Section: Urology

Original Research Article

CLINICAL PROFILE OF RENAL CELL CARCINOMA-HISTOPATHOLOGY CORRELATION & RECURRENCE RATE

R. Bhargavi[1], Bhushan Ulhas Wad[2], T.Srikala Prasad[3]

[1]Assistant Professor, Department of Urology, Government Royapettah Hospital, Tamilnadu, India
[2]Senior Resident, Department of Urology, Government Kilpauk Medical College, Tamilnadu, India
[3]Professor, Department of Urology, Government Kilpauk Medical College, Tamilnadu, India

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Corresponding Author:
Dr. Bhushan Ulhas Wad,
Email: bhushanwad24@gmail.com

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Abstract

Background: Renal cell carcinoma (RCC) is the most common kidney malignancy, with an increasing global incidence owing to advancements in imaging technologies. Early detection and effective surgical management are critical to improve patient outcomes. The aim is to analyse the clinical profile, histopathological correlations, and recurrence patterns of RCC in patients undergoing surgical management. **Materials and Methods:** This retrospective study included 15 patients with RCC treated at the Government Kilpauk Medical College, Chennai, over 1.5 years. Clinical data, imaging findings, and histopathological features were recorded. Surgical interventions included radical or partial nephrectomy, followed by histopathological analysis and a one-year postoperative follow-up to evaluate recurrence patterns. **Result:** Clear cell RCC was the predominant subtype, accounting for 73% of the cases, followed by papillary and chromophobe RCC. Early-stage tumours (T1) comprised 46% of cases, with incidental detection being a significant contributor to early diagnosis. Smoking was identified as the primary risk factor affecting 60% of the patients. Clinical features showed haematuria as the most common symptom, and imaging indicated that 73% of the renal masses exhibited contrast enhancement typical of RCC. No local recurrences were noted during the follow-up, although one case of pulmonary metastasis was observed. Surgical management was effective with minimal recurrence rates and favourable outcomes. **Conclusion:** This study highlights the importance of early detection using advanced imaging and effective surgical management to reduce recurrence and improve survival in patients with RCC. Histopathological evaluation plays a pivotal role in prognostic assessment and multidisciplinary collaboration is essential for optimizing patient outcomes.

INTRODUCTION

Renal cell carcinoma (RCC) is the most common malignancy originating in the kidney, accounting for over 90% of all renal cancers. Globally, RCC represents 2–3% of all adult malignancies, with its incidence steadily rising owing to advancements in imaging technologies and the growing prevalence of health screening programs. The highest RCC prevalence is reported in developed nations, such as the United States and countries in Europe while developing regions like India are experiencing an increasing incidence as healthcare accessibility improves.[1,2] RCC predominantly affects individuals in the sixth or seventh decade of life and is more common in males, with a global male-to-female ratio of approximately 2:1.[3]

The risk factors for RCC include both modifiable and non-modifiable elements. Smoking remains a well-documented contributor because of its carcinogenic effects on renal epithelial cells. Obesity and hypertension also play significant roles by causing hormonal imbalances and inducing chronic stress in the kidneys.[4,5] Additionally, genetic factors are critical, particularly mutations in the von Hippel-Lindau (VHL) tumour suppressor gene, which are frequently observed in clear cell RCC, the most prevalent subtype. VHL mutations lead to abnormal activation of hypoxia-inducible factor (HIF) pathways, resulting in enhanced angiogenesis and tumour growth.[2]

RCC is pathologically diverse and encompasses several subtypes, including clear cell, papillary, and chromophobe. Clear cell RCC constitutes 70–80% of RCC cases and is often associated with an aggressive clinical course and poor outcomes. Papillary RCC, divided into types 1 and 2, tends to be less aggressive, whereas chromophobe RCC typically exhibits the most favourable prognosis among these subtypes.6

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Clinically, RCC is frequently discovered incidentally during imaging for unrelated conditions. Symptomatic presentations such as haematuria, flank pain, and palpable abdominal masses are usually indicative of advanced disease. Metastatic RCC may manifest with systemic symptoms, including weight loss, anaemia, and paraneoplastic syndromes like hypercalcemia or hypertension.[7]

Aim

This study aimed to assess the clinical profile, histopathological features, and recurrence rates of patients diagnosed with RCC who underwent surgical management.

MATERIALS AND METHODS

The study was a retrospective observational analysis conducted for 1.5 years in 15 patients with a diagnosis of localized or locally advanced RCC admitted to the Urology Department at Government Kilpauk Medical College, Chennai.

Inclusion Criteria

Patients diagnosed with localized or locally advanced RCC, deemed suitable for surgical intervention, were included in the study.

Exclusion Criteria

Patients with metastatic RCC lesions and those undergoing surgical treatment for pelvic or ureteric renal tumours were excluded.

Methods

Patients underwent comprehensive clinical assessment, routine laboratory investigations (renal function tests, liver function tests, ESR, serum calcium), and imaging studies, such as contrast-enhanced CT or MRI. Based on these findings, surgical management involved either open or laparoscopic radical nephrectomy or partial nephrectomy.

Postoperative histopathological examination of the specimens was conducted to document tumour type, grade, and lymphovascular invasion. Patients were followed up for one year postoperatively to monitor for recurrence using clinical evaluation and imaging studies (CT abdomen and chest CT).

The data collected included demographic information, presenting symptoms, comorbidities, risk factors such as smoking and hypertension, imaging findings, histopathological features, type of surgical procedure performed, and recurrence or metastatic outcomes during the follow-up period. The frequencies and percentages of all data are presented in a pie chart.

RESULTS

The analysis of the clinical and histopathological profiles of RCC patients' demographic data indicated that the highest prevalence was in the 50-60 and 40-50 age groups, each with five cases. The 20-30 and 60-70 age groups each had two cases, while the 30-40 age group had one case. Regarding gender distribution, males represented a larger proportion (66.6%) than females (33.3%).

Smoking emerged as the primary risk factor implicated in approximately 9 cases (60%). Obesity and hypertension were also significant but less prevalent, with obesity observed in 3 patients (20%) and hypertension in 2 patients (13.3%). Interestingly, 1 patient (6.7%) did not present with any of the common risk factors, indicating the potential involvement of other unidentified etiological factors. Furthermore, the analysis indicated that 5 patients (33.3%) had a combination of multiple risk factors, which might complicate their clinical management [Figure 1]. Preoperative biopsy was utilized in the diagnostic process for 2 patients (13.3%), assisting in the determination of appropriate surgical and therapeutic interventions.

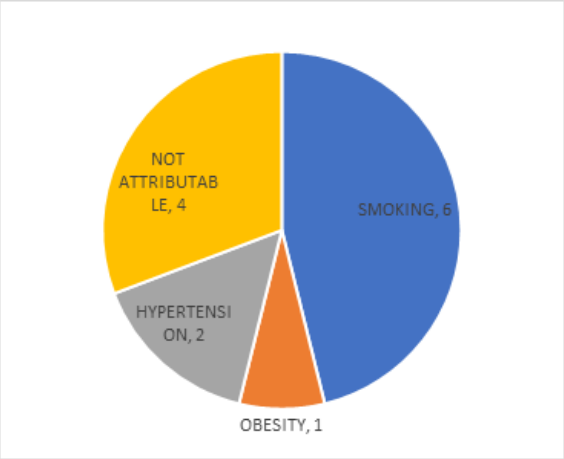

Figure 1: Distribution of Risk Factors in Patients with Renal Cell Carcinoma

In the analysis of clinical features among patients with renal cell carcinoma, haematuria was present in 7 patients, making it the most frequently reported symptom. Incidental discoveries of tumours during unrelated medical imaging were noted in 4 patients. Flank pain and newly diagnosed hypertension following the detection of RCC were reported in 2 patients. No cases of fever or other constitutional symptoms were reported [Figure 2].

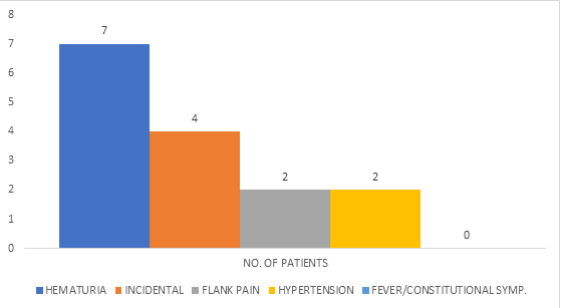

Figure 2: Distribution of Clinical Features in Patients with Renal Cell Carcinoma

Two patients had a history of other malignancies for which they had received treatment. Additionally, three patients developed hypertension after RCC diagnosis.

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Imaging assessments revealed that 11 of the 15 renal masses (73%) displayed prompt contrast enhancement. Among these, three masses were identified as hypovascular, with two classified as the papillary subtype and one as a rare neuroendocrine tumour. Additionally, one tumour exhibited internal fat density but was diagnosed as angiomyolipoma based on imaging enhancement characteristics. Notably, two cases involved local organ infiltration, indicating more aggressive disease progression. Importantly, no lesions were detected in the contralateral kidneys of any patient, suggesting the presence of a localized disease. Staging discrepancies between imaging and histopathological evaluations were primarily attributed to angiomyolipoma and neuroendocrine tumours. T1-stage tumours, indicating limited organ-confined disease, were the most common, comprising approximately 46% of cases according to imaging studies [Figure 3].

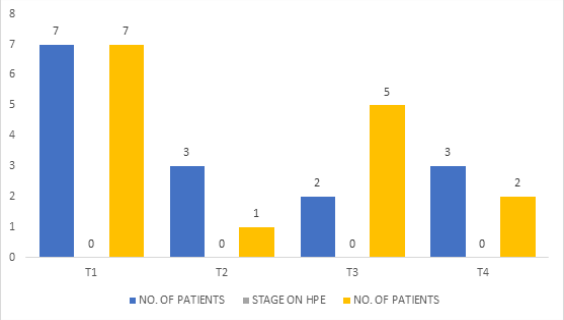

Figure 3: Imaging and Histopathological Staging of Renal Masses

In the surgical treatment of renal cell carcinoma, 14 of 15 patients underwent open nephrectomy, while one patient underwent laparoscopic nephrectomy. Of these, 11 patients underwent radical nephrectomy aimed at complete removal of the kidney and tumour, whereas 4 underwent partial nephrectomy. Notably, intraoperative findings revealed local organ infiltration in 2 patients, involving the ascending colon and appendix, and another 2 had psoas muscle involvement. Three patients developed renal vein thrombosis.

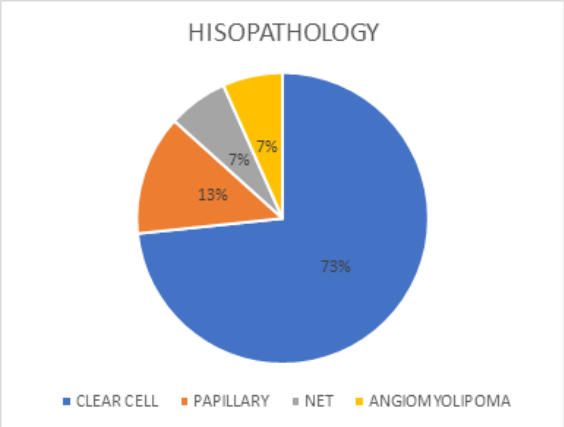

Figure 4: Histopathological Subtypes Distribution in Renal Cell Carcinoma Patients

Histopathological evaluation of the renal masses showed that the majority of tumours (73%) were classified as clear cell renal cell carcinoma, the most common subtype. Papillary renal cell carcinoma was found in 13% of cases, and neuroendocrine tumour (NET) and angiomyolipomas were identified in 7% of the patients (Figure 4). About tumour grading, ISUP Grade 2 was the most frequently observed, followed by Grade 1. None of the tumours exhibited sarcomatoid features. Additionally, lymphovascular invasion was present in five cases.

During the follow-up period, only one patient developed pulmonary metastasis. Histopathological examination (HPE) of this patient confirmed the subtype to be clear cell RCC, which is known for its potential to metastasize. Notably, there were no cases of local recurrence in the operated bed in any of the patients.

DISCUSSION

Our study provides valuable insights into the clinical profiles, histopathological correlations, and recurrence patterns of RCC, emphasizing the importance of integrating clinical, radiological, and pathological findings for comprehensive patient care. Clear cell RCC was the most prevalent subtype in 73% of cases, consistent with global statistics and studies, such as Sharma et al. (2024), which reported a 73.73% prevalence in Tamil Nadu. This subtype was followed by papillary and chromophobe RCC. The early detection of incidental tumours in the T1 stage (46% in our study) reflects the trends observed in Sharma et al.'s study, which identified 48.38% of cases in the same stage. These findings highlight how imaging advancements are facilitating earlier diagnosis.8 Narmadha et al. (2019) similarly noted the importance of imaging techniques like MRI in enhancing histopathological assessments for improved staging and management.[9]

The correlation between tumour size and Fuhrman grade observed in our study aligns with the findings of Zhang et al. (2012), who demonstrated that larger tumours are associated with higher nuclear grades and more aggressive behaviour. Their analysis highlighted tumour size as a critical factor influencing histological characteristics and prognosis. These findings reinforce the importance of tumour size as a prognostic indicator in RCC management.[10]

No local recurrence was observed in this cohort, and the metastasis rate was 6.7%, indicating the success of surgical interventions including radical and partial nephrectomy. Similar findings were noted by Abu-Ghanem et al. (2020), who reported long-term disease-free survival after early surgical management.[11] Mattila et al. (2022) further discussed how histological subtypes and tumour grades contribute to assessing recurrence risks, emphasizing the importance of individualized follow-up approaches.[12]

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While this study offers strengths such as a detailed examination of histopathological subtypes and a one-year follow-up, its limitations include a small sample size, a single-centre scope, and a retrospective design. These factors may restrict the broad applicability of our findings. Zhang et al. (2012) similarly noted the importance of multicentre studies to confirm such observations and evaluate long-term results. Future research should focus on incorporating molecular and genetic profiling, as suggested by Carril-Ajuria et al. (2019), to refine prognostic models and enable more personalized care.[13]

This study underscores the value of early detection, effective surgical treatment, and collaboration across disciplines. By combining precise histopathological evaluation, advanced imaging, and targeted public health efforts, RCC outcomes can be significantly improved, as reflected in both this study and existing literature.

CONCLUSION

This study highlights the importance of histopathological assessment and its integration with clinical findings for the diagnosis and management of RCC. Clear cell RCC continues to be the most common subtype, with early detection enabled by advancements in imaging techniques, contributing to improved patient outcomes. Surgical approaches tailored to the tumour stage and histological features have proven effective in reducing recurrence rates and enhancing survival. Collaboration across specialities, including clinicians, radiologists, and pathologists, is crucial for improving RCC treatment and follow-up protocols. Future studies should incorporate molecular profiling to improve prognostic models and support individualized therapeutic strategies.

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