

## Original Research Article

# Diagnostic accuracy of computed tomography scan in renal cell carcinoma

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## ABSTRACT

**Background:** Renal cell carcinoma (RCC) is becoming more common over the world. At the same time, numerous European and North American countries have achieved lower death rates.

**Methods:** This cross-sectional observational study was conducted from July 2013 to June 2014 in the department of radiology and imaging of Dhaka Medical College Hospital. Clinically suspected 50 cases of renal cell carcinoma were included in this study. The study taken ethical clearance from the department and consent from the respondents. Statistical package for the social sciences (SPSS) software used for the analysis.

**Results:** The mean age of the patients was 50.08±13.04 years. Male to female ratio was 2.1. More than half of the cases had hypodense lesion while 28% patients had calcification in the lesion. Mild enhancement was found in 56% cases and 50% were heterogenous in nature. Both nodal involvement and metastasis were limited. Computed tomography (CT) scan had 97.73% sensitivity and 100% specificity in diagnosis RCC. The diagnostic accuracy, positive predicative value and negative predicative values were 98%, 100% and 85.7 respectively.

**Conclusions:** CT scan is a useful diagnostic modality in diagnosis of renal cell carcinoma.

**Keywords:** Tomography, Carcinoma, CT scan, Renal, Accuracy

## INTRODUCTION

Kidney cancer accounts for nearly 2% of all malignancies globally.<sup>1</sup> It is the 8<sup>th</sup> most common malignancy with a worldwide annual increase of 1.5-5.9%.<sup>2,3</sup> Renal cell carcinoma (RCC) represents the greater part of malignant tumours of the kidney (80-90%). The remainder includes transitional cell carcinomas, non-epithelial kidney tumours and Wilms' tumours.<sup>4,5</sup> RCC may occur at any age, although most patients are more than 40 years and most cases arise spontaneously in fifth to seventh decades.<sup>2</sup> In children over 5 years only 0.3% to 1.3% of all cases of

RCC present in childhood. Risk factors include cigarette smoking, exposure to petroleum products, obesity, Von Hippel-Lindau disease, hereditary papillary renal cancer and patients on long term dialysis.<sup>6</sup>

Due to its high metastatic potential, a correct diagnosis and staging is required for therapy planning. When imaging is done for other medical reasons, the majority of kidney tumors are discovered by chance.<sup>7</sup> Ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) are the most routinely utilized imaging techniques to assess these incidental renal masses, with renal tumors

being accurately characterized in most cases merely by imaging.<sup>8</sup> Nonetheless, there are a number of circumstances that can obstruct the diagnosis. Nonetheless, there are numerous factors that can impede the diagnosis. The number of unexpected benign renal masses at resection has increased as the number of incidentally detected renal masses has increased.<sup>9</sup> Not only technical factors, but also errors in image interpretation and specific pathologic features, can result in misdiagnosis and, in some cases, unnecessary surgery.<sup>10</sup> Ultrasonogram is now a day being applied as an initial test as it is less time consuming, non-hazardous, cheaper and moreover can be done with minimal preparation and patients with renal impairment.

CT is the primary modality for the detection, diagnosis and staging of RCC. CT displays to the observer small differences in soft tissue areas not normally separable on X-ray KUB or IVU. On CT RCC are usually isodense or hypodense compare to normal renal tissue occasionally hyper dense.<sup>11</sup> Previous studies showed that CT scan is 94% sensitive to detect small renal cell carcinomas.<sup>12</sup> In the detection of inferior venacaval involvement in RCC, CT scan is about 75% sensitive and 100% specific.<sup>13</sup> The overall accuracy of multidetector CT in staging of preoperative renal cell carcinoma was found to be 89%.<sup>14</sup> For instance if most of the lesions studied are 2.3 cm in diameter the detection rates will be higher than if the lesions are less than 1.5 cm in the diameter.<sup>15</sup>

MRI assumes a primary role in tumour detection and staging in patients in whom contrast enhance CT scan is contraindicated because of previous major reactions to contrast material or renal failure. But it is difficult to appreciate tumour calcification on MRI. Moreover, it is time consuming, costly and contraindicated in patients with pacemaker, metallic prosthesis and in case of claustrophobia. Contrast enhanced MRI with gadolinium is helpful for diagnosis of RCC by its enhancement.<sup>16</sup>

Since intravenous urography and ultrasonogram independently cannot not provide concluding information, it is important to select a cost effective method for diagnosis of renal cell carcinoma. Though histopathology is the gold standard, CT scan has been proved to be 94% sensitive in the diagnosis of RCC in previous study. Many research works had already been done all over the world emphasizing the role of CT scan for the diagnosis of RCC but no such study is done in our country. So the aim of this study was to find out and validate the diagnostic accuracy of CT in renal cell carcinoma.

**METHODS**

This cross-sectional observational study was conducted in the department of radiology and imaging in collaboration with departments of urology, nephrology and pathology, Dhaka Medical College Hospital, Dhaka from July 2013 to June 2014 over a period of one year. The study included fifty clinically suspected cases of renal cell carcinoma

referred to the department of radiology and imaging at Dhaka Medical College Hospital in Dhaka. Adult patients of both sexes who were clinically suspicious of RCC were enrolled in this study. Patients with abnormal bleeding disorders were not allowed to participate in this study. CT was carried out on all the patients and diagnose were made on computed tomographic criteria. Histopathology was done for each lesion of the study subject. Computed tomographic and histopathological diagnoses were then compared to find out sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) and accuracy of CT in diagnosis of renal cell carcinoma. HITACHI Scenaria model with 64 Slice CT Scanner having 10 mm of slice thickness, 120Kv of KvP, 400 mA and 0.5 sec scan time machine was used for CT.

Prior to the commencement of the study, the protocol was approved by the local research approval committee. The aims and objectives of the study was explained to patients and then informed and verbal consent was taken from each subject and they were assured that all information and records would be kept confidential and be used for research purpose only. Demographic data were collected by face-to-face interview of the patients or attendants. Clinical examinations were done and the findings were recorded. Computed tomographic findings and histology findings also recorded as well. All the data were checked and edited after collection. Data were then analyzed by computer based software.

**RESULTS**

Table 1 data shows that the majority of patients were male (68.0%) and the remaining were female (32.0%). The age group distribution indicates that patients between 41-60 years old were the most common, with 22.0%, 30.0% and 22.0% of patients falling into the age groups of 41-50, 51-60, and 61-70, respectively. The youngest age group ( $\leq 40$  years) represented 18.0% of the sample, while patients older than 70 years represented the smallest proportion at 10.0%. The mean age of the sample was 50.08 years, with a standard deviation of 13.04 years. The age range of the sample was between 32 and 86 years.

**Table 1: Age group distribution of the patients (N=50).**

Variables	Frequency	Percent
<b>Age (years)</b>	9	18.0
$\leq 40$	11	22.0
41-50	15	30.0
51-60	10	20.0
61-70	5	10.0
$>70$	9	18.0
<b>Mean SD</b>	50.08 $\pm$ 13.04	
<b>Min - max</b>	32-86	
<b>Gender</b>		
Male	34	68.0
Female	16	32.0

Table 2 shows that 56.0% of the lesions were located in the right kidney, 36.0% were in the left kidney, and 8.0% involved both kidneys. The majority of lesions (86.0%) were ill-defined, while only 14.0% were well-defined. In terms of density on non-contrast enhanced CT (NECT), 58.0% of lesions were hypodense, 40.0% were isodense, and only 2.0% were hyperdense. Calcification was present in 28.0% of lesions. In terms of degree of enhancement, 56.0% of lesions showed mild enhancement, 30.0% showed moderate enhancement, and 14.0% showed no enhancement. The pattern of enhancement was heterogeneous in 50.0% of cases, homogenous in 36.0%, and 14.0% showed no enhancement. Nodal involvement was present in 28.0% of cases, while involvement of the renal vein and inferior vena cava (IVC) was present in 16.0% of cases. Metastasis was present in 34.0% of cases.

**Table 2: Characteristics of the lesions (N=50).**

Variables	Frequency	Percent
<b>Site of involvement</b>		
Right kidney	28	56.0
Left kidney	18	36.0
Both	4	8.0
<b>Margin of the lesion</b>		
Ill defined	43	86.0
Well defined	7	14.0
<b>Density of lesion in NECT</b>		
Hypodense	29	58.0
Isodense	20	40.0
Hyperdense	1	2.0
Calcification (present)	14	28.0
<b>Degree of enhancement</b>		
Mild	28	56.0
Moderate	15	30.0
No	7	14.0
<b>Pattern of enhancement</b>		
Heterogeneous	25	50.0
Homogenous	18	36.0
No enhancement	7	14.0
Nodal involvement	14	28.0
Involvement of renal vein and IVC	8	16.0
Metastasis (present)	17	34.0

**Table 5: Sensitivity, specificity, positive and negative predictive values, and diagnostic accuracy of CT scan in diagnosis RCC.**

CT findings	Histopathology findings		Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
	RCC	Other than RCC					
RCC	43 (TP)	0 (FP)	97.73	100.0	100.0	85.71	98.0
Other than RCC	1 (FN)	6 (TN)					

**DISCUSSION**

The mean age of the patients was 50.08±13.04 years ranged from 32 to 86 years (Table 1). It was reported in the

Table 3 shows that 86.0% of the lesions were diagnosed as RCC, which is the most common type of kidney cancer in adults. Only 4.0% of lesions were diagnosed as transitional cell carcinoma (TCC) and another 4.0% were diagnosed as tuberculosis (TB) abscess and angioliipoma. The remaining 2.0% of lesions were diagnosed as complex renal cyst.

Table 4 shows that 88.0% of the lesions were diagnosed as RCC, which is consistent with the CT diagnosis in Table 3.

Additionally, 4.0% of the lesions were diagnosed as TCC, while another 4.0% were diagnosed as angioliipoma. The remaining 4.0% of lesions included a TB abscess and an infected cyst.

**Table 3: Findings of the CT diagnosis of the lesions (N=50).**

Findings	Frequency	Percent
RCC	43	86.0
TCC	2	4.0
TB abscess	2	4.0
Angioliipoma	2	4.0
Complex renal cyst	1	2.0

**Table 4: Histopathological findings of the lesions (N=50).**

Findings	Frequency	Percent
RCC	44	88.0
TCC	2	4.0
Angioliipoma	2	4.0
TB abscess	1	2.0
Infected cyst	1	2.0

Table 5, among the 50 patients in the study, CT scan correctly identified 43 patients with RCC, resulting in a sensitivity of 97.73% and a specificity of 100.0%. The PPV of CT scan was 100.0%, indicating that the test was highly accurate in confirming the presence of RCC. The NPV was 85.71%, indicating that the test was less reliable in ruling out the presence of RCC. The overall diagnostic accuracy of CT scan in detecting RCC was 98.0%.

other study that RCC usually occurs after the age of 40 years.<sup>17</sup> The current study finding is consistent with that study in this regard. In the present study male to female ratio was 2.1:1 (Table 1). This finding is in agreement with

the report of Sutton who reported male to female ratio as 2.5:1.<sup>17</sup>

The majority of the lesions were ill-defined (86.0%) and hypodense in NECT (58.0%). Calcification was present in 28.0% of the lesions, and nodal involvement was found in 28.0% of the patients (Table 2).

CT achieved excellent diagnostic accuracy in this study. This study found 97.73% sensitivity, 100.0% specificity, 100.0% PPV, 85.71% NPV and 98.0% accuracy in diagnosis RCC (Table 5). In a study conducted in Bangladesh by Biswas et al (2011), sensitivity, specificity, positive predictive value, negative predictive value and accuracy of CT scan in the diagnosis of renal tumours were 100%, 66.66%, 100.0%, 85.7% and 97.43 respectively.<sup>18</sup>

Triphasic contrast-enhanced CT was found to have 98% sensitivity and 92% specificity for the diagnosis of RCC by Ruppert-Kohlmayr et al.<sup>19</sup> Divgi et al discovered that multiphasic contrast-enhanced CT has 76% sensitivity and 47% specificity for RCC diagnosis.<sup>20</sup> Li et al revealed that contrast-enhanced CT has an 81% sensitivity and a 64% specificity for RCC diagnosis.<sup>21</sup> Tamai et al noticed that contrast-enhanced CT has an 89% sensitivity and a 73% specificity for RCC diagnosis.<sup>22</sup> Yuan et al found that contrast-enhanced CT has a sensitivity of 73% and a specificity of 50% for diagnosing RCC.<sup>23</sup> Kim et al reported that multiphasic contrast-enhanced CT has 74% sensitivity and 100% specificity for RCC diagnosis.<sup>24</sup>

### Limitations

This is a single center study with limited sample size. So, the findings might not reflect the scenarios of the whole country.

### CONCLUSION

CT scan was found highly sensitivity and specificity test to diagnose the RCC. The diagnostic accuracy, positive predicative value and negative predicative values were also high. So it can be stated that CT scan with or without contrast is the most precise method of diagnostic confirmation of renal cell carcinoma.

### Recommendations

We recommend multi-centre study with large sample size.

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