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Research Article

COMPUTED TOMOGRAPHY EVALUATION OF RENAL CELL CARCINOMA AND ITS CORRELATION WITH HISTOPATHOLOGY

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ABSTRACT

Introduction: Renal cell carcinoma is conspicuous for its easy detectability in radiographic images. It has five major morphological types, and each has its own unique radiographic signature. Imaging plays a significant role in its diagnosis and staging. Computed tomography is the first choice for imaging renal masses. In this study, we have aimed to find the incidence of Renal cell carcinoma based on its morphology, as diagnosed by non-contrast, as well as Contrast Enhanced Computed tomography, further confirmed by histopathology.

Methods: All the Computed tomography diagnosed cases of Renal Cell Carcinoma, presenting to the Second Affiliated Hospital of Anhui Medical University, over the period of two years (January 2015- December 2016), were followed up till confirmation was done by biopsy and histopathology. We calculated the incidence based on various epidemiological parameters.

Result: Out of 55 cases of Renal cell carcinoma, Clear Cell composed the greatest fraction of 81.1% and showed higher enhancement pattern followed by Chromophobe type which was 9.09%. 7.27% were of papillary type and unclassified type composed 1.81% of the total cases.

Conclusion: Clear Cell Carcinoma formed the majority of cases of Renal Cell Carcinoma and had higher enhancement pattern in comparison to other types of Renal Cell Carcinoma in Computed tomography.

Keywords: *Computed tomography; Histopathology; Renal cell carcinoma;*

INTRODUCTION

Renal cell carcinoma (RCC) encompasses a heterogeneous group of cancer derived from renal tubular epithelial cells and is among the 10 most common cancers worldwide.[1] It is the most common type of kidney cancer in adults. It accounts for 2% of all adult malignancies.[2] Globally, the incidence of RCC varies, with the highest rates observed in the Czech Republic and North America.[3] Recently, because of the better imaging and better treatment, the incidence rates are increasing while mortality rates are decreasing.

Multislice CT is the idol technique for imaging renal cell carcinoma. RCC is now thought to be clinicopathologically heterogeneous diseases which are classified by histology into clear cell, papillary, chromophobe, collecting duct carcinoma, medullary carcinoma, and unclassified categories.[4] However, there might be some mismatch between histology and radiology finding. The aim of this study is to evaluate differentiation of various types of renal cell carcinoma on CT images and correlation with its histopathology.

METHODOLOGY

This retrospective analytical study was conducted in Second Affiliated hospital of Anhui Medical University, Hefei, China from January 2015 to October 2016. The approval for the study was taken from Institutional review committee (Ref. no. ID 20140223012) of Anhui Medical University, Hefei, China. The patients who had undergone CT scan of abdomen during this period and diagnosed as Renal Cell Carcinoma in CT scan and further confirmed by biopsy and histopathology were included in this study. Revision CT of previously diagnosed cases of RCC, CT positive cases who had a negative histopathology for RCC and cases with inconclusive CT findings who were later found to have RCC based on their histopathology report were excluded from this study.

A convenient purposive sampling technique was used and total number of 55 patients fulfilling the inclusion criteria were selected. The detailed clinical history including the primary symptoms, severity of symptoms, duration of symptoms, extrarenal complications, associated co-morbidities and relevant family history was taken from their medical record. CT scans of abdomen and pelvis of those patients were studied from the record system. In this center, Contrast Enhanced CT (CECT) of abdomen and pelvis was performed in all using the GE Lightspeed VCT machine. Iodixanol Injection (VISIPAQUE®)100ml(27g(l)/100ml) was used as the radiocontrast medium with all aseptic precautions. The contrast was administered at a rate of 2.5ml/second. The scanning protocol for RCC consists of a combination of nonenhanced and contrast-enhanced CT in corticomedullary and nephrographic and excretory phases. The CT images of diagnosed cases of RCC were evaluated by using proforma. The CT attenuation values in different phases were evaluated. The histopathology report of those patients were also reviewed from the medical data.

The data were entered in SPSS version 20 .Then, frequency and percentage of each type of finding were calculated.

RESULTS

Out of 73 CT images indicative of RCC [ball-type renal mass] in the designated study period, 55 cases were confirmed to have RCC based on their histopathologic findings. Out of the 55 patients, 44(80%) were male and 11(20%) were female. The age of the patients ranged from 23-78years, and the mean age was 57.11years. The patients were further divided based on their histopathological grading as Clear Cell RCC, Papillary RCC, Chromophobe RCC and Unclassified RCC.

Most cases 45(81.1%) were found to be Clear cell RCC. Chromophobe RCCs was the second most incident form of RCC that is 5 (9.09%). Papillary RCC consisted of 4(7.27%) of the cases while there was only one case of unclassified RCC (1.81%) during the study period. Out of 55 patients, 44 (80%) were male and 11(20%) were female. The predominance of males can be seen to be prevalent throughout all the types of RCC, except the unclassified type which has only one sample.

Type of RCC	Corticomedullary Phase	Nephrographic Phase	Excretory Phase
Clear Cell(n=45)	136±40HU	114±22HU	93±15HU
Papillary(n=4)	67±28HU	85±42HU	80±30HU
Chromophobe(n=5)	82±23HU	90±28HU	61±17HU
Unclassified (Sarcomatoid) (n=1)	99HU	102HU	92HU

Table 1: Measurement of CT attenuation values in different phases (n=55)

In the corticomedullary phase of CCRCCs the enhancement of lesion was hyperdense to renal cortex. In nephrogenic phase, the measurement of attenuation was lesser than corticomedullary phase and excretory phase showing an early washout pattern. Similarly, the measurement of all the papillary RCCs was isodense to renal cortex on corticomedullary phase. In the nephrogenic phase, the attenuation was higher than that of corticomedullary phase showing a prolonged enhancement pattern. Our results showed that in chromophobe RCCs there was a mildly enhancement pattern in the corticomedullary phase than the nephrogenic phase. Our results also showed one case of unclassified RCC (Sarcomatoid).

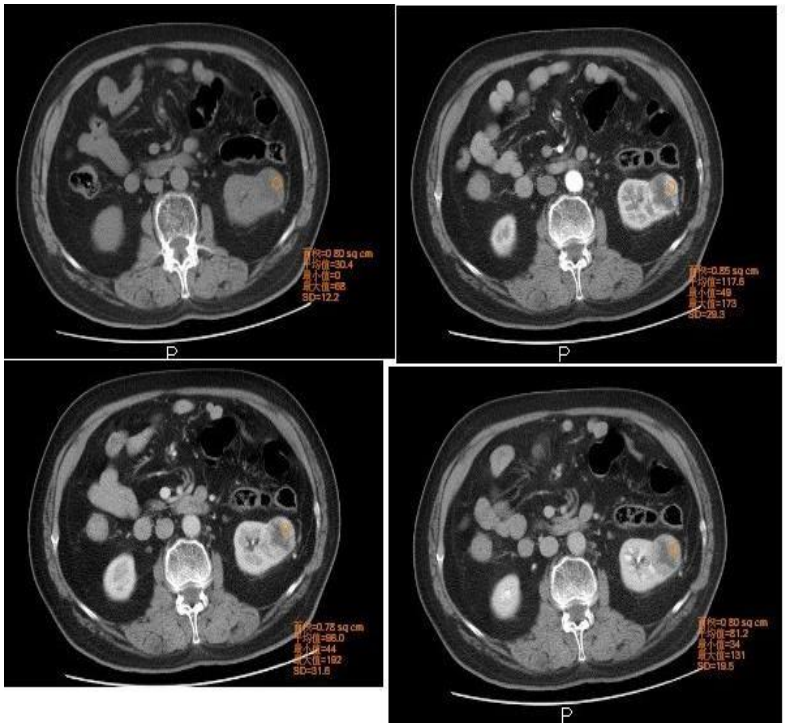

Figure 1: Male, 78 years, CCRCC in left renal (A). A solid round heterogeneous mass with clear boundary in un-enhancement with Ct value of 30HU;(B). In the corticomedullary phase mass shows obviously heterogeneous enhancement with necrosis present with high CTvalueof117HU. (C). In the parenchymal phase, the CT value of the same location was 96HU. (D). In the excretion phase, the Ct value was 80HU showed as delayed phase.

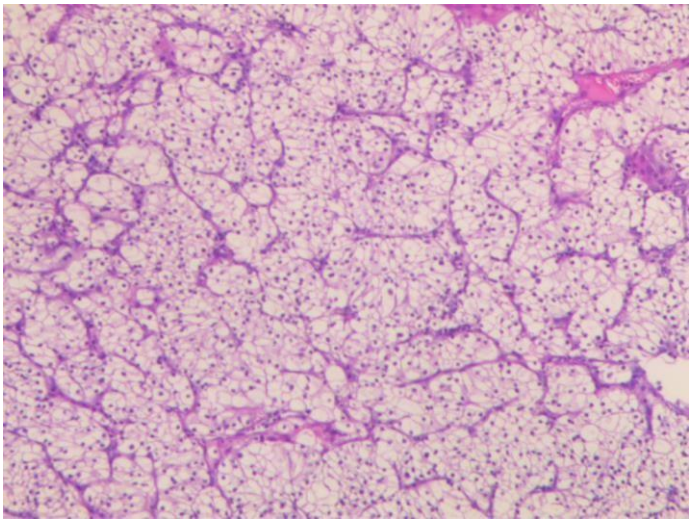

Figure 2: HEstain (10x40), CCRCC (Fuhrman grade I)

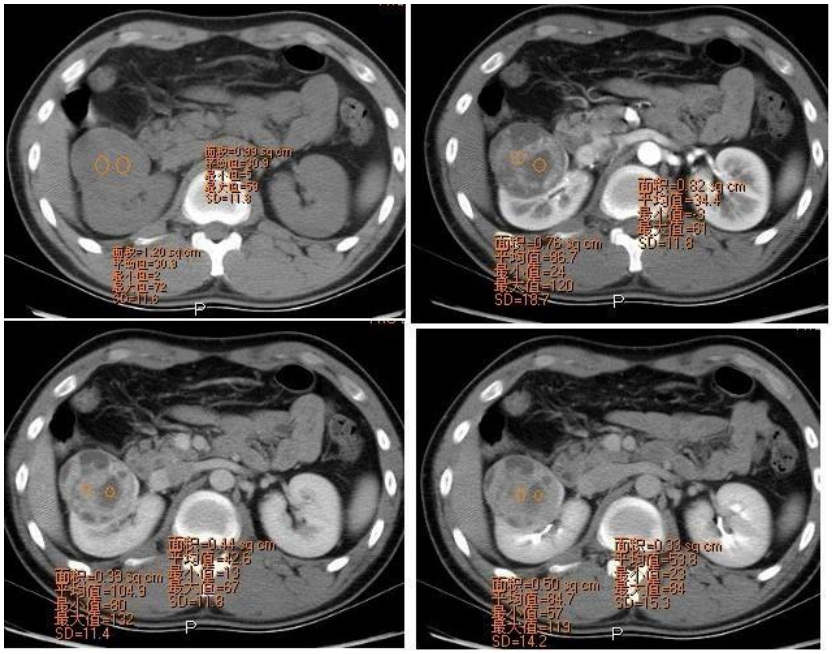

Figure 3: Male, 24 years, right renal papillary carcinoma;(A).In unenhanced phase there is homogeneous round mass with clear boundary in the upper pole of the right kidney with CT value of 30HU;(B).In corticomedullary phase mass is heterogeneous and mildly enhanced by the mass with CT value of 86HU;(C).the CT value of same location is 104HU in the parenchymal phase ;(D).in excretion phase the CT value is84HU.

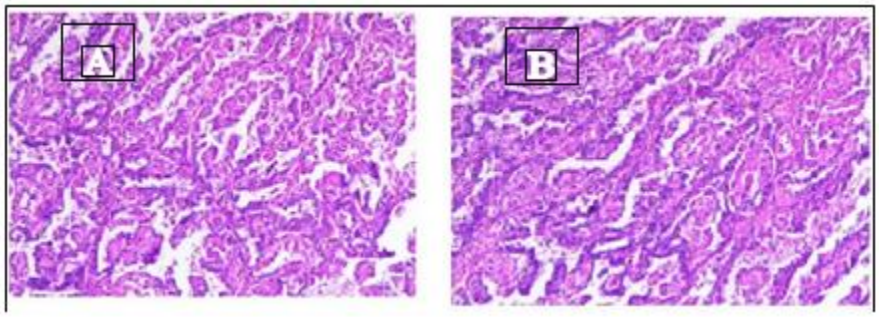

Figure 4: HE stain- Papillary Renal cell carcinoma

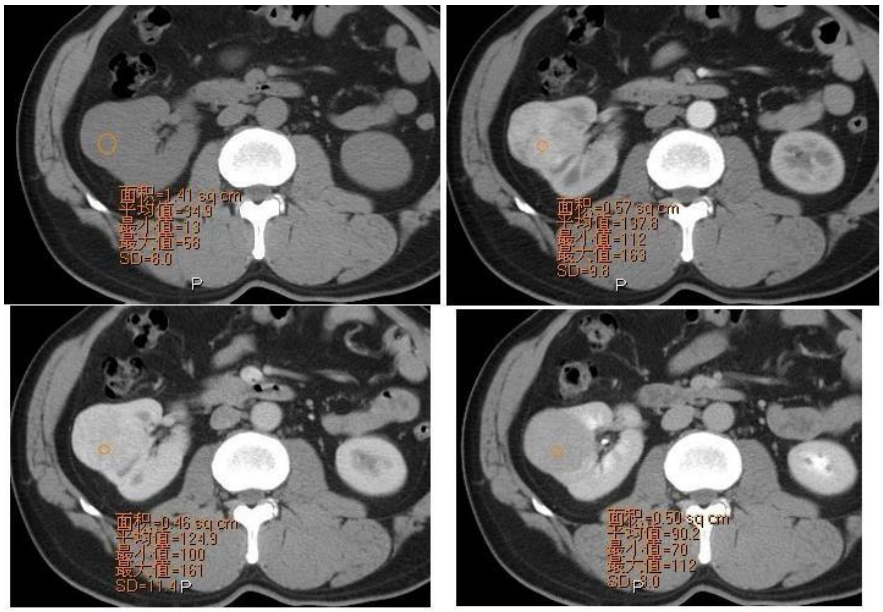

Figure 5: Male, 72years, right chromophobe;(A). unenhanced CT shows round, lobular homogeneous mass in the upper pole of the right kidney with CT value of 34HU;(B). In corticomedullary phase mass shows obviously heterogeneous mass with CT value of 137HU;(C).the CT value of the same location shows 124HU in parenchymal phase;(D).In the excretory phase the CTvalue shows 90HU.

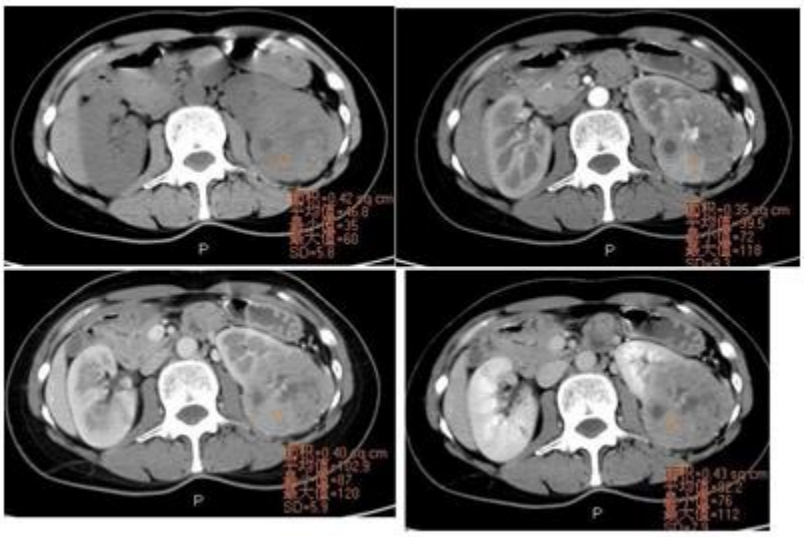

Figure 6: Female,45years, Left renal Unclassified RCC (sarcomatoid);(A). Heterogenous mass with irregular margin and necrosis seen in unenhanced phase with CT value of 46HU;(B). In corticomedullary phase the mass is heterogeneously enhanced with CT value of 99HU,tumor vessels seen;(C). The CTvalue of the same location is 102HU in parenchymal phase;(D). In excretory phase the CTvalue is 92HU.

The attenuation of CT values of CCRCCs are136±40HU, 114±22HU, 93±15HU in the corticomedullary phase, nephrographic phase and excretory phase respectively. A fast-in in the corticomedullary phase and a

fast-out at delayed phase is the typical feature of conventional RCC (CCRCC) which is different from other non-conventional RCC.

Papillary carcinoma shows the measurement of CT attenuation values of 67±28HU, 85±42HU, 80±30HU in the corticomedullary phase, nephrographic phase and excretory phase respectively. In this case the nephrographic phase has higher enhancement than the corticomedullary phase due to the prolonged enhancement. This indicates that the CCRCCs are more vascular than the papillary carcinoma. Similarly, chromophobe RCC has measurement of CT attenuation values of82±23HU, 90±28HU, 61±17HU in the corticomedullary phase, nephrographic phase and excretory phase respectively which shows that the enhancement pattern is less than the clear cell carcinoma due to the delayed washout. In this study we also found one case of unclassified (Sarcomatoid) which occurs less than4-5% (according to Who). The CT attenuation values was 99HU, 102HU, 92HU in the corticomedullary phase, nephrographic phase and excretory phase respectively .The mass was large, heterogeneous, margin was not clear and the peritumoral neovascularity was seen. The diagnosis in the subjects was further confirmed by histopathology based on the Fuhrman Grading.

DISCUSSIONS

The incidence of different types of Renal Cell Carcinoma as seen in literature is70- 80% Clear Cell RCC, 10%PapillaryRCC, 5%ChromophobeRCC and <1%Unclassified RCC.[1]

Our study revealed a similar trend of incidence as Clear Cell RCC composed the greatest fraction of the total with 81.81% of the total cases. However, Chromophobe RCC was the second most prevalent group during the study period with 9.09% of the total. 7.27% cases were of Papillary RCC and unclassified RCC composed 1.81% of the total cases. The mean age of patients was 56.03 years. The median age of patients with RCC in the Surveillance, Epidemiology, and End Results (SEER) database in the United States was 64 years with a near normal distribution.[5]Accordingly, when RCC is diagnosed at younger ages (less than 46 years), the possibility of an underlying hereditary kidney cancer syndrome- accounting for 3-5% of all RCCs should be considered.[1]Bilateral RCC consist of a rare clinical entity accounting for 5% of patients with RCC.[6] Sporadic, synchronous, bilateral or unilateral RCCs are even rarer, distinct categories of RCC and their biological behavior is different from hereditary bilateral RCC.[7]Genetic factors also contribute to RCC risk, as evidenced by individuals with a family history of renal cancer having an approximate twofold increased risk.[8]

This study showed that the enhancement pattern is different in different types of RCC especially between the conventional renal cell carcinoma (clear cell carcinoma) and the nonconventional renal cell carcinomas. In both the corticomedullary and excretory phases, CCRCC (conventional renal carcinoma) showed stronger enhancement than other types of RCC (non-conventional renal carcinoma). The tumors that enhanced more than approximately 84 HU in the corticomedullary phase and 44 HU in the excretory phase were likely to be conventional renal carcinoma. Similarly, an article reported that, to differentiate different subtypes of RCCs, the enhancement pattern is the most useful parameter, especially conventional renal

carcinoma(CCRCC) versus non-conventional renal carcinomas.[9] The tumors that enhanced more than approximately 84 HU in the corticomedullary phase and 44 HU in the excretory phase were likely to be conventional renal carcinoma with 74%sensitivity and 100%specificity.[9]

Another study had discussed about both the attenuation values on unenhanced CT in pathologically verified RCCs which showed that 100% of RCCs had regions measuring 20 to 70 HU in density and 72.5% (140/193) of the pathologically verified tumors were entirely within the 20 to 70 HU range so the regions measuring outside this range suggested to be benign and partial or indeterminate tumors that may be necessary for further follow up.[10] The other study by reported accurate rates as high as 95.7%, with sensitivity and specificity of 98.3% and 92% respectively, when a 100 HU cut off value was used for differentiating RCC from renal papillary carcinoma.[11] A prior study showed value of 84HU in the nephrogenic phase and value of 44 HU in the excretory phase to differentiate Clear cell carcinoma from other tumors, with sensitivity and specificity of , respectively, 74% and 100%, and 84% and 91%.[9] Lastly, the excretory phase (5-10minutes after injection) can be required for the findings of micro hypervascular RCC and to examine for spreading of the tumor into the collecting system.[12]

CT imaging seems to be a promising imaging modality for diagnosis and characterization of various types of renal cell carcinoma. However, need of radiation exposure and its cost are disadvantages of this imaging technique. Hence, further studies in future such as adjustment or reduction of radiation dose for proper characterization of RCC can be of great help.

Our study included only 55 cases and included patients of singular ethnicity. As a result, we might not be able to generalize the result to a greater subset of population. Greater incidence of chromophobe RCC over papillary RCC can be attributed to the paucity of subjects in our study.

CONCLUSIONS

On the basis of the findings from our study, we can conclude that Clear Cell Carcinoma forms the majority of cases diagnosed with Renal Cell Carcinoma. Similarly, the incidence of RCC in males is far greater than in the females. Similarly, CCRCCs has higher enhancement pattern in comparison to other types of RCC.

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