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EVALUATING THE ROLE OF THE MDCT IN DETECTION OF THE RENAL MASSES IN CANCER INSTITUTE

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ABSTRACT

Background: Due to advancements in diagnostic parameters, CT scan times have significantly decreased. This is because different software packages allow for adjustment of the scan settings and an increase in spatial resolution. **Aim**: The purpose of this study was to examine the pattern of renal mass enhancement and attenuation at various stages (cortico-medullary, nephrographic, and unenhanced phases).

Methods: Multidetector CT was utilized for a more accurate assessment of the enhancement pattern and attenuation values of renal masses during the nephrographic, corticomedullary, and unenhanced phases. Referrals for CT abdomen were made for participants who complained of flank pain/fullness, hematuria, or renal masses on ultrasonography. Finally, 20 cases with renal masses on CT that were confirmed to exist were added.

Results: The kidney masses were determined to have a mean size of 6.4 ± 4 cm, with a range of 2 to 20 cm. 12 lesions were discovered to be cancerous, while eight lesions were benign. Only one benign lesion had poorly defined tumor margins, compared to seven benign lesions with well-defined margins. Merely two malignant lesions exhibited clearly defined margins, whereas the remaining ten lesions displayed poorly defined margins. There was a statistically significant difference between the margins of the benign and malignant tumours. In benign lesions, the enhancing pattern was diverse in three cases and homogenous in five.

Conclusion: According to the current study's findings, renal masses should be appropriately characterized and detected during all phases of the examination process, including the nephrographic, corticomedullary, and enhanced phases.

Keywords: malignancy, enhancing pattern, benign, CT, renal masses, attenuation.

INTRODUCTION

Renal tumours, particularly RCC, are a major public health concern in India, where the frequency is approximately 1/100,000 in women and 2/100,000 in males. Since life expectancy is rising, awareness is improving, better diagnostic facilities like MRI and CT are available, and risk factors like obesity are becoming more common, incidence is predicted to rise in India2. Accurate radiographic detection is crucial for ensuring appropriate renal mass care. Solid lesions and cystic lesions are the two common forms of renal tumours that are typically encountered. About 27% of the people with lesions were found to have cystic lesions, which are often found in subjects older than 60.3.

Renal masses identified by CT or MRI are categorized as solid or complicated cystic. It is discovered that 85% of solid lumps are cancerous. Therefore, unless they turn out to be benign, any solid lumps encountered are assumed to be cancerous. Renal cell carcinoma is the most frequent malignant tumor seen in the kidneys, and its incidence is rising by 3% year. Clear cell carcinoma is the most prevalent subtype of renal cell carcinoma, with papillary carcinoma coming in second.4 Secondary sarcomas, metastatic lesions, lymphomas, and transitional cell carcinomas are other malignant lesions that can be seen in the kidney. Usually, cancers related to the gastrointestinal system, lungs, and breast cause metastases in the kidney.

About 20% of lesions are benign tumours, with oncocytomas being the most prevalent solid tumor.5. Hematatomas, renal infarction, lipomatosis, and inflammatory pseudotumours with or without pus are frequently observed among non-cancerous masses found in the kidney. The diagnosis and treatment of renal masses have become increasingly significant in recent times due to a rise in their incidence.6

The time required for scanning has significantly decreased as a result of improvements in diagnostic parameters. CT, when combined with a variety of software that allows for manipulation and an increase in spatial resolutions, may scan data faster. Faster scanning and results are achieved with multidetector CT due to its shorter rotation time than traditional CT. Additionally, a variety of thin slices, where these slices are in three dimensions for improved vision and treatment planning, might help in a better assessment of the renal masses to be found.7

The benefits of multidetector CT include improved spatial resolution, faster scan times, higher temporal resolution, and expanded volume coverage. Renal cell carcinoma is the most prevalent tumor of the kidney's epithelial cells, making up around 90% of all cancers found in the renal system. It is also the most deadly disease found in the urologic system. Subjects with renal cell cancer and lymph node metastases have just 20% five-year survival.8

Accurate diagnosis and treatment are required due to the rise in incidence and improvements in detection and diagnosis. Since some of the lesions found are benign and some turn out to be malignant, surgery is required to remove them.9. In this clinical study, renal masses were studied for their enhancement and attenuation patterns during three distinct phases: cortico-medullary, nephrogenic, and unenhanced. Additionally, renal parenchymal enhancement characteristics were assessed during these phases, and results from CT scans were compared with pathological diagnoses.

MATERIAL & METHODS

The goal of the current prospective observational study was to compare the results of the CT scan with the pathological diagnosis, as well as to examine the enhancement and attenuation pattern of renal masses during various phases (Cortico-medullary, nephrographic, and unenhanced phases). Twenty participants in the study, ranging in age from 32 to 54, were involved. There were both male and female patients included. Multidetector CT revealed the renal mass in each of the 20 included individuals. The study was carried out at MCSRC, Patna, from April 1, 2023, to October 31, 2023.

Multidetector CT was utilized for a more accurate evaluation of the enhancement pattern and attenuation values of actual masses during the nephrographic, corticomedullary, and unenhanced phases. Individuals who reported having flank pain or fullness, as well as those who were referred for an abdominal CT scan after an ultrasonography incidentally revealed renal tumours. Finally, 20 cases with renal masses on CT that were confirmed to exist were added.

Every participant in the study gave their informed consent. The Institute's Ethical Committee gave the study its blessing. The renal cysts were classified using the Bosniak criteria. Cysts were categorized as either benign or malignant. Subjects with simple renal cysts seen on ultrasonography and those who had suffered traumatic kidney injury were not allowed to participate in the study. A clinical significance level of $p<0.05$ was used to the statistical evaluation of the gathered data.

RESULTS

The goal of the current investigation was to assess renal parenchymal enhancement features during the cortico-medullary, nephrogenic, and unenhanced phases, as well as the enhancement and attenuation pattern of renal masses during these stages. Additionally, a comparison between the pathology diagnosis and the CT findings was made. Twenty patients, ranging in age from 32 to 54, with a mean age of 41.7, were enrolled in the study. Table 1 contains a list of the study individuals' demographic details. Upon assessment, the average size of the kidney masses

observed was determined to be 6.423±4, with a range of 2 to 20 cms. Both benign and malignant tumours' radiological characteristics were evaluated and classified.

Twelve of the twenty participants had malignant tumours discovered, while eight of the subjects had benign lesions. Table 2 illustrates the features of renal masses. Regarding the enhanced pattern, it was observed that in 5 of the benign lesions, the pattern was homogenous, but in the other 3 benign lesions, there was heterogeneity. Out of the twelve malignant lesions, only one had a homogenous enhancing pattern, while the other eleven had heterogeneous patterns. With a p-value of less than 0.05, the variations between the enhanced patterns and heterogeneity in malignant and benign lesions were statistically significant.

Only one benign lesion had poorly defined tumor margins, whereas the other seven benign lesions had well-defined margins. Of the malignant lesions, only two had well-defined margins, while the remaining ten had ill-defined margins. A p-value of <0.05 indicated that there was a statistically significant difference between the margins of the benign and malignant tumor. In contrast to one malignant lesion exhibiting calcification, two benign lesions displayed calcification. The benign and malignant lesion attenuation patterns revealed that, in the unenhanced phase, the HU values for the two types of lesions were, respectively, 9.25 and 34.58. The HU values for malignant renal masses were 72.4 and 94.00 in the nephrographic and corticomedullary phases, respectively (Table 3). The nephrographic phase was characterized by less enhancement than the corticomedullary phase. The enhanced difference between benign and malignant tumours was also statistically significant, with a p-value of <0.05.

DISCUSSION

Multidetector CT is a useful tool for accurately characterizing and diagnosing kidney masses. The use of MDCT for renal mass identification and management has expanded significantly due to advancements in data recording and display technology. The goal of the current clinical investigation was to examine the patterns of renal mass augmentation and attenuation at various stages. Planning an appropriate course of treatment and providing patients with counseling requires an accurate assessment of the renal tumours. Twelve of the twenty participants had malignant masses, while eight of the participants had benign tumours. This is most likely because of the cancer-focused tertiary center. Of all the tumours found, renal cell carcinoma was the most often occurring, accounting for 55% of the cases.

The tumor in this study had a mean size of 6.4 ± 4. These results were in line with research conducted in 2004 by Shetty et al. (10), where lesion sizes ranged from 2.4 to 14 cm. The mean size of the renal masses was similarly reported to be 7 cm by Welch et al.11 in another investigation. With respect to enhancement pattern, the benign and malignant tumours had HUs in the unenhanced phase of 9.25±19.55 and 34.58±3.654, respectively, with a p-value of 0.008. These results, with a p-value of 0.000, were 16.62±27.097 and 94.00±10.171 during the corticomedullary phase, respectively. The values for benign and malignant tumours during the nephrographic phase were 18.37±27.90 and 72.41±10.714, respectively. All of these values lacked statistical significance.

These results also differed from non-significant studies by Cohan et al. (2012) and Szolar et al. (2013) that found more attenuation in the corticomedullary phase relative to the neurogenic phase. In five cases, the benign tumor exhibited a homogenous pattern, while the other three cases had a heterogeneous distribution. One mass had a homogenous distribution, while 11 cases of malignant tumours had a heterogeneous distribution. These results were consistent with the increasing enhancement radiographically described in the Birnbaum et al investigation. In the current investigation, the most frequent presenting symptoms for benign lesions were fever (n = 2) and pain (n = 3), while similar results were seen for malignant cases. These results were in contrast with the findings by Jayson et al[14] and Amendola et al[15] where hematuria and flank pain was the most common presenting symptom shown by the 131 subjects studied.

CONCLUSION

In the present study, all the masses were visible in both nephrographic phases and corticomedullary phases. For differentiating benign tumours from malignant tumours, and their characterization, attenuation values, and the enhancement patterns played an important tool. Regarding enhancement patterns of benign tumours, no statistically significant difference was seen in nephrographic and corticomedullary phases. For malignant renal masses, enhancement was greater in the corticomedullary phase compared to the nephrographic phase. The present study concludes that renal masses should be evaluated in all phases including unenhanced, corticomedullary, and

nephrographic phases for appropriate characterization and detection of the renal masses. Although, the present study had few limitations including a smaller sample size, short monitoring period.

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TABLES

Demographic Characteristic	Value
Total Subjects	20
Mean Age (in years)	41.7± 6.69
Age Range	32-54 years
Males	12
Females	8

Table 1: Demographic Characteristics of study subjects

Renal Mass Characteristic	Number	Percentage	SD
Size	6.4(cm)		4.0
Frequency			
Right	10	50	
Left	7	35	
Bilateral	3	15	
CT Diagnosis			
Renal Cell Carcinoma	11	55	
Transitional Cell Carcinoma	1	5	
Angiomyolipoma	2	10	
Renal Abscess	1	5	
Oncocytoma	1	5	
Bosniak Type II	2	10	
Bosniak Type III	1	5	
Bosniak Type IV	1	5	

Table 2: Characteristics of Renal Masses in study subjects

Parameter	Benign (n=8)	Malignant (n=12)	p-value
Presenting Symptom			
Fever	2	3	0.077
Pain	3	4	0.574
Lump	1	2	0.413
Haematuria	1	2	0.85
Weight Loss	1	1	0.005
Tumor Margins			
Well-defined	7	2	0.002
Ill-defined	1	10	
Enhancement Pattern			
Heterogeneous	3	11	0.01
Homogeneous	5	1	
Attenuation			
Hyperdense	0	1	0.76
Hypodense	7	10	
Isodense	1	1	
Hounsfield Unit			
Unenhanced Phase	9.25±19.55	34.58±3.654	0.008
Corticomedullary Phase	16.62±27.097	94.00±10.171	0.000
Nephrographic phase	18.37±27.90	72.41±10.714	0.001

Table 3: Comparison of Benign and Malignant Renal Masses in study subjects