is 98% and into inferior vena caval is 100%.

The values for CT are 78% and 96% respectively by Johnson et al in 1987.[13] For lymph node metastases, MR is 99% sensitive as against 83% sensitivity of CT scan. Also in detecting adjacent organ metastases, MRI is more accurate than CT {98% - 100%}.

Later in 1997, Lantraveras and Ferruci[14] proposed the role of MRI for evaluation of renal masses in selected cases of renal cell carcinoma, in which tumour thrombus in the renal vein or IVC is suspected, but not detected by CT.

In our study of renal masses, we encountered 10 cases of Wilms' tumour. All patients were below 10 yrs. of age [Table 1 and 2].

In the present study, 40 cases were found and studied [Table 1].

CT evaluation of renal tumour begins with unenhanced scans. This helps in knowing the presence of any calcification, helps in determining whether the tumour enhances and to what degree it enhances after injection of contrast.

The attenuation value of renal cell carcinomas ranges between 15 - 50 HU. In our study, the range was between 15 to 60 HU. Areas of necrosis or old haemorrhage has lower attenuation values. 75% tumours had irregular margins; only 10 tumours appeared well defined with smooth margins.

On contrast enhanced scans, vascular parts of the tumour enhanced markedly, but the cystic or necrotic areas enhanced slightly or not at all resulting in an inhomogeneous appearance in 100% renal cell carcinomas.

Contrast administration accentuates the difference between the tumour and surrounding kidney. In the present study, 25% [10/40] of renal cell carcinomas and 40% of Wilms' tumours were confined to the renal capsule as seen on CT.

Perinephric extension beyond renal capsule was observed in 75% [30/40] cases of renal cell carcinoma and in 60% [6/10] cases of Wilms' tumours.

In 20% [8/40] cases of renal cell carcinoma showed extension beyond renal fascia, whereas no direct extension beyond renal fascia was seen in any case of Wilms' tumour.

In the present study, CT demonstrated inferior vena caval invasion in 4 cases.

In the present study, renal vein invasion was seen in 8 cases, where the diameter of vein was more than 2 cms on CT. IVC was dilated in three cases, where it measured more than 3 cm. In one case, IVC diameter was within normal limits but a thrombus was seen in it.

Intracaval filling defects may be due to bland thrombus or tumoural thrombus. CT can differentiate the two since tumour thrombus shows contrast enhancement, whereas bland thrombus shows no enhancement. CT detected regional lymph node involvement in two patients.

Lymph nodes measuring between 1 and 2 cm in known cases of malignancy, especially if they are multiple and enhancing, are usually metastatic. Nodes exceeding 2 cm in diameter with post-contrast enhancement are almost always metastatic.

CT showed distant metastasis to liver in two cases of renal cell carcinoma and distant metastasis to lungs in two cases of Wilms' tumour.

CONCLUSION

This can be concluded from our study that contrast CT scan is investigation of choice for pre-operative staging of malignant renal masses due to its ability in demonstrating perinephric extension, invasion of renal fascia, evaluation of retroperitoneum and detection of distant metastases.

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