ORIGINAL ARTICLE
DIAGNOSTIC ACCURACY OF CONTRAST ENHANCED CT FOR DETECTION OF RENAL CELL CARCINOMA TAKING HISTOPATHOLOGY AS GOLD STANDARD

Faiza Akram¹, Arfa Mazhar², Hamza Javed³, Muhammad Fayyaz⁴, Ayub Khan⁵, Khalil Ahmad⁶
¹Department of Radiology, Ayub Medical College, Abbottabad, ²Department of Radiology, King Abdullah Teaching hospital, Mansehra, ³Pakistan Red Crescent Society, ⁴Dentistry Department Ayub Medical College, Abbottabad, ⁵Health Department, Government of KP-Pakistan, ⁶Free lancer

Background: Renal cell carcinoma being the commonest primary renal malignancy of adulthood accounts for approximately 80–90% renal malignant lesions. The purpose of radiological imaging modalities when devising the treatment options for renal masses is crucial as it significantly influence the clinical outcome and prognosis of the disease. Subjective impression by a radiologist for diagnosing a mass lesion is known to be critical and its precision is improved by contrast enhanced CT as demonstrated by certain retrospective analyses. We aimed to ascertain the diagnostic accuracy of contrast enhanced computed tomography to diagnose renal cell cancers by verifying through histopathology reported diagnoses. Methods: This Cross-sectional (validation) study was carried out in Radiology and Urology departments of Ayub Teaching Hospital; Abbottabad, from 1st November 2020 to 30th April 2022. The study population included all admitted symptomatic patients with age range 18–70 years of either gender. The patients were subjected to detailed clinical examination and history and an ultrasound and contrast enhanced CT abdomen and pelvis. CT scans were reported under supervision of single consultant radiologist. Data was analysed in SPSS version 20.0. Result: Mean age of the patients was 38.88±11.62 years ranging from 18–70 years and mean duration of symptoms was 54.64±49.171 ranging from 3–180 days. All of the total 113 patients underwent contrast enhanced CT scan and later operated to confirm the diagnoses by histopathology. The comparison yielded true positive (TP) cases to be 67, True Negative (TN) 16, False Positive (FP) 26, and 4 False Negative (FN) as per CT scan diagnoses. CT scan had a diagnostic Accuracy of 73.45% with 94.37% sensitivity and 38.10% specificity. Conclusion: Contrast-enhanced CT has a high sensitivity for making the diagnosis of renal cell carcinoma; however, its specificity is low. A multidisciplinary approach is necessary to overcome the low specificity. Therefore, collaboration between radiologists and urologic oncologists should be considered while devising treatment plan for patients.

Keywords: Validity parameters; Diagnostic Accuracy; Renal cell carcinoma; Contrast enhanced CT; Histopathology


INTRODUCTION
Renal cell carcinoma (RCC) being the most frequently encountered primary renal system malignancy of adulthood accounts for approximately 80–90% renal malignant lesions.¹ About 3.38 hundred thousand cases of RCC are diagnosed annually globally.² Majority of the patients of RCC are asymptomatic but can present with a multitude of symptoms as the tumour metastasizes.³ Increased incidental findings of RCC and other abdominal malignancies have been reported in the recent past due to more often use of imaging modalities, especially renal masses of ≤4 cm.⁴,⁵ Screening computed tomography (CT) of 3000 patients done for screening colonic pathologies reported an incidental finding of renal lesion of >1 cm size in 14% of their study sample.⁶ Almost every imaging modality has limitation of being unable to reliably differentiate between benign or malignant nature of any lesion as well as extent of spread of the tumor.⁷,⁸ Imaging modalities of choice for renal system includes ultrasonography, CT and magnetic resonance imaging (MRI).⁹,¹⁰ Contrast enhanced CT scans are preferred for assessing the stage of renal lesions as it can better characterize the extent of spread of renal lesion as well as the nature of the mass being solid or cystic.¹¹,¹² About 90% of the malignant renal lesions are RCC.¹³,¹⁴ Most common type of RCC is clear cell (75%), then papillary carcinoma (7–15%) and chromophobe RCC (~5%), while distal ducts and
medullary region carcinomas to gather accounts for <1% of the tumours.²,⁵,₁₆ RCC are locally invasive tumours that can metastasize and the most common sites for metastasis is regional lymphatics, lungs, bone, liver and brain etc.⁴,¹⁷

The purpose of radiological imaging modalities when devising the treatment options for renal masses is crucial as it significantly influence the clinical outcome and prognosis of the disease.⁶ So far diagnostic accuracy and staging precision of kidney tumours has been scrutinized and explored by using various investigative modalities, including ultrasonography, MRI and CAT scan.¹⁸,¹⁹ Subjective impression by a radiologist for diagnosing a mass lesion is known to be critical and its precision is improved by contrast enhanced CT as demonstrated by certain retrospective analyses.³,⁹,¹⁰,₂⁰,₂¹ CT, being the conventional prime imaging modality for the work-up of RCC, furnish exceptional anatomical details by giving virtual stereoscopic reconstructed images.⁴,¹²

We aimed to ascertain the diagnostic accuracy of contrast enhanced computed tomography to diagnose renal cell cancers by verifying through histopathology reported diagnoses. The outcomes from our data may provide evidence to support the use of contrast enhanced CAT scan as radiological modality of choice for pre-surgery assessment of renal cell malignancy and thus machinate a prim management plan in order to reduce the associated morbidity and mortality.

**MATERIAL AND METHODS**

This Cross-sectional (validation) study was carried out in Radiology and Urology departments of Ayub Teaching Hospital; Abbottabad, from 1st November 2020 to 30th April 2022. A sample size of 113 was calculated using the Epiinfo web-based sample size calculator. After obtaining approval from the hospital medical ethics committee, data was collected using non-probability consecutive sampling technique from all symptomatic patients aged 18–70 years, presenting to urology and radiology departments of ATH during the study period. Patients known to have solitary kidney, CRF or patients on dialysis were excluded from this study. The purpose, benefits and risks involved in study as well as the purpose of the research were rationalized to the patients. When agreed upon, written educated consent was acquired from the patients. All patients were subjected to detailed clinical examination and history and ultrasound abdomen and pelvis. Once ultrasound was done, the patients were referred to contrast enhanced CT scan. Departmental protocols were followed for performing the contrast enhanced CT. All CT scans were reported under supervision of single expert radiologist having minimum experience of 5 years.

After surgery, histopathology was performed and a copy of the report was obtained to compare the CT diagnoses with the gold standard. All the above-mentioned data was jotted down on a pre-designed proforma.

Data was analysed using SPSS version 20.0. Mean and standard deviation were calculated for continuous variables, while frequency and percentages were calculated for categorical variables. Diagnostic validity of contrast enhanced CT with regard to sensitivity, specificity; positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy were calculated from a 2x2 table by taking histopathology as gold standard.

**RESULTS**

Among 113 patients included, 48.7% (55) were male and 51.3% (58) were female. The mean age of the study participants was calculated at 38.88±11.62 years. Our study population in the age range of 31–70 years was 70.8% while the mean duration of symptoms was 54.64±49.171 days, as shown in table-1.

Figure-1 shows the frequency of main signs and symptoms with which patients presented to the urology clinic. The most common symptom was flank pain present in 90% patients while least common symptom was weight loss found in 49% patients.

Table-2 shows the cross tabulation between frequency of diagnosis of renal carcinoma on CT versus the frequency of diagnosis on histopathology. Out of the total 113 patients, 67 were true positive (TP), 16 True Negative (TN), 26 False Positive (FP), and 04 False Negative (FN) as per CT scan-based diagnoses.

Table-3 shows the validity parameters of CT scan to diagnose a case of renal mass as renal carcinoma. These parameters were calculated by comparing the CT based diagnoses with the gold standard that is histopathology. We found that CT scan had a diagnostic Accuracy of 73.45% with 94.37% sensitivity and 38.10% specificity.

![Figure-1: Frequency of main signs and symptoms](http://www.jamc.ayubmed.edu.pk)
The mean age of the patients was 38.88±12.620 ranging from 18–70 years and mean duration of symptoms was 54.64±49.171 ranging from 3–180 days while in frequency of age group, 33 (29.2%) were from age group of 18–30 years and 80(70.8%) were from age group of 31–70 years. The frequency of gender there were 55 (48.7%) male and 58 (51.3%) female. These findings are in correlation with the current literature.10,14

In our study, the sensitivity of the CT scan was 94.37% and Specificity was 38.10%. The positive and negative predictive values were 72.04% and 80.88% respectively. The overall diagnostic accuracy of CT scan was calculated to be 73.45%. Our results are very close to the so far published literature. A study conducted by Jae Heon Kim et al., in the Soonchunhyang University hospital, included 68 patients found that 60 (88.2%) of them had RCC and eight had innocuous disease. The sensitivity and specificity of contrast enhanced CT for predicting RCC was found to be 79.7% and 44.4% respectively and the diagnostic accuracy rate of contrast enhanced CT was 79.41%. A systematic review article assessed the diagnostic performance of contrast enhanced CT for renal cancers and reported the median sensitivity and specificity to be 88% (interquartile range [IQR] 81–94%) and 75% (IQR 51–90%).

Alejandro Sanchez et al in their review article on management of small renal masses suggested that a multiphasic enhanced imaging modality such as MRI or CT should be used for the initial workup of renal masses. Although, the sensitivity of CT scan to detect a renal carcinoma is high, but the specificity is very low. Therefore, one can miss a serious renal cancer using just CT scan as a modality for diagnosis of a renal lesion. Therefore, collaboration between radiologists and urology oncologists should be considered while devising treatment plan for patients with renal malignancy.

DISCUSSION

Table-1: Age distribution and duration of symptoms (in days)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>113</td>
<td>18</td>
<td>70</td>
<td>38.88</td>
<td>12.620</td>
</tr>
<tr>
<td>Duration (days)</td>
<td>113</td>
<td>3</td>
<td>180</td>
<td>54.64</td>
<td>49.171</td>
</tr>
</tbody>
</table>

Table-2: Cross tabulation of diagnosis on CT with histopathology

<table>
<thead>
<tr>
<th>Diagnosis on CT</th>
<th>Diagnosis on Histopathology</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Present</td>
<td>67</td>
<td>26</td>
</tr>
<tr>
<td>Absent</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td>42</td>
</tr>
</tbody>
</table>

Table-3: Validity parameters of CT for diagnosis of renal carcinomas

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>94.37%</td>
<td>38.10%</td>
<td>72.04%</td>
<td>80.00%</td>
<td>73.45%</td>
</tr>
</tbody>
</table>

CONCLUSION

Contrast-enhanced CT has a high sensitivity for making the diagnosis of renal cell carcinoma; however, its specificity is low. A multidisciplinary approach is necessary to overcome the low specificity. Therefore, collaboration between radiologists and urology oncologists should be considered while devising treatment plan for patients.

AUTHORS’ CONTRIBUTION

FA, AM: Conceptualization of the study design, proof reading. HJ, MF: Data collection, data analysis, data interpretation. AK, KA: Data collection, write-up.

REFERENCES