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The Impact of Radiological and Pathological Size of Renal Cell Carcinoma on Stage of Disease

Muddasir Hussaain[1*], Pardeep Kumar[1], Mehnaz Jabeen[1], Abdul Khalique[1], Muhammad Adnan Sarwar[1], Asad Shahzad Hasan[2], Altaf H Hashmi[2]

[1]Assistant Professor, Sindh Institute of Urology and Transplantation Karachi, Pakistan.
Email: mudassir.hussain120@gmail.com
*Corresponding author

[2]Professor, Sindh Institute of Urology and Transplantation, Karachi, Pakistan.

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Abstract

Background: Renal cell carcinoma is the most common tumour of kidneys and surgery in the form of Radical nephrectomy has been the only curative option for organ confined disease. However with advent modern surgical practices, the potential options for treatment have changed to include nephron sparing partial nephrectomy and local ablative techniques, so as to preserve renal mass and prevent long term chronic renal failure. Objective: "To estimate the frequency of change in stage of renal cell carcinoma based on discrepancy in preoperative radiological and postoperative pathological size". Study Setting and Duration: This study was conducted at the Department of oncology, Sindh institute of urology and transplantation Karachi for the duration of six months, from June 2020 to December 2020. Study Design: This was a cross-sectional study. **Methods:** A total of 81 cases with renal cell carcinoma, measured equal to or less than 10 cm on preoperative computerized tomography scan were included in this study. After surgical resection of renal mass, the specimens were sent to pathology department. The preoperative radiological size was used to categorize disease into preoperative rT1a, rT1b or rT2 disease (TNM staging of RCC 2009). The postoperative pathological size was used to categorize disease into postoperative pT1a, pT1b or pT2 (TNM staging of RCC 2010) disease.**Results:** The average age of the patient was 46.33±8.75 years. Out of 81 cases, 32(39.51%) changed stages while 49(60.49%) did not change their stages. **Conclusion:** There was a small over estimation (1 mm) of pathological size by CT overall, but this is of uncertain clinical significance. For some patients, the difference leads to a discrepancy between clinical and pathological staging, which may have implications for pre-operative patient counseling regarding prognosis and choice of treatment strategy.

Keywords: Renal cell carcinoma, Pathological size, Tumour of kidneys, Radical nephrectomyhas.

INTRODUCTION

Renal cell carcinoma is the most common tumour of kidneys and surgery in the form of Radical nephrectomyhas been the only curative option for organ confined disease.[1] However with advent modern surgical practices, the potential options for treatment have changed to include nephron sparing partial nephrectomy and local ablative techniques, so as to preserve renal mass and prevent long term chronic renal failure.[1] The America joint committee on cancer have proposed Tumour Node metastasis classification updated in 2009which classifies disease confined to kidney on size alone i.e. T1 (T1a ≤ 4 cm and T1b > 4 cm to ≤ 7 cm) and T2 (T2a

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> 7 cm to ≤ 10 cm, T2b > 10 cm).[2] According to EAU guidelines, Nephron sparing partial nephrectomy is the standard treatment option for T1a (≤ 4cm) and Radical nephrectomy is the standard for T1b (> 4 cm but ≤ 7 cm).[3] The clinical decisions and proposed treatment options (nephron sparing Vs radical nephrectomy) are based on preoperative radiological size as demonstrated on computerized tomography scan.[4] However, studies have shown discrepancy in estimated preoperative radiological and postoperative pathological size of renal cell carcinoma ranging from 0.5 to 1.1 cm resulting in change in stage in up to 30% cases.[4-7] If such discrepancy is taken into consideration, there is potential to opt for nephron sparing partial nephrectomy in cases which appear to be T1b (> 4 cm but ≤ 7 cm) or more radiologically [8].

This Prospective study is being performed to document the frequency of change in stage of RCC when radiologic and pathologic sizes are considered separately. Previous studies on the subject are retrospective and have not estimated the clinical impact of above mentioned discrepancy on management of RCC. This could help clinicians to take appropriate decisions regarding possible nephron sparing surgery especially in T1b tumour (> 4 cm to ≤ 7 cm).

MATERIALS AND METHODS

This cross-sectional study was conducted at the Department of oncology, Sindh institute of urology and transplantation Karachi for the duration of six months, from June 2020 to December 2020. Non probability consecutive sampling technique was used and sample size was 81, Calculated through http://www.openepi.com/SampleSize/SSPropor.htm using formula; "Sample Size for Frequency in a Population". Frequency values are taken from study by Ning Zhang et al4 which reported change in stage frequency of 30%. Margin of error was 10% and Confidence level was 95%.

Inclusion Criteria

- All specimens of patients of either gender, aged between 20 to 70 years, which were measured equal to or less than 10 cm on preoperative computerized tomography scan

Exclusion Criteria

- Specimens with positive resection margins (because exact pathological size cannot be determined in such cases)
- Patients with distant metastatic disease
- Patients with known cardiac disease (ischemic heart disease)

Data Collection Procedure

After approval from Institute review board, Patients with unilateral renal mass was presumably enrolled through oncology clinic of Sindh institute of urology and transplantation. Renal cell carcinoma was diagnosed on triphasic computerized tomography scan of chest abdomen and pelvis at radiology department of same hospital. Patients were seen by team of surgeons and oncologist to plan definitive treatment

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(Nephron sparing or radical nephrectomy). After surgical resection of renal mass, the specimens were sent to pathology department of same hospital. The tissue was examined by team of pathologist and reported after gross and microscopic examination clearing mentioning size of specimen in three dimensions. If the radiology and pathology reports matched the inclusion criteria (tumour size ≤10 cm), the patients specimen was selected for study. The collected variables were included radiological size (mm) as shown on preoperative computerized tomography scan and pathological size (mm) as shown on postoperative specimen pathology report. The preoperative radiological size was used to categorize disease into preoperative rT1a, rT1b or rT2 disease (TNM staging of RCC 2009). The postoperative pathological size was used to categorize disease into postoperative pT1a, pT1b or pT2 (TNM staging of RCC 2010) disease.

Data Analysis Procedure

The calculations was done using SPSS version 20. Cases were categorized into preoperative rT1a, rT1b or rT2 and postoperative pT1a, pT1b, pT2. Quantitative variables x`like age, BMI, preoperative radiological size and post-operative pathological size was shown as mean and Qualitative variables like gender, diabetes mellitus, hypertension, obesity, smoking, education status, socioeconomic status and frequency of change in stage was shown as percentage. Stratification of effect modifiers e.g. age, gender, obesity, smoking, hypertension, diabetes mellitus, education status and socioeconomic status was done. Post stratification chi-square test was applied to determine the effect of these effect modifiers on outcomes of the study. P-value ≤0.05 was taken as significant difference.

RESULTS

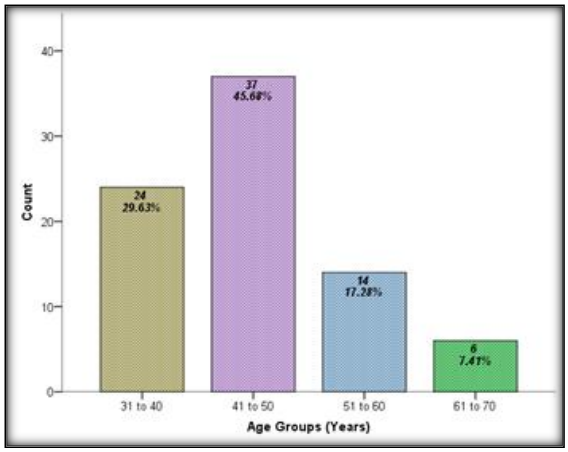

Figure 1: Age distribution of the patients; n=81

Table 1: Descriptive statistics of characteristics of patients; n=81

	Mean	95% Confidence Interval for Mean		Std. Deviation
		Lower Bound	Upper Bound	
Age (Years)	46.33	44.40	48.27	8.75
BMI (kg/m^2)	26.06	25.08	27.03	4.39
Preoperative radiological size	6.88	6.56	7.19	1.42
Postoperative pathological size	5.88	5.47	6.28	1.84

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A total of 81 cases with renal cell carcinoma, measured equal to or less than 10 cm on preoperative computerized tomography scan were included in this study. Age distribution of the patients is presented in [Figure 1]. The average age of the patient was 46.33±8.75 years. The average BMI of the patients was 26.06±4.39 kg/m2. Similarly pre and postoperative radiological size of the carcinoma is also presented in [Table 1]. There were 44(54.32%) male and 37(45.68%) female [Figure 2]. Out of 81 cases, 18(22.22%) patients were obese. Diabetic mellitus was observed in 60.49 % (49/81) (figure 2). Hypertension was 46.91% (38/81) and 27.16% (22/81) were smoker. There were 54.32% endophytic and 45.68% exophytic. Pre-operative, 49(60.5%) had Stage T1b, 32(39.5%) had stage T2 while post-operative there were 20(24.7%) had stage T1a, 42(51.9%) had T1b and 19923.5%) had stage T2 as shown in [Table 2]. Frequency of change in stage of renal cell carcinoma based on discrepancy in preoperative radiological and postoperative pathological size. Out of 81 cases, 32(39.51%) changed stages while 49(60.49%) did not change their stages.

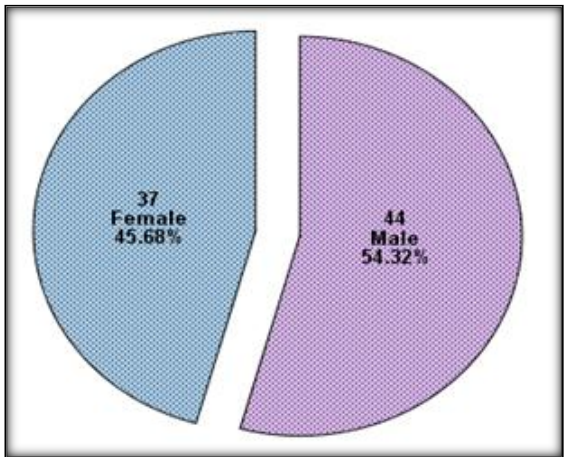

Figure 2: Gender distribution of the patients; n=81

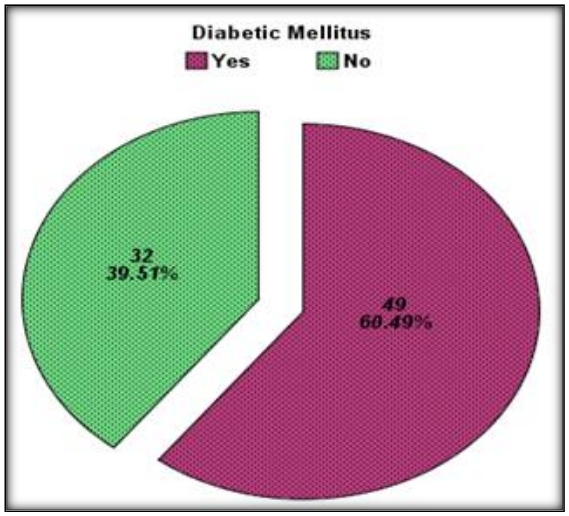

Figure 3: Diabetic mellitus of the patients; n=81

Table 2: Pre and post-operative t stage; n=81

T Stage	Preoperative	Postoperative
T1a	-	20(24.7%)
T1b	49(60.5%)	42(51.9%)
T2	32(39.5%)	19(23.5%)

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Table 3: Frequency of change in stage of renal cell carcinoma based on discrepancy in preoperative radiological and postoperative pathological size by age groups

Age Groups (Years)	Change In Stage Of Renal Cell Carcinoma		Total	P-Value
	Yes	NO		
31 to 40	10(41.7%)	14(58.3%)	24	0.970
41 to 50	15(40.5%)	22(59.5%)	37	
51 to 60	5(35.7%)	9(64.3%)	14	
61 to 70	2(33.3%)	4(66.7%)	6	
Chi-Square= 0.234				

Stratification analysis was performed and observed that rate of change in stage of renal cell carcinoma was not statistically significant among different age groups (p=0.970) as shown in table 3. Rate of changes of stage of renal cell carcinoma based on discrepancy in preoperative radiological and postoperative pathological size was insignificant with gender, obesity, diabetic status, hypertension status, smoker, SES and education status.

DISCUSSION

Renal cell carcinoma (RCC) is the third most common cancer of the genitourinary system and in 2015 will account for an estimated 61,560 new cases and 14,080 deaths in the United States.[9] Over the past several decades, the incidence of RCC has risen steadily by approximately 2-4% annually.[10] Tumor size is an important prognostic indicator for RCC. Outcome of nephrectomy has been studied according to pathological tumor size. Pre-operatively, we must rely upon CT estimates of pathological tumor size to guide counseling regarding prognosis and choice of treatment modality. Imaging plays an integral role in the evaluation and management of a patient with a renal mass, from the preoperative workup to the postoperative surveillance. Unfortunately, in clinical practice the urologist is often faced with imaging dilemmas that lack definitive answers. To estimate the frequency of change in stage of renal cell carcinoma based on discrepancy in preoperative radiological and postoperative pathological size, A total of 81 cases of either gender, aged between 20 to 70 years were recruited. All specimens measured equal to or less than 10 cm on preoperative computerized tomography scan were included.

RCC incidence indicates that men are at an increased risk of developing RCC.[11] In a study on Californian population analysis, for example, males had twice the incidence rate and a lower survival rate when compared with females.[12] Females also present with less advanced tumors, leading to a 19% reduced risk of death from RCC compared with men.[13] In our study out of 81 cases there were 54.32% male and 45.68% female. RCC is the most common renal malignancy in adults, with an average age at diagnosis in the early 60s.[14] The incidence of RCC was predominated in males with the dominant age range at presentation being 41-50 years in our study. The average age of the patient in our study was 46.33±8.75 years Habib et al.[15] observed the incidence of RCC was

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predominated in males with a dominant age range at presentation being 50-59 years.

Cigarette smoking is an established independent risk factor for RCC. This increased risk is strongly dose dependent and also leads to a more advanced stage at diagnosis than in nonsmokers.[16] In our study out of 81 cases 27.16% were smoker. Increased body mass index (BMI) is an independent risk factor for RCC.[17] The prevalence of obesity has increased markedly not only in high-resource countries such as the United States and Western Europe, but also in low- and middle income countries since the 1980s.[18]The average BMI of the patients in our study was 26.06±4.39 kg/m2. We found out of 81 cases in our study 22.22% patients were obese. Hypertension doubles the risk of RCC. Most studies reported an association with a history of long-term hypertension, and cohort studies with blood pressure measurements taken at baseline generally reported a dose-response of increasing risks with rising levels of blood pressure.[19,20] In a Swedish cohort study with sequential blood pressure measurements, renal cell cancer risk increased with further elevation of blood pressure and decreased with reduction in blood pressure over time, In our study out of 81 patients, 46.91% were found to be hypertensive. Diabetes mellitus (DM), a metabolic disease, is one of the major causes of morbidity and mortality worldwide.[21] Epidemiologic studies have shown that patients with diabetes mellitus are at higher risk than the general population for developing certain malignancies including kidney, liver, biliary tract, pancreas and colon. In our study Diabetic mellitus was observed in 60.49 % cases.

In our study Pre-operatively 60.5% had Stage T1b, 39.5% had stage T2 while post-operative there were 24.7% had stage T1a, 51.9% had T1b and 23.5%) had stage T2. In a study on Discrepancy between radiological and pathological size of renal masses Jeffery et al,[22] reported the pathological tumor stage (according to the 2009 TNM staging system) was T1a in 36.9% patients, T1b in 26.1%, T2a in 11.5%, T2b in 3.2%, T3a in 30 (19.1%), T3b in 2 (1.3%), T3c in 2 1.3% and T4 in0.6%. The Frequency of change in stage of renal cell carcinoma based on discrepancy in preoperative radiological and postoperative pathological size in our study was, Out of 81 cases, 39.51% changed stages while 60.49% did not change their stages. Preoperative radiological mean tumor size in our study was 6.88 +1.2cm and postoperative pathological size of tumor was found to be 5.88 +1.84cm showing the difference of 1 cm. Similar results were reported by Kurta et al,[23] reported on the largest series (N = 521), and found that mean radiological tumor size was larger than mean pathological tumor size by 1 mm. Similarly, CT was found to overestimate pathological tumor size overall by 6.3 mm in a study by Herr,[24] and by 10.0 mm in a paper by Irani et al.[25] Choi et al,[26] found that CT tumor size was on average larger than pathological size for smaller tumors only (<6 cm or T1).In several other

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series, mean radiological tumor size was greater than mean pathological size, but the difference did not reach statistical significance.[27]

CONCLUSION

There was a small over estimation (1 mm) of pathological size by CT overall, but this is of uncertain clinical significance. For some patients, the difference leads to a discrepancy between clinical and pathological staging, which may have implications for pre-operative patient counseling regarding prognosis and choice of treatment strategy. There is a need for studies examining the correlation between clinical and pathological staging for RCC. Studies that report prognosis according to radiological rather than pathological tumor size would guide us in making treatment decisions based on clinical tumor size. The development and validation of pre-operative prognostic nomograms would also aid decision-making.

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