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**ORIGINAL ARTICLE**

# Diagnostic Accuracy of MDCT (Multidetector Computed Tomography) for Staging of Renal Cell Carcinoma, Taking Histopathology as Gold Standard

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## ABSTRACT

**Background:** The advancement in technology has introduced multi-detector CT scanners and achievement of better spatial resolution with faster acquisition has become a possibility. The three-dimensional reformatted images along with multiplanar reconstructions upgrade the staging capabilities for RCC.
**Aim:** To check accuracy of MDCT (Multi-detector Computed tomography) in staging renal cell carcinoma with histopathology taken as the gold standard.
**Study design**: The study is a descriptive cross sectional study.
**Settings:** Radiology Department, Bahawal Victoria Hospital, Bahawalpur
**Study duration:** 16"' January 2019 to 15"' July 2019.
**Methods** 157 patients (including both genders) were included with age range of 25-60 years, showing features of renal cell carcinoma on ultrasonography. Those Patients with renal mass other than renal cell carcinoma, solitary functioning kidney and pregnant females were eliminated from the study. All the selected patients had Multi-detector CT scan abdomen performed.
**Results**: Mean age was 44.66+9.3 I years. Out of these 157 patients, there were 90(57.32) male patients and 67 (42.68°/c) females with ratio of I.3: I. All the patients had CT scan of abdomen and pelvis. The results showed that 8I of the patients were True Positive and only 08 were False Positive. Out of 68 CT negative patients, 07 (False Negative) showed renal cell carcinoma on histopathology while 6 I True Negative patients had no evidence of RCC on histopathology (p=0.0001).
Conclusion: Multi-detector CT scan is a very sensitive yet accurate non - invasive method for staging renal cell ca.
**Keywords:** Renal cell carcinoma, multidetector CT scan, imaging, sensitivity

## INTRODUCTION

One of the most common solid lesion of the kidney is RCC (Renal cell carcinoma). It accounts for about 90% of all malignances of the renal tract[1]. There is a male predilection of about 1.5:1. It usually occurs in 60-70 year old patients. Smoking, obesity and hypertension are the major risk factors. Family history also plays a role in its etiology. History of a first-degree relative with this type of cancer is associated with an increased risk[2,3]. For people with such a history the best advice is to abstain from cigarette smoking and watch their weight.[4] The systematic approach to reaching the diagnosis of this disease include a thorough medical history, followed by evaluation of signs and symptoms and to assess any risk factors associated[5]. In the process of screening, a series of chemical tests are done. In physical examination, finding a mass is considered significant[6]. A competent radiologist can then perform an ultrasound or CT scan guided percutaneous biopsy of the renal mass for sampling. Histopathology of the sampled tissue is done to establish the diagnosis. However, percutaneous biopsy is not a routine procedure especially when the radiologist can see the typical imaging features of this carcinoma. If we evaluate this practice from a risk benefit perspective, we can see that a false negative result and consequently a medical complication to the patient makes it an unsuitable practice[7]. Thus biopsy tests are a must to correctly distinguishing benign tumours from malignant ones. In the modern times with more and more use of imaging techniques, there are increasing cases of incidental discovery of RCC. The cases thus diagnosed are usually earlier in stage and of smaller size when discovered through ultrasound or CT done for some other complaint[8]. The need of the day is that renal tumor imaging should reliably differentiate between benign and malignant lesions and to stage these lesions accurately as it is necessary to the suitable treatment planning[9]. Spiral (CT) has been chosen for evaluation of tumor metastasis due to its high accuracy for a long time[10]. The advancement in technology has introduced multi-detector CT scanners and achievement of better spatial resolution with faster acquisition has become a possibility[11,12]. In a study, the sensitivity were 68%, specificity 85%, 76% PPV and 81% NPV of CT scan for capsular invasion. CT scan had 77% sensitivity, 82% specificity, 67% of PPV and 88.2% of NPV or hilar lymph nodes. For adrenal involvement Sensitivity were 100%, specificity 98.33%, PPV 83.33% and NPV 100% of CT scan. CT scan sensitivities 84.2%, specificities 97.5%, PPV 89%, and NPV 96.3% for renal vein invasion

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and sensitivities 100%, specificities 97.77%, PPV 80% and NPV 100% for IVC tumor thrombi[13].

Renal cell carcinoma stage is the prime factor responsible for the prognosis and survival of patients, it is of utmost importance in the optimal treatment planning. CT scan is the most commonly and widely imaging modality in our health care system for staging the renal cell carcinoma pre-operatively but on searching the literature, no statistics on diagnostic accuracy of this commonly used imaging modality in staging renal cell carcinoma in local population, was found. Keeping in mind this, the study was aimed at determining the diagnostic accuracy of MDCT for renal cell carcinoma staging, with histopathology taken as gold standard. Moreover, this will also be helpful for the surgeons to set pre-operative managements protocols accordingly.

## MATERIALS & METHODS

This is a descriptive cross sectional study conducted in Radiology Department , Bahawal Victoria Hospital, Bahawalpur from 16"' January 2019 to 15"' July 2019. Sample size of 157 cases has been calculated with 95% confidence level, precision 10% for sensitivity and specificity of CT scan in detecting capsular involvement as 67.6% and 85.20% respectively and prevalence of capsular invasion as 37.78%. Sampling technique used was non - probability, consecutive sampling.

**Inclusion Criteria**:

1. All patients showing features of renal cell carcinoma on ultrasonography (echogenicity of mass relative to rest of renal parenchyma).
2. Duration of disease >3 months.
3. Size of lesion >2cm.
4. Age: 25 -60 years.
5. Both genders.

**Exclusion Criteria:**

1. Renal mass other than renal cell carcinoma.
2. Pregnant females.
3. Patients with s/creatinine > I . I mg/dl.
4. Patients with solitary functioning kidney.
5. Patients not willing for operation.
6. Patients who did not want to be a part of the study.

**Data collection procedure:** Total 157 consecutive patients who fulfilled the above mentioned inclusion criteria were part of the study. All these were referred to radiology department to have MDCT scan done. Every patient was asked to sign an informed consent for this procedure. Multi -detector CT scan abdomen was performed in all the patients. CT findings were interpreted by radiologist (at least 5 years post -fellowship experience) and stage of the renal cell carcinoma was done. Surgery was done in each case and histopathology of the obtained resected specimen was obtained. The histopathology report was interpreted by the consultant histopathologist and again stage of the renal cell carcinoma was noted. MDCT scan findings in each case were compared with histopathology findings. A special proforma was carefully designed to obtain all the data including the demographic features.

**Data analysis procedure:** The data obtained through proforma was then analyzed through computer using software SPSS 20.0. Age and BMI of patients, duration of disease and size of the tumour were presented as mean and standard deviation. Qualitative variables like gender and stage of RCC (0/1/11/Ill/1 V) on MD CT and histopathology were presented as frequency and percentage. A 2x2 contingency table was used to calculate sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of MDCT in staging renal cell carcinoma taking histopathology as gold standard. Disease modifying factors like age, gender, duration of disease, size of tumour, BMl and co-morbid conditions i.e. diabetes mellitus (yes/no) and hypertension (yes/no) were controlled through stratifications. Post-stratification 2x2 contingency table was brought into use to calculate sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of M D CT in staging renal cell carcinoma.

## RESULTS

Patients included in this study were from 25 -60 years of age and the mean age was 44.6± 9.3 years. Majority of the patients i-e 112 (7 I .34%) were between 41 -60 years of age. Out of total 157 patients included in this study, 90(57.32%) were males and 67(42.68%) were females making a ratio of 1.3:1. Mean duration of disease was 6.95±I.8 months. Mean size of tumour was 6.43x I.94cm. Mean BMI was 29.16x2.59 kg/m2.

Table I shows the comparison of MDCT (Multi-detector computed tomography) in staging renal cell carcinoma, with histopathology.

All the patients had CT scan of abdomen and pelvis. The results showed that 8I of the patients were True Positive and only 08 were False Positive. Out of 68 CT negative patients, 07 (False Negative) showed renal cell carcinoma on histopathology while 6 I True Negative patients had no evidence of RCC on histopathology (p=0.0001). The overall sensitivity 92.05%, specificity 88.41%, positive predictive value 9 I .0 I%, negative predictive value 89.7 I% and the diagnostic accuracy, taking histopathology as gold standard was found out to be 90.45%.

Figure 1: Multifocal renal cell carcinoma on Non-enhanced CT scan.

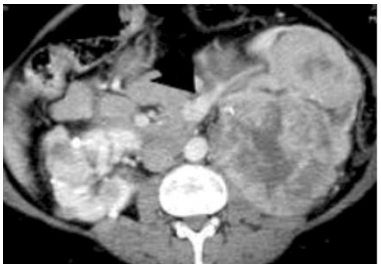

Fig. 2: Multifocal renal cell carcinoma on contrast-enhanced CT scan

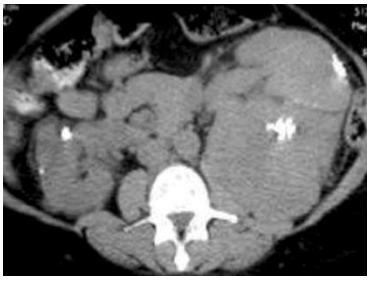

Table I Comparison of MDCT in staging renal cell carcinoma with histopathology.

| | +ve result of histopathology | -ve result of histopathology |
|---|---|---|
| Positive result on CT | 81(TP)* | 08(FP)*** |
| Negative result on CT | 07(FN)** | 61(TN)**** |

P value 0.0001
TP=True positive **-FP=False positive ***-FN =False negative ****-TN=True negative, Sensitivity: 92.05%, Specificity: 88.41%
Positive Predictive Value (PPV): 91.0l % Negative Predictive Value (NPV): 89.7l % Diagnostic Accuracy: 90.45%

## DISCUSSION

The most important factor which affects the prognosis and ultimately the survival of the patient is the stage of RCC at the time of diagnosis. At present, TNM classification is the commonly employed staging system for RCC. It includes the histopathological features like tumor size, tumor extension and thrombus. For adequate evaluation of all these parameters and accurate preoperative staging, Imaging modalities are required. Ultrasound [US], magnetic resonance imaging [MRI] and angiography, all can be used in the work up of suspected patients of RCC, however, computed tomography (CT) is preferred over other modalities as modality of choice. Since its introduction in the late 1990s, MDCT is preferred for the preoperative imaging and staging of RCC because of higher spatial resolution, speed of acquisition and ability to reformat images in different planes which in turn gives excellent anatomical details[15,16].

As already mentioned, in this study the overall sensitivity was found to be 92.05%, specificity 88.41%, positive predictive value 91.0l%, negative predictive value 89.7 l% and the diagnostic accuracy was found out to be 90.45%. In another study, the sensitivity was 68%, specificity 85%, PPV 76%, and NPV 81% for capsular invasion. In the same study CT for hilar lymph nodes had sensitivity of 77%, specificity 82%, PPV 67%, NPV 88.2%. For adrenal involvement Sensitivity was100%, specificity 98.33%, PPV 83.33% and NPV of CT scan were 100%. For renal vein invasion CT scan sensitivities 84.2%, specificities 97.5%, PPVs 89% and NPVs were 96.3% and for IVC tumor thrombi sensitivities 100%, specificities 97.77%, PPVs 80% and NPVs 100%[13].

In an earlier study, accuracy of 64.5%, while 29.5% overs stage and under-stage observed in 6% of cases. Highest Sensitivity and specificity noted in stage T3b (85 and 99.5%, respectively), while T4 stage showed the lowest sensitivity and PPV i.e. (57 and 45%). Degree of agreement with pathological staging was substantial in TI (x= 0.7), fair in stage T2 (x=0. 4), perfect in T3b (x=0.81), and slight for the other stages (x=<0.1). On multivariate analysis, conventional RCC and tumour size >7cm represent the significant risk factors (RR: 1 .6, 95°/ Cl: 1 .1 -2.3, P <0.004 and RR: 2.4, 95°/ Cl: 1 .7-3.5, P < 0.001, respectively)[16]. In another study, there was a difference in tumour size of 0.21 cm between radiographic findings and pathological findings. In T1 a group, the difference observed was 0.33 cm. There was moderate agreement between MDCT and histopathological findings for T staging (Kappa = 0.469), fair agreement observed for N staging (Kappa=0.322), and excellent agreement observed for M staging (Kappa=0.932). The Sensitivity was 32.26% and specificity 85.87% of MDCT in detecting perinephric fat invasion and in detecting tumour thrombosis it was observed as 84% and l00%, in detecting adrenal gland invasion sensitivity was 60% and specificity 95.79%, in detecting lymph node involvement sensitivity was found out to be 50% and specificity 96.36%, in detecting distant metastasis it was observed as 100% and 99.67%, respectively. In regard to stage grouping, among 314 patients 237 were correctly staged by MDCT, with an overall accuracy of 75.48%[18]. In a study done in Turkey, 51 of 57 were correctly staged, five cases were overstaged and one case was under staged by MDCT, with an overall diagnostic accuracy of 59%[19] Cat al ano et al reported that the accuracy of high resolution MDCT for assessment of perinephric fat infiltration of renal cell carcinoma was 95%, with sensitivity 96%, and specificity 93% and accuracy 95% ; the positive and negative predictive values were l00% and 93% respectively[20]. In comparison with the spiral CT used before, M DCT showed to have higher spatial resolution and better anatomy detail delineation. As shown by a latest retrospective analysis of 5339 patients, 5 years cancer specific survival was 94.9% in pT I a, 92.6% in pT lb , 55.4% in pT2a, 70% in pT2b and 64.7% in pT3a,[21] and patient s with different stages of tumors may end up requiring different treatments. To determine the correct stage of pT1a tumors is crucial because infiltration to the perinephric fat leads to the un suitability of nephron sparing surgery (NSS). NSS is most advantageous for tumors found in the upper or lower pole or those found in a periphery and those showing a clear interface to the renal vessels and its collecting system[22].

It is very difficult to diagnose presence of capsular invasion in RCC with CT only as it is shown to have sensitivity of only 67% as compared to the sensitivity of histological examination.[23] In a study false positive diagnosis was seen in patients with perinephric edema, fat necrosis and inflammatory changes owing to previous stone disease or inflammation. [24] Involvement of lymph nodes is always noted for checking prognosis of disease. However there is not enough clarification about extended lymphadenectomy's role in survival of patients with lymph nodes which are clinically undetectable. Therefore it can be used to stage RCC in patients who have clinically palpable nodes or enlarged lymph nodes detected through CT scan. [25] Detecting lymph node metastasis with the axial CT scans is challenging. The criteria is based on size limit of 10mm. According to Johnson et al CT scan can detect lymph nodes metastasis having size of at least 1 cm in diameter with an accuracy of 83-88% and histopathology confirmed it[26]. Axial CT scan showed a 10% false negative rate and a 58% false positive rate, reactive hyperplasia being the main reason[27]. CT is preferably used as an investigation of choice in patients with suspected RCC for its diagnosis, proper characterization and then staging, demonstrating staging accuracy up to 91%. 28-30 CT scan is superior to MRl in staging RCC as the former is more widely available and easy to use and the findings observed are interpreted with relative ease.

In surgical cases, detailed anatomical details are required to be provided preoperatively on imaging like the correlation of tumour to surrounding renal parenchyma including vascular supply of tumour and normal renal tissue. These details are particularly important in the pre-

operative surgical planning of patients who are undergoing nephron sparing surgery (NSS)[31].

For patients with compromised renal function who cannot undergo contrast studies MRI of the abdomen is done. Ultrasonography may also be considered in these patients to stage small renal tumours. PET tracer fluorine - 1S- 2- fluoro-2- deoxy -D- glucose- PET can also help in detecting primary carcinoma and it might be used as an alternative modality to confirm and detect unsuspected metastasis[33]. The introduction and advancements in MDCT scanners has improved the preoperative detection and evaluation of RCC[34].

The fast scanning time of MDCT leads to fast and efficient imaging of the kidneys which is more important during specific organ perfusion phases. This is usually done after administering intravenous iodinated contrast material. This improves the diagnostic ability of CT in the identification and thus characterization of lesions of renal origin[35].

## CONCLUSION

The study concluded that multi-detector CT scan is a very sensitive yet accurate non - invasive method for staging renal cell carcinoma. It has drastically improved the accurate staging of RCC and in turn leading to better pre-operative management planning of these patients. It has resulted in improved patient care and prognosis. As a result, we recommend that Multidetector CT scan must be used as the chosen modality for accurate staging in renal cell carcinoma which will result in proper pre- operative planning for these particular patients.

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