COMPARATIVE STUDY OF RENAL MASSES BY ULTRASONOGRAPHY AND COMPUTED TOMOGRAPHY

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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 [pseudotumours]. The aim of this study is to study and evaluate the nature of renal masses by ultrasound and computed tomography.

MATERIALS AND METHODS

This retrospective descriptive study was carried out in the Department of Radiology, Patna Medical College and Hospital, during October 2015 - October 2016 in one year duration. Fifty patients irrespective of age and sex, suspicious of malignant renal masses were included in this study. Ultrasound was done by Toshiba Nemio XG USG machine with different types of probes- curvilinear with 3.5 - 5 MHz and linear probe with 7 - 10 MHz frequency and also by Colour Doppler study whenever needed. 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

Fifty cases of renal masses comprising of polycystic kidney disease,[1] parapelvic cyst,[2] renal cell carcinoma,[3] Wilms' tumour[4] and squamous cell carcinoma[5] were clinically studied and evaluated radiologically by ultrasonography and CT. Ultrasound remains the modality of choice for initial screening in cases of adult polycystic kidney disease.

CONCLUSION

It can be concluded from our study that ultrasound and 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, Ultrasound, Computed Tomography.

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BACKGROUND

Renal 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. 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).[6] 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).[5] The detection and definition of nature of tumour and its extent was difficult in early days of IVU. With the addition of ultrasound and CT in diagnostic imaging, the accuracy of tumour detection has approached to nearly 100%. Also, since the introduction of these two modalities more and more asymptomatic renal tumours are being detected, thereby improving patient's prognosis and treatment. Though there are still a small number of renal masses, which remains 'Indeterminate' even after evaluation by these modalities and are diagnosed only by surgical exploration with histopathological studies. The role of magnetic resonance imaging [MRI]- a latest diagnostic imaging modality has improved detection of these masses. Certain workers have found that it is more superior than CT in staging of the tumours. There have been various studies worldwide comparing the diagnostic utility of these imaging modalities. Workers have found that CT is superior to IVU, ultrasonography and angiography in detection of renal and retroperitoneal detail and in staging of renal neoplasm. On the other hand, ultrasound combined with cyst aspiration has an important role in all those cysts like renal masses which are indeterminate on CT. There is lack of comprehensive studies involving a large series of cases in the Indian literature. Most of the works are in the form of

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isolated case report. Besides this little work has been done in the field of CT in renal masses. The present study has been an attempt to evaluate the role of CT and USG in the detection of renal masses.

MATERIALS AND METHODS

This retrospective descriptive study was carried out in the Department of Radiology, Patna Medical College and Hospital for ultrasound and CT scan during October 2015 - October 2016. Study was carried out on GE Bright Speed 16 Slice CT scan machine and ultrasonography machine [Toshiba Nemio XG with colour Doppler] using different probes- curvilinear with 3.5 - 5 MHz and linear probe with 7 - 10 MHz frequency. A total number of 50 patients with suspected renal mass were studied, irrespective of age and sex. Simple cortical cysts were the most common incidentally found lesions. They are not included in the study. In all the patients taken up for study, a detailed clinical history was taken with emphasis on the duration of the symptoms and specific complaints like fever, pain abdomen and haematuria. These patients were also examined for the abdomen lump. Routine and other relevant laboratory investigations were done like blood urea, serum creatinine, routine urine, microscopic examination for malignant cells etc. Ultrasound was done by Toshiba Nemio XG USG machine with different types of probes- curvilinear with 3.5 - 5 MHz and linear probe with 7 - 10 MHz frequency and also by Colour Doppler study whenever needed.

Statistical Analysis

The data collection was entered in the Microsoft Excel computer program using SPSS version 7 and checked for any discrepancy. The result was presented in proportional/percentages.

RESULTS

Ultrasound has showed 35% sensitive and 48% specificity for lesion under 2.5 cm in diameter; and 65% sensitive and 75% specificity; and 80% specificity for lesion under 2.5 and 80% sensitive and 95% specific for lesion between 2.5 and 7. Fifty patients with suspected renal masses were studied and evaluated by ultrasonography and computed tomography. Role of US and CT was studied in defining the nature and extent of the lesions. The radiological findings were correlated with surgical or pathological diagnosis. Simple cortical cyst, the commonest renal masses have been excluded from the study. 60% of cases studied were malignant renal neoplasm. The majority of cases were those of renal cell carcinoma (32%) 16 [Table 1].

Type of Lesions	No. of Cases	Percentage
Renal Cystic Disease		
Adult Polycystic Kidney Disease	12	24
Parapelvic Cyst	8	16
Neoplastic		
Renal Cell Carcinoma	16	32
Wilms' Tumour	10	20
Squamous Cell Carcinoma	4	8
Total	**50**	**100**

Table 1. Type of Renal Masses Studied

The youngest patient in our study was an 8-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 [Table 2].

Age (Years)	Patients	Percentage
0-10	10	20
11-20	4	8
21-30	6	12
31-40	4	8
41-50	8	16
51-60	8	16
61-70	6	12
71-80	4	8
Total	**50**	**100**

Table 2. Age-Group Distribution of Patients

There was a male preponderance in each group except for Wilms' tumour.

Type	Male	Female	Total
Adult Polycystic Kidney Disease	8	4	12
Parapelvic Cyst	6	2	8
Renal Cell Carcinoma	10	6	16
Wilms' Tumour	4	6	10
Squamous Cell Carcinoma	4	_	4
Total	**32**	**18**	**50**

Table 3. Sex Distribution of Patients

62.5% (10/16) of patients with renal cell carcinoma presented with a palpable lump and/or complained of pain abdomen. 87.5% (14/16) of these patients had painless haematuria. All patients complained of weight loss. All patients of Wilms' tumour had a palpable lump at the time of presentation. All the patients of squamous cell carcinoma presented with a palpable lump, complained of pain abdomen and weight loss [Table 4].

Type	Pain Abdomen	Haematuria	Fever	Wt. Loss	Hypertension	Palpable Lump
Adult Polycystic Kidney Disease(1)	4	4	-	-	6	
Parapelvic Cyst(2)	6	-	2	-	-	
Renal Cell Carcinoma(3)	16	14	6	-	8	10
Wilms' Tumour(4)	4	4	8	4	-	4
Squamous Cell Carcinoma(5)	4	2	-	4	-	4

Table 4. Signs and Symptoms in Patients with Renal Masses

Renal Mass	Rt. Kid.	Lt. Kid.	Bilateral	Up. Pole	Lower Pole	Whole Kid.	< 3 cm	3 - 5 cm	5 - 10 cm	> 10 cm
Adult Polycystic Kidney Disease(1)	-	-	12	-	-	12	-	-	-	12
Parapelvic Cyst(2)	6	2	-	-	-	-	4	4	-	-
Renal Cell Carcinoma(3)	10	6	-	10	6	-	-	2	1	4
Wilms' Tumour(4)	2	8	-	2	8	-	-	-	-	8
Squamous Cell(5) Carcinoma	4	-	-	-	-	4	-	-	2	2
Total 50	**22**	**16**	**12**	**12**	**14**	**16**	**4**	**6**	**3**	**26**

Table 5. Ultrasound in Renal Masses (Side, Site and Size of Lesion)

Rt. Kid. - Right Kidney, Lt. Kid. - Left Kidney, Bilat. - Bilateral, Upp. Pole - Upper Pole, Low. Pole - Lower Pole.

Cysts arising from renal hilum. Majority of renal cell carcinoma 62.5% (10/16) were between 5 and 10 cm in size. While in Wilms', 80% (8/10 tumours) were more than 10 cm in size [Table 5].

Renal Mass	Solid	Cystic	Mixed/ Heterogeneous	Calcu/ Calcif
Adult Polycystic Kidney Disease(1)	-	12	-	-
Parapelvic Cyst(2)	-	8	-	-
Renal Cell Carcinoma(3)	4	-	8	4
Wilms' Tumour(4)	-	-	4	4

Table 6. Ultrasonographic Characters of Renal Masses

50% (8/10) renal cell carcinomas and both squamous cell carcinomas appeared heterogeneous on US. 80% (8/10) of Wilms' tumour appeared predominantly solid. Calculi/ Calcification were seen in all the cases of squamous cell carcinoma.

Characteristics	APKD	PC	RCC (16)	Wilms'	SCC
Size (Kidney)					
Less than 3 cm	-	4	-	-	-
3-5 cms	-	4	2	-	-
5-10 cms	-	-	10	2	2
More than 10 cms	12	-	4	8	2
Density					
Predominantly Solid	-	-	4	-	-
Predominantly Cystic	12	8	-	-	-
Solid with Necrosis	-	-	12	10	4
Texture					
Homogenous	-	8	2	4	-
Non-homogenous	12	-	14	6	4
Margins					
Smooth	-	8	4	6	-
Irregular	12 (lobulated)	-	12	4	4

Table 7. Computed Tomography- CT Characteristics of Renal Masses

APKD- Adult Polycystic Kidney Disease, PC- Parapelvic Cyst, SCC- Squamous Cell Carcinoma, RCC- Renal Cell Carcinoma.

Renal Mass	Homogenous	Non-homogenous	Peripheral	Absent
Adult Polycystic Kidney Disease(1)	-	-	-	12
Parapelvic Cyst(2)	-	-	-	8
Renal Cell Carcinoma(3)	-	16	-	-
Wilms' Tumour(4)	4	6	-	-
Squamous Cell CA.(5)	-	4	-	-

Table 8. CT Finding- Contrast Enhancement in Renal Masses

The cysts in adult polycystic kidney disease did not enhance on contrast CT. 100% (16/16) of renal cell carcinomas showed non-homogenous contrast enhancement. 60% (6/10) of Wilms' tumour showed non-homogenous enhancement.

Renal Mass	Ultrasound				Computed Tomography				
	Solid	Cystic	Mixed	Calcif./ Calculus	Pred. Solid	Pred. Cystic	Solid with Necrotic Areas	Calculus	Calcf.
Adult Polycystic Kidney Disease(1)	–	12	–	–	12	–	–	–	–
Parapelvic Cyst(2)	–	8	–	–	–	8	–	–	–
Renal Cell Carcinoma(3)	4	–	8	4	4	–	12	2	2
Wilms' Tumour(4)	8	–	2	–	–	–	10	–	2
Squamous Cell Ca.	–	–	4	4	–	–	4	4	–

Table 9. Comparison between Ultrasound and Computed Tomography (Renal Mass Characteristics)

Calcf- Calcification, Pred.- Predominantly.

Two cases of renal cell carcinoma appeared as a mass of mixed echo texture on US, while on CT a solid nodule was seen inside a simple renal cyst. CT detected small, anterior, curvilinear calcification in two cases of Wilms' tumour, which was not seen on US or plain skiagram.

Renal Mass	Ultrasound					Computed Tomography					
	Venous Invasion		Lymph Node		Distant Metast.	Perineph. Extn.	Venous Invasion		Lymph Node		Direct Invasion on Adjacent Organs
RCC[3]	4	6	-	-	2	12	4	6	2	-	4
WILM'S [4]	-	-	-	-	2	6	-	-	-	-	-
SCC[5]	-	-	-	-	-	4	-	-	-	-	-

R- Regional, D- Distant.

CT detected retroperitoneal lymph node involvement in two cases of RCC, which were not detected by US. CT detected perinephric extension and direct invasion through Gerota's fascia in renal cell carcinoma, which could not be appreciated on US.

DISCUSSION

With the explosion of technologies in diagnostic radiology, more and more small asymptomatic lesions are being detected, thereby increasing cure rate and survival of the patients. Many asymptomatic renal cell carcinomas are now being detected incidentally during USG and CT done for other reasons. Intravenous urography was and still remains the primary screening test for all patients who presents with urinary symptoms such as haematuria. It is well known however that small renal tumours, especially those tumours which are exophytic and arise from anterior or posterior surface may not be detected on IVU. In the present study, 50 cases of renal masses were investigated radiologically using modalities like urography, ultrasound and CT. The patients selected were either symptomatic having the renal symptoms or having symptoms unrelated to urinary tract, but a renal mass was detected incidentally on investigation. USG guided fine needle aspiration cytology (FNAC) was performed in cases, where a definite radiological diagnosis could not be made. The role of ultrasound and CT was specifically studied in relation to renal mass echotexture, 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 USG and CT in diagnosis of renal masses. We encountered 12 cases (24%) of APKD in our study. All the patients were between ages of 21 years to 60 years. The patients presented with palpable masses, hypertension, pain abdomen and haematuria. 50%[7] patients were hypertensive at the time of presentation, while 50%[7] patients were normotensive. On USG, the kidneys in all[1] cases were enlarged with lobulated contours showing numerous cysts of varying sizes. These findings on US have been observed by several workers like [Kristensen et al 1972][8] and discussed the various advantages of USG in evaluation of APKD. They said that bilateral involvement can be well demonstrated on USG, even when IVP suggests unilateral disease. Also USG helps in demonstrating the extent of the disease and distinguishes polycystic disease from other abdominal masses. It is a useful screening modality for family members of this patient, although in our study all family members were not screened. On CT, the kidneys showed the same changes as seen on USG on unenhanced scan. There was no evidence of calcification in our study. In all 12 patients, the kidneys were enlarged with lobulated contours with distortion of collecting systems and replacement of renal parenchyma by multiple cysts of varying sizes. CT is useful in detecting the uncommon association of APKD and tumours. The most common neoplasm found with polycystic disease is renal cell carcinoma. However, no associated tumour was seen in our study. APKD frequently showed cysts in liver and occasionally in the pancreas and spleen on CT. CT scan and USG have been compared in several studies for APKD patients. It is generally seen that for initial diagnosis, CT may be slightly more sensitive than USG. Although, CT reveals the details of other abdominal structures such as liver and pancreas, it exposes patients to radiation and contrast. Therefore, US has the small advantage over CT for initial screening. CT is indicated when USG is not convincingly positive or when a renal complication such as intracystic haemorrhage, perinephric abscess or renal cell carcinoma is suspected. Various terms used for parapelvic cysts include renal sinus cyst, peripelvic cyst and parapelvic lymphatic cyst. Before the advent of US and CT, these cysts were diagnosed infrequently. Some workers have recommended the term "renal sinus cyst" as a generic description of any cystic mass found in the renal sinus. The true incidence of parapelvic cyst is unknown. We came across only 8 parapelvic cysts (16%) during our period of study [Table 1]. These cysts have been a focus of much discussion because of their confusion with hydronephrosis. These cysts can also be sonographically confused with renal pelvis lipomatosis. On US, the parapelvic cyst was diagnosed without difficulty because of its site and characteristics. The cysts measured between 1 - 5 cm were echo free with smooth margins and acoustic enhancement. They may blend with the normal pelvis mimicking dilatation, but these can be differentiated on post contrast scans since they do not show any enhancement. Although, in our case a definite diagnosis could be made on US. CT post-contrast has a definite role in diagnosing parapelvic cysts and differentiating them from hydronephrosis whenever confusion between the two entities occurs. Wilms' tumour represents 2% of all abdominal masses occurring after new-born period. In our study of renal masses, we encountered 20% cases of Wilms' tumour. All patients were below 10 yrs. of age. All the patients in our study presented with an abdominal lump. 80% had fever and none had hypertension. Haematuria was the presenting complaint of 40% [Table 5]. While according to Cremin, 15% of children with Wilms' have haematuria. Mertem et al in 1976 had observed that Wilms' occurring in adolescents and adults often attain large sizes cause much renal destruction and present clinically with flank pain, haematuria and palpable lump, but haematuria is not commonly seen. Ultrasound was diagnostic in all of our cases. It detected the gross morphology of the tumour, local or distant [liver] metastasis and condition of the contralateral kidney. 80% of tumours were predominantly solid on US with homogeneous appearance. Renal cell malignancy is the most common urological malignancy in adults, accounting for 4%

of adult malignancies. In the present study, 16 cases were found and studied. The age range of the patients was 36 to 80 years. According to this study, renal cell carcinoma occurs in patients over the age of 40 years and it is most common in fifth and sixth decades. In present study, the male-to-female ratio is 5: 3 [Table 4]. In our study 87.5% [14/16] patients had painless haematuria, 100% of patients had abdominal pain and 62% had palpable lump and 75% patients complained of weight loss. The classical triad of renal cell carcinoma i.e. flanks pain, gross haematuria and palpable lump is seen in 62% and 75% patients present with weight loss. This classical triad was seen in 50% of the patients in the present study. The pattern of calcification is an unreliable criterion since calcification in the renal cell carcinoma may be curvilinear, punctate or mixed. In our study, it was only central punctuate calcification, while two cases had mixed types of calcification. On Ultrasonography, 62.5% of the tumours were seen in the right kidney. 50% of the tumours were present as masses of mixed or heterogeneous echotexture and 25% appeared predominantly solid on ultrasonography. In our study, all the 4 solid renal cell carcinomas appeared predominantly isoechoic on USG as compared with renal cortex. No false positive or false negative cases were detected. In our study of 16 cases of renal cell carcinoma, 10 were on the right side and six on the left side. USG detected a large ipsilateral paraaortic lymph node in one case of left-sided renal cell carcinoma. However, it could not detect retroperitoneal lymph nodes in another case, which were detected by CT. In the present study, we found that US was not reliable in defining perinephric fat and renal fascia as different structures and further it could not detect direct muscle or abdominal wall invasion as seen on CT. This view is shared by other workers like Levine et al,[9] who said that sonography cannot distinguish stage I and stage II renal cell carcinomas and is also inaccurate in staging of IVA tumours. Consequently, sonography was found to be distinctly inferior to be CT for staging of RCC. US detected liver metastasis in two cases (12.5%).

CT evaluation of a renal tumour begins with unenhanced scans. This helps in knowing the presence of any calcification undetected on plain skiagram or US and helps in determining whether the tumour enhances and to what degree it enhances after injection of contrast. Pre-contrast CT appearances of RCC vary considerably, depending on their gross pathological features. In our study, on CT 75% of the tumours appeared solid with necrotic areas. 25% appeared predominantly solid in nature. 87.5% tumours had a non-homogenous appearance on pre-contrast CT. 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%[1] tumours had irregular margins; only 4 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% [4/16] of renal cell carcinomas were confined to the renal capsule as seen on CT. In 75%[1] tumours, perinephric extension beyond renal capsule was observed. In 25% [4/16] cases, the tumour had spread through the renal fascia with direct invasion of abdominal wall in one case.

Levine et al[9] stated that CT findings that indicate a stage II tumour include an indistinct tumour margin, obliteration and blurring of perirenal fat and thickening of renal fascia. According to above workers, CT is accurate in detecting these changes.

In the present study two tumours which were confined to renal capsule on surgery was misinterpreted as stage II on CT, because of large size of the tumour. This difficulty in discriminating stage I and II tumours occurred, because the size of the tumour was quite large and same thing was also observed by Doda et al in 1986. These workers otherwise did not find any correlation between size and stage of the tumour.

In the present study CT demonstrated inferior vena caval invasion in 6 cases, which was also detected by US. CT showed invasion of left renal vein in two cases of left-sided renal cell carcinoma, but was unable to show tumour extension into right renal veins in four cases. Thus, CT had no advantage over US in demonstrating vascular invasion in our study. Renal vein extension is suspected on CT if the vein is enlarged and shows intraluminal areas of decreased density on post-contrast scan or abrupt changes in calibre. For the purpose of detecting renal vein invasion, the renal vein diameter should not exceed 1.5 cm on CT (The actual diameter corrected from diameter on scan). Furthermore, the mean inferior vena caval diameter should not exceed 2.7 cm (Actual diameter corrected from diameter on scan). In the present study, renal vein invasion was seen only in two cases where the diameter of left vein was 2 cms on CT. IVC was dilated in two 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 in patients with renal cell carcinoma may result from either bland thrombus or tumour thrombus or combination of the two. CT can differentiate the two since tumour thrombus shows contrast enhancement whereas bland thrombus displays no enhancement (Handel et al, 1993). CT detected regional lymph node involvement in two patients, which were not detected by US. The limitation of US in detecting these lymph nodes has already been discussed. According to Levine, abdominal lymph nodes less than 1 cm in diameter can be identified on CT and are considered normal.

Nodes in 1 to 2 cm range, especially if numerous should be regarded with suspicion, but are considered indeterminate by criterion alone and nodes exceeding 2 cm in diameter are almost always enlarged by tumour. CT demonstrated direct spread through Gerota's fascia in 4 cases, a feature not appreciated on US as perinephric fat and renal fascia cannot be shown as distinct structures on US.

CT showed distant metastasis to liver in two cases (also seen on US). In our study CT staging, according to Robson's method has been done, since this method is easy, widely used and correlates well with information derived from CT. The accuracy of CT in staging renal cell carcinoma in the present study was 90%. In our study, only two cases showed distant metastases to liver. They were more than 10 cm in size. Out of 4 tumours more than 10 cm in size in our study, 50% of the tumours did not cause metastases.

Squamous cell carcinoma- We studied 4 cases of squamous cell carcinoma during the period of this

observation. All the cases were male and of over 40 years. All these cases were presented with palpable lump on the right side, pain in the abdomen and weight loss.

On USG, the entire kidney was converted into a heterogeneous mass with calculi within it [Table 7]. The masses were heterogeneous with areas of pus and necrosis. The US picture was indistinguishable from pyonephrosis and xanthogranulomatous pyelonephritis. In all these cases, there were no lymph node enlargement or IVC invasion detected.

The CT appearances were also not able to exclude pyonephrosis and xanthogranulomatous pyelonephritis. On CT, the involved kidney was enlarged with multiple low-density areas suggesting pus and necrosis. The masses showed heterogeneous enhancement on post contrast scan.

CONCLUSION

Ultrasound is the first step in the staging of renal cancer before surgery; to assess 2.5 and 7 in diameter CT scan is the gold standard for solid and cystic lesion.

Ultrasound has a definitive role in determining the nature of renal cell carcinoma. However, ultrasound has its limitation in determining the extent of tumour. It cannot show perinephric fat and renal fascia as distinct structures and has limitation in evaluating central retroperitoneum, making it difficult to evaluate tumour extension into the retroperitoneal lymph nodes. Ultrasound is equally sensitive to CT in detecting venous invasion into renal vein or inferior vena cava in cases of renal cell carcinoma. CT has definite advantage over USG in pre-operative staging of renal cell carcinoma due to its ability in demonstrating perinephric extension, invasion of renal fascia, evaluation of central retroperitoneum and detection of distant metastases. In case of squamous cell carcinoma, it may be difficult to give a definite diagnosis based on USG and CT. However, USG-guided needle aspiration may be helpful in few cases. Both USG and CT are useful in determining the nature and extent of Wilms' tumour with CT having few advantages over USG in detection of necrosis, calcification and perinephric extension of the tumour.

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