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RESEARCH ARTICLE

# Clinicopathological Profile and Treatment Outcome of Renal Cell Carcinoma: A Review from a Tertiary Cancer Centre in North East India

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## Abstract

**Background and Objectives:** Renal cell carcinoma (RCC) constitutes 4% of adult malignancies and 90% of kidney cancers. While extensively studied in Western populations, data from India particularly Northeast India remain limited. This retrospective study aimed to assess overall survival (OS), progression-free survival (PFS), and disease-free survival (DFS) among RCC patients treated at a tertiary cancer centre in Northeast India between January 2020 and December 2022. **Materials and Methods:** We retrospectively analyzed 88 RCC patients who received treatment. Clinical parameters, including age, sex, histology, stage, metastatic pattern, treatment, and outcomes, were recorded. Kaplan-Meier analysis was used for survival estimation. Prognostic factors were evaluated using univariate and multivariate analyses. **Results:** The majority had clear cell histology (85%), with a median age of 56 years and a male-to-female ratio of 3:1. Metastatic disease was present in 65%, commonly affecting the lungs (67%), bones (44%), liver (32%), and brain (10%). Among those with metastasis, 40% were classified as poor-risk according to IMDC criteria. All non-metastatic patients (n=31) underwent surgery (68% radical, 32% partial nephrectomy). Among metastatic patients (n=57), VEGFR tyrosine kinase inhibitors were commonly used sunitinib (n=22) and pazopanib (n=25); one received nivolumab-based immunotherapy. With a median follow-up of 17 months, metastatic RCC showed poor outcomes, with median PFS and OS of 9 and 12 months, respectively. Non-metastatic RCC had an 18-month OS of 80.5%, with median OS not reached. OS varied by IMDC risk: 30 months (favorable), 12 months (intermediate), and 6 months (poor) ($p<0.001$). Sunitinib and pazopanib had comparable efficacy overall, though sunitinib had superior OS in favorable-risk patients (51 vs. 28 months, $p<0.0001$). **Conclusions:** RCC patients in Northeast India often present younger and with advanced disease. VEGFR-TKIs remain standard in limited access to immunotherapy. Enhanced early detection and access to immunotherapy are vital to improve outcomes.

**Keywords:** Renal cell carcinoma- clinicopathology- tyrosine kinase inhibitors- survival outcomes- Indian cohort

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## Introduction

Renal cell carcinoma (RCC) is the most common kidney cancer in adults, comprising over 90% of kidney neoplasms and accounting for 4% of adult malignancies globally [1]. According to GLOBOCAN 2022, there are approximately 435,000 new cases and 156,000 deaths annually worldwide [1]. Although its incidence is rising, mortality is declining due to advances in treatment. In developed countries, RCC incidence has more than doubled since 1975, whereas the incidence remains lower in Asia, particularly in India, likely due to underreporting [2]. However, with increasing life expectancy, improved diagnostics, and rising risk factors like obesity and smoking, RCC incidence in India is expected to grow [3].

RCC arises primarily in the renal cortex, involving

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the glomerulus, tubules, and collecting ducts, whereas renal pelvis cancers resemble urothelial carcinoma [4]. Advances in imaging modalities such as CT and MRI have improved early detection, with a 5-year survival rate of 93% for localized disease [5, 6]. However, metastatic RCC remains challenging, with a 5-year survival rate of only 13%, necessitating systemic therapies in most patients [6].

RCC, historically resistant to chemotherapy and radiation, is considered an immunogenic tumor, with early immunotherapies showing limited success [7]. Treatment of RCC has changed dramatically from 20 years ago when the only options were surgical treatment and inadequate immunotherapy. Modern treatment approaches now include targeted therapies, such as anti-vascular endothelial growth factor (VEGF) antibodies, tyrosine kinase inhibitors, mammalian target of rapamycin (mTOR) pathway inhibitors, and immune checkpoint inhibitors (ICIs) with revolutionizing outcomes [8].

Most RCC data are derived from Western populations, highlighting a significant gap in Indian data [9, 10]. This study presents the experience of RCC at Dr. B. Borooah Cancer Institute, Guwahati, focusing on epidemiology, histopathology, management, outcomes, and prognosis.

## Materials and Methods

This retrospective study analysed electronic medical records (EMR) of renal cell carcinoma (RCC) patients who presented to our institution between January 2020 and December 2022. All patients underwent baseline clinical staging evaluation and tumour characterization. Tumours were staged according to the 8th edition of the American Joint Committee on Cancer (AJCC) TNM staging system, and histological subtypes were classified per the 2016 World Health Organization (WHO) renal tumour classification [11, 12]. Patients with metastatic RCC were stratified using the International Metastatic RCC Database Consortium (IMDC) criteria, a validated prognostic scoring tool for patients receiving VEGF-targeted or subsequent therapies into favorable (score 0), intermediate (score 1–2), or poor (score ≥ 3) risk groups [13]. Treatment was tailored to each patient according to the stage of disease, patient factors, and available modalities.

The primary endpoint was overall survival (OS), defined as the duration from diagnosis to death or the most recent follow-up. Secondary endpoints included disease-free survival (DFS) for non-metastatic RCC and progression-free survival (PFS) for metastatic RCC, defined as the time from treatment initiation to recurrence, progression, death, or last follow-up. Key variables analyzed in the study comprised demographic factors (age and gender), TNM staging, WHO grading, histopathological subtypes, IMDC risk categories, patterns of metastasis, and treatment modalities.

The survival analysis was performed using Kaplan-Meier curves, and the associations between OS and categorical variables were assessed with the log-rank test. Frequencies of categorical variables were analyzed using Chi-square tests, with statistical significance set at $P < 0.05$. All statistical analyses were conducted using SPSS version 17. Ethical approval for the study was obtained from the Institutional Ethics Committee.

## Results

*Patient demographics and clinical presentation*

Out of 102 patients presenting to the OPD with suspected renal cell carcinoma (RCC), 88 were diagnosed and initiated on treatment. Of these, 66 (75%) were male and 22 (25%) were female, with a male-to-female ratio of 3:1. The majority (57%) were aged 50–70 years, while 33% were under 50. The median age was 56, with the youngest being 21 and the oldest being 86 years (Table 1).

RCC was equally distributed between the right and left kidneys. Nearly half of the patients (47.7%) presented with an ECOG performance status of 0–1. Histologically, clear cell carcinoma was the predominant subtype, accounting for 85% of cases, followed by papillary RCC (8%), collecting duct carcinoma (5%), and other rare variants. Notably, 20% of tumors were grade IV, including those with sarcomatoid and rhabdoid differentiation.

*Disease stage and metastatic pattern at diagnosis*

A significant number of patients presented with advanced disease. Of the 88 diagnosed cases, 31 (35.2%) had non-metastatic RCC, while 57 (64.8%) presented with metastatic disease. Among metastatic cases, 25% had a history of nephrectomy for early-stage RCC, with a median recurrence interval of 16 months (range: 3–144 months).

Based on the International Metastatic RCC Database Consortium (IMDC) risk stratification, 40% of metastatic

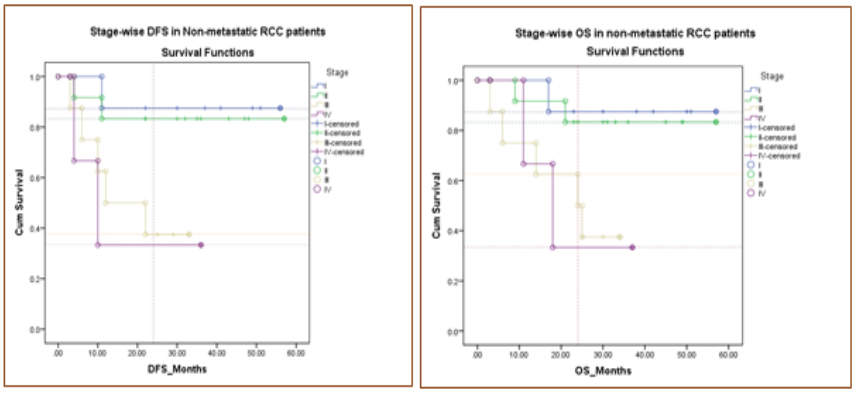


Figure 1. DFS and OS in Non-metastatic RCC Patients According to TNM Stage

Table 1. Baseline Characteristics of Study Population

| Baseline characteristics | Total number of patients (N=88) n (%) |
|---|---|
| Sex | |
| Male | 66 (75) |
| Female | 22 (25) |
| Age (in years) | |
| 21-30 | 4 (4.5) |
| 31-40 | 7 (8) |
| 41-50 | 18 (20.5) |
| 51-60 | 34 (39) |
| 61-70 | 16 (18) |
| 71-80 | 8 (9) |
| 81-90 | 1 (1) |
| Laterality | |
| Right | 47 (53) |
| Left | 41 (47) |
| ECOG PS | |
| 0 | 10 (11) |
| 1 | 32 (36) |
| 2 | 28 (32) |
| ≥3 | 18 (21) |
| Haemoglobin (gm/dl) | |
| Hb <12 | 52 (59) |
| Hb ≥12 | 36 (41) |
| Platelets (x10⁹/L) | |
| Platelets < 150 | 23 (26) |
| Platelets ≥ 150 | 65 (74) |
| Corrected calcium (mg/dl) | |
| ≤10.5 | 67 (76) |
| >10.5 | 21 (24) |
| Histology | |
| Clear cell ca | 75 (85) |
| Papillary ca | 7 (8) |
| Collecting duct ca | 4 (5) |
| Chromophobe | 1 (1) |
| Oncocytoma | 1 (1) |
| WHO/ISUP Grade | |
| 1 | 16 (18) |
| 2 | 28 (32) |
| 3 | 26 (30) |
| 4 | 18 (20) |
| TNM Stage (AJCC 8th Ed.) | |
| Non metastatic RCC | 31 (35) |
| I | 8 (9) |
| II | 12 (14) |
| III | 8 (9) |
| IV | 3 (3) |
| Metastatic RCC | 57 (65) |

patients were classified as poor risk; while 26% were favorable risk. Lung was the most common site of distant metastases (67%), followed by lymph nodes (49%), bones (44%), liver (32%), adrenal glands (12%), and brain (10.5%). Thirty percent of patients had metastasis to a single site, while 46% had involvement of three or more sites (Table 2).

*Treatment patterns*

All patients with non-metastatic RCC (n=31) underwent surgical intervention. Among them, 68% underwent radical nephrectomy, while 32% underwent partial nephrectomy, primarily for early-stage disease. None of these patients received adjuvant therapy.

Among patients with metastatic RCC (n=57), cytoreductive nephrectomy was performed in three cases, followed by systemic therapy. The majority (n=47) were treated with vascular endothelial growth factor receptor tyrosine kinase inhibitors (VEGFR TKIs) such as sunitinib or pazopanib as first-line palliative therapy. One patient received single-agent nivolumab immunotherapy. Nine patients, deemed unfit for systemic therapy, received the best supportive care. Additionally, 21 patients underwent palliative radiotherapy for symptom management, particularly for bone pain or brain metastases.

*Response to therapy*

Radiological response to therapy in patients with metastatic RCC assessed every 3–4 months following the initiation of treatment, based on RECIST criteria version 1.1. Data on radiological response were available for 43 out of 47 patients. Among those evaluated, 8 patients in the sunitinib group and 10 in the pazopanib group achieved a radiological response (complete and partial responses). In addition, one patient treated with nivolumab demonstrated a partial response. The disease control rate was 73% with sunitinib and 76% with pazopanib (Table 3).

*Survival outcomes*

The median follow-up duration was 17±15.75 months (range: 1–58 months). The median overall survival (OS) for non-metastatic RCC not reached, while for metastatic RCC it was 12 months (95% CI: 11.15–22.85). At 18 months, the estimated OS was 80.5% for non-metastatic RCC and 32% for metastatic RCC ($p < 0.001$).

For organ-confined RCC, the median disease-free survival (DFS) and OS not reached. However, advanced stages had poorer outcomes. The 2-year estimated DFS was 87.5% for stage I, 83.25% for stage II, 37.5% for stage III, and 33.3% for stage IV ($p = 0.034$). The 2-year OS was 87.5%, 83.25%, 50%, and 33.3% for stages I, II, III, and IV, respectively ($p = 0.048$) (Figure 1 and Table 4).

In metastatic RCC, the median progression-free survival (PFS) was 9 months (95% CI: 6.90–11.10), and the median overall survival (OS) was 12 months (95% CI: 7.97–16.03). Outcomes varied significantly by IMDC risk group, with favorable-risk patients showing better survival compared to intermediate- and poor-risk groups. The median time to progression was 26 months (95% CI: 6.81–45.19) for favorable risk, 10 months (95% CI:

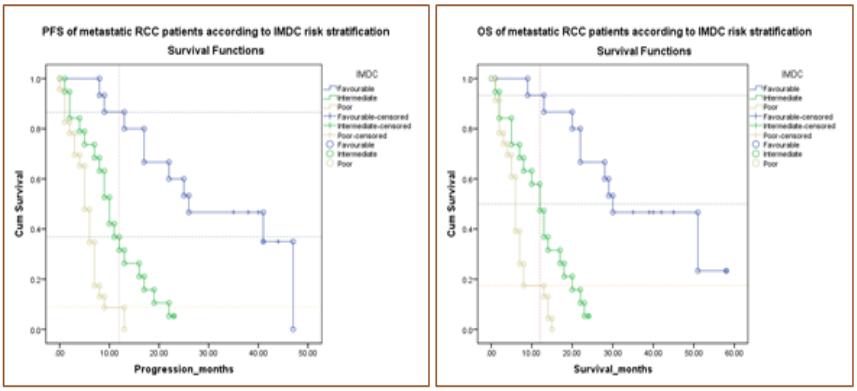


Figure 2. PFS and OS in Metastatic RCC Patients According to IMDC Risk Stratification

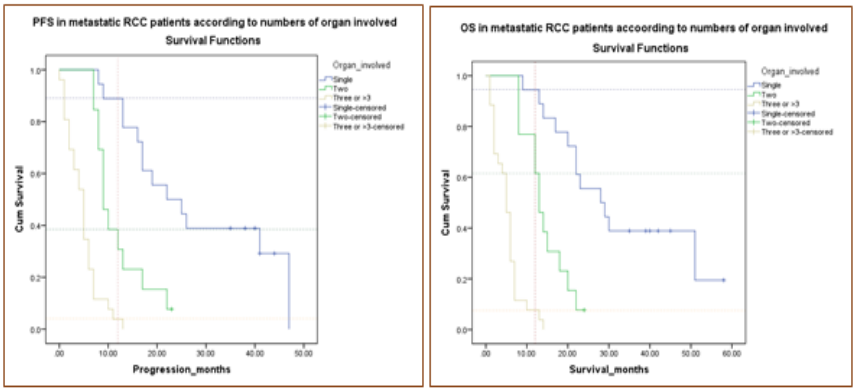


Figure 3. PFS and OS in Metastatic RCC Patients According to Number of Involved Organs

7.89–12.11) for intermediate risk, and 5 months (95% CI: 3.66–6.34) for poor risk. The one-year PFS rates were 86.5%, 36.75%, and 8.75%, respectively ($p < 0.001$). A similar trend was also observed for OS. The median survival time was 30 months (95% CI: 14.16–45.84) for favorable risk, 12 months (95% CI: 8.80–15.20) for intermediate risk, and 6 months (95% CI: 5.08–6.92) for poor risk. The 12-month OS rates were 86.5%, 50%, and 17.5%, respectively ($p < 0.001$) (Figure 2 and Table 5).

In a cohort of 57 metastatic RCC patients, those with one organ involvement had a median PFS of 22 months (95% CI: 9.53–34.47) and 12-month PFS of 89%, while those with involvement of two organs had a median PFS of 9 months (95% CI: 7.24–10.76) and 12-month PFS of 38.5%, and patients with ≥ 3 organs involved had a median PFS of 5 months (95% CI: 3.64–6.36) and 12-month PFS of 4%, with corresponding median OS of 28 months (95% CI: 15.53–40.47), 13 months (95% CI: 10.65–15.35), and 5 months (95% CI: 3.89–6.11) and 12-month OS rates of 94.5%, 61.5%, and 7.5%, respectively ($P < 0.0001$) (Figure 3 and Table 6).

In patients with metastatic RCC (n= 57 patients), 47 patients received VEGFR inhibitor TKI (sunitinib by 22 patients and pazopanib by 25 patients). In those patients, median PFS was 8 months (95% CI: 3.40–12.60) and 10 months (95% CI: 5.10–14.90) for sunitinib and pazopanib groups, respectively ($p = 0.851$). The median OS were similar in both the sunitinib and pazopanib groups [13 months (95% CI: 8.42–17.58) vs. 13 months (95% CI: 9.74–16.26); $p = 0.903$]. The 18-month estimated PFS was 27.25% for sunitinib group and 24% for pazopanib group, with OS estimates of 32% and 40%, respectively (Figure 4 and Table 7).

Survival outcomes with use of sunitinib and pazopanib also varied according to IMDC risk groups. In favorable-risk patients, sunitinib showed significantly longer median OS (51 months vs. 28 months, $p < 0.0001$). For intermediate-risk (13 months vs. 12 months) and poor-risk groups (6 months vs. 7 months), the outcomes

Table 2. Baseline Characteristics of Metastatic RCC Patients

| Baseline characteristics | Total number of patients (N=57) |
|---|---|
| IMDC risk stratification | |
| Favorable | 15 (26) |
| Intermediate | 19 (33) |
| Poor | 23 (41) |
| Number of metastatic sites | |
| 1 | 17 (30) |
| 2 | 14 (24) |
| ≥3 | 26 (46) |
| Site of metastatic disease | |
| Lung | 38 (67) |
| Node | 28 (49) |
| Bone | 25 (44) |
| Liver | 18 (32) |
| Adrenal | 7 (12) |
| Brain | 6 (10) |

Table 3. Radiological Response of TKIs (according to RESIST v 1.1 criteria)

| Response | Sunitinib (n=22) | Pazopanib (n=25) | Immunotherapy (n=1) |
|---|---|---|---|
| CR | 1 (4%) | 0 (0%) | 0 |
| PR | 7 (32%) | 10 (40%) | 1 (100%) |
| SD | 8 (36%) | 9 (36%) | 0 |
| PD | 3 (14%) | 5 (20%) | 0 |
| Not done | 3 (14%) | 1 (4%) | 0 |
| ORR (CR+PR) | 8 (36%) | 10 (40%) | 1 (100%) |
| Disease control rate (CR=PR+SD) | 16 (73%) | 19 (76%) | 1 (100%) |

Table 4. Survival of Non-metastatic RCC Patients

| TNM stage AJCC 8th Ed. (n=31) | Median DFS (in months) | 24-months DFS (in %) | P-value | Median OS (in months) | 24- months OS (in %) | P-value |
|---|---|---|---|---|---|---|
| I (n=8) | NR | 87.3 | | NR | 87.3 | |
| II (n=12) | NR | 83.25 | | NR | 83.25 | |
| III (n=8) | 12 (95% CI: 0-28.63) | 37.5 | 0.034 | 24 (95% CI: 8.75-39.25) | 62.5 | 0.048 |
| IV (n=3) | 10 (95% CI: 0.40-19.61) | 33.5 | | 18 (95% CI: 6.80-29.20) | 33.5 | |

were comparable amongst sunitinib and pazopanib groups (Figure 5 and Table 8).

*Toxicity profile*

The most common adverse effects (>2%) associated with pazopanib were elevated liver enzymes (48%), diarrhoea (36%), and hypertension (28%). In patients receiving sunitinib, the most frequent adverse effects included hand-foot syndrome (50%), fatigue (45%), mucositis (41%), haematological abnormalities, and elevated creatinine levels (36%). Dose reductions were required in eight patients treated with sunitinib and five patients treated with pazopanib (Table 9).

On multivariate analysis, survival outcomes in patients with metastatic RCC were seen to be significantly associated with IMDC risk stratification, use of VEGF inhibitors, and the number of metastatic sites.

## Discussion

We conducted a retrospective observational analysis of 88 patients with histologically confirmed renal cell carcinoma (RCC) who underwent treatment between January 1, 2020, and December 30, 2022, with a median follow-up period of 17 months.

RCC is often considered a disease of older adults, with the SEER database reporting a median diagnosis age of 64 years, with 50% of cases occurring between 55–75 years. [14, 15]. Interestingly, our study showed a younger median age of diagnosis at 56 years, with 33% of patients under 50 and 12.5% below 40 years. This earlier onset mirrors findings from other Indian and Asian studies, potentially attributable to genetic predispositions, environmental influences, or underreporting [9, 16-18].

Globally, RCC exhibits a male-to-female ratio of 2:1; however, our study identified an even greater male predominance of 3:1.6 This finding aligns with other Indian and Asian studies, potentially reflecting lower smoking prevalence among women and socioeconomic factors affecting healthcare access [16, 19, 20]. Nearly half (48%) of our patients presented with good performance status, consistent with the often-asymptomatic course of the disease.

Clear cell RCC (ccRCC) is the most frequently

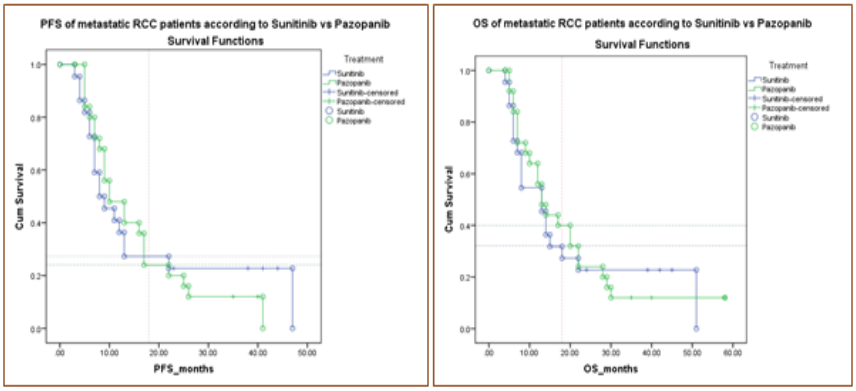


Figure 4. PFS and OS in Metastatic RCC Patients According to TKIs (Sunitinib and pazopanib)

Table 5. Survival of Metastatic RCC Patients

| IMDC risk criteria (n=57) | Median PFS (in months) | 12-months PFS (in %) | P-value | Median OS (in months) | 12-months OS (in %) | P-value |
|---|---|---|---|---|---|---|
| Favorable (n=15) | 26 (95% CI: 6.81-45.19) | 86.5 | | 30 (95% CI: 14.16-45.84) | 93.35 | |
| Intermediate (n=19) | 10 (95% CI: 7.89-12.10) | 36.75 | | 12(95% CI: 8.80-15.20) | 50 | |
| Poor (n=23) | 5 (95% CI: 3.66-6.34) | 8.75 | <0.0001 | 6 (95% CI: 5.08-16.03) | 17.5 | <0.0001 |

Table 6. Survival of Metastatic RCC Patients According to Number of Involved Organs

| Number of involved organs (n=57) | Median PFS (in months) | 12-months PFS (in %) | P-value | Median OS (in months) | 12-months OS (in %) | P-value |
|---|---|---|---|---|---|---|
| One (n=18) | 22 (95% CI: 9.53-34.47) | 89 | | 28 (95% CI: 15.53-40.47) | 94.5 | |
| Two (n=13) | 9 (95% CI: 7.24-10.76) | 38.5 | | 13 (95% CI: 10.65-15.35) | 61.5 | |
| ≥ Three (n=26) | 5 (95% CI: 3.64-6.36) | 4 | <0.0001 | 5 (95% CI: 3.89-6.11) | 7.5 | <0.0001 |

Table 7. Comparison of Sunitinib vs Pazopanib in 1st Line Treatment of Metastatic RCC

| PFS | | | |
|---|---|---|---|
| TKI | Median PFS (months) | 18-months PFS (%) | P-Value |
| Sunitinib (n=22) | 8 (95% CI: 3.40–12.60) | 27.25 | 0.851 |
| Pazopanib (n=25) | 10 (95% CI: 5.10–14.90) | 24 | |
| OS | | | |
| TKI | Median OS (months) | 18-months OS (%) | P-value |
| Sunitinib (n=22) | 13 (95% CI: 8.42–17.58) | 32 | 0.903 |
| Pazopanib (n=25) | 13 (95% CI: 9.74–16.26) | 40 | |

diagnosed subtype worldwide, accounting for 70–75% of cases [12, 21]. In our cohort, ccRCC accounted for 85%, followed by papillary RCC (8%), collecting duct carcinoma (5%), and chromophobe RCC and oncocytoma (1% each). Notably, the incidence of collecting duct carcinoma in our cohort was higher than the global rate of less than 1%.22 This subtype, alongside ccRCC, is linked to poorer outcomes due to its association with advanced stages and metastatic presentation [23, 24].

Tumor grading, a key prognostic factor, has shifted from the Fuhrman grading system to the WHO/ISUP system, which assesses nucleolar prominence and high-grade features such as sarcomatoid and rhabdoid morphology [25-27]. This system is considered more reproducible and clinically relevant. In our cohort, 62% of patients presented with grades II and III, while 20% had grade IV tumors, including sarcomatoid and rhabdoid features, both of which are associated with poor outcomes. High-grade features correspond to a reported 5-year survival of 15–22% and frequently present with metastases (45–77%) [28].

The staging at diagnosis showed significant regional differences. SEER data indicate that 60–70% of RCC cases in Western countries are diagnosed at early stages. In contrast, only 35% of our patients presented with non-metastatic disease, while 65% had stage IV metastatic RCC. This higher proportion of metastatic cases compared to other Indian studies may reflect delayed diagnosis, limited access to healthcare, and regional factors [9, 10, 17].

The lungs were the most common site of metastases (67%), followed by lymph nodes, bones, and the liver. Interestingly, 10% of patients presented with brain metastases, higher than reported rates in the literature [29]. RCC ranks third among cancers likely to metastasize to the brain, following lung cancer and melanoma, with an estimated incidence of 6.5% [30]. Additionally, 46% of patients had multi-organ metastases, underscoring RCC's aggressive and often silent metastatic nature.

Metastatic RCC patients were stratified using the International Metastatic RCC Database Consortium (IMDC) criteria, a validated prognostic tool for patients receiving VEGF-targeted or subsequent therapies [13]. Based on these criteria, 40% of patients fell into the poor-risk group, while 26% were classified as favorable-risk, indicating an aggressive disease profile in this population.

Treatment decisions were made collaboratively by a multidisciplinary tumor board. Radiological staging was performed for all patients, with biopsies conducted when necessary. Non-metastatic cases predominantly underwent surgery, with 68% receiving radical nephrectomy and 32% partial nephrectomy. No patients received adjuvant therapy, aligning with current guidelines. Among metastatic RCC patients, three underwent cytoreductive surgery for symptom management before systemic therapy. Palliative radiotherapy was administered to 21 patients, targeting bone (16 cases) and brain metastases (6 cases). First-line systemic therapy primarily included anti-VEGF tyrosine kinase inhibitors (TKIs), such as sunitinib (n=22) and pazopanib (n=25), with one patient receiving nivolumab monotherapy.

In metastatic RCC, systemic therapies are the cornerstone of treatment, with minimal roles for surgery [31]. Advances in treatment have shifted from interferon-α and interleukin-2 therapies to modern

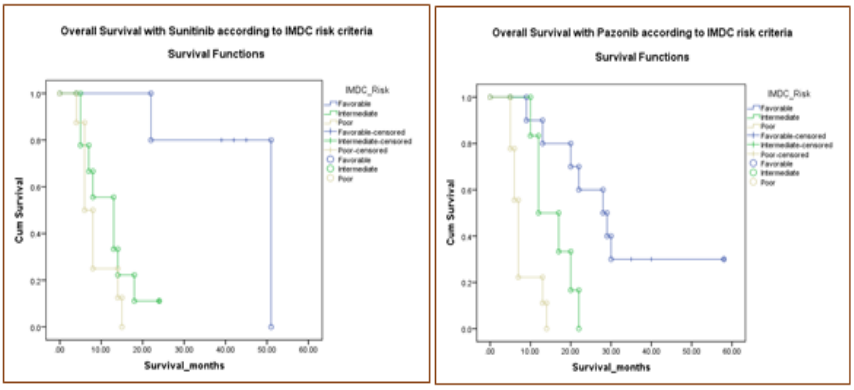


Figure 5. Overall Survival between Sunitinib and Pazopanib According to IMDC Risk Stratification

VEGF and immune checkpoint inhibitors (ICIs) [32, 33]. VEGF receptor-targeted TKIs (e.g., sunitinib, pazopanib, cabozantinib, lenvatinib, axitinib) and ICIs (e.g., nivolumab, pembrolizumab, ipilimumab) remain pivotal in managing ccRCC due to its highly vascular and immunogenic nature [34, 35]. Treatment choice is influenced by performance status, laboratory parameters, and prior nephrectomy [36-38]. However, the optimal sequencing of therapies remains uncertain due to limited comparative data and real-world evidence.

Globally, approximately 50% of metastatic RCC patients proceed to second-line therapy, necessitating a thorough understanding of the molecular and clinical profiles of available agents [39]. In India, challenges include the high cost of treatment and limited reimbursement for immunotherapies. These financial constraints often restrict patients to single-agent TKIs, despite international guidelines recommending combination regimens for optimal management [40].Additionally, treatment decisions often consider factors such as disease burden, clinical symptoms, and patient performance status [38]. The absence of RCC-specific treatment guidelines tailored to the Indian context further complicates treatment strategies.

For non-metastatic RCC, the median overall survival (OS) was not reached, with an 18-month OS rate of 80.5%. In metastatic RCC, the median OS was 12 months (95% CI: 11.15–22.85), with an 18-month OS rate of 32% ($p < 0.001$). Organ-confined RCC showed better outcomes, with a 24-month survival rate of 87.5% in stage I patients, declining to 33.3% in stage IV patients.

Radiological responses in metastatic RCC patients were observed in eight patients treated with sunitinib and ten with pazopanib, including complete and partial responses. One patient on nivolumab achieved a partial response. The disease control rates were 73% for sunitinib and 76% for pazopanib, consistent with findings from the COMPARZ trial and other studies [41, 42].

Survival outcomes in metastatic RCC varied by IMDC risk category, with favorable-risk patients demonstrating significantly longer progression-free survival (PFS) and OS compared to intermediate- and poor-risk groups ($p < 0.001$). Similar findings were reported by Bazarbashi et al [43].

In patients with metastatic RCC, sunitinib and pazopanib demonstrated similar efficacy, with median PFS of 8 and 10 months and median OS of 13 months for both ($p > 0.8$). The 18-month OS rates are 32% and 40% for the sunitinib group and the pazopanib group, respectively. In comparison, landmark trials by RJ Motzer et al. reported a median PFS of 11 months and OS of 21.8 months for sunitinib and a median PFS of 10.5 months and OS of 28.3 months for pazopanib [41, 44, 45]. Meta-analysis by Deng et al. confirmed the equivalent efficacy of sunitinib and pazopanib, with lower total costs for pazopanib [46].

According to IMDC criteria, sunitinib demonstrated better median OS in favorable-risk patients (51 months vs. 28 months, $p < 0.0001$). Median OS was comparable for patients with both intermediate-risk (13 vs. 12 months) and poor-risk groups (6 vs. 7 months). Rini et al. reported a median OS of 23.0 months and 5.1 months in sunitinib-treated IMDC intermediate- and poor-risk groups, respectively, while OS in the favorable-risk group of patients, not reached [47].

In metastatic patients, both progression-free survival (PFS) and overall survival (OS) showed a significant decline with an increasing number of involved organs. Patients with metastasis to a single organ had the most favorable outcomes, with a median PFS of 22 months and a median OS of 28 months. In contrast, those with metastases involving three or more organs experienced the poorest outcomes, with a median PFS and OS of just 5 months ($P < 0.0001$).

We observed that pazopanib was associated more

Table 8. Comparison of Survival between Sunitinib and Pazopanib According to IMDC Risk Stratification (median 0S in months)

| IMDC risk | Sunitinib (n=22) | Pazopanib (n=25) | P-value |
|---|---|---|---|
| Favorable (n=15) | 51 (NR) | 28 (17.15 to 38.85) | <0.0001 |
| Intermediate (n=15) | 13 (6.07 to 19.93) | 12 (6.39 to 17.60) | |
| Poor (n=17) | 6 (3.78 to 8.21) | 7 (6.19 to 7.81) | |

Table 9. Toxicity Profile of VEGF-TKI (sunitinib vs. pazopanib)

| Toxicity | Sunitinib (N=22) n (%) | Pazopanib (N=25) n (%) |
|---|---|---|
| Anaemia | 6 (27) | 4 (16) |
| Neutropenia | 8 (36) | 3 (12) |
| Thrombocytopenia | 4 (18) | 1 (4) |
| Increase creatinine | 8 (36) | 3 (12) |
| Increase liver enzymes | 7 (32) | 12 (48) |
| Fatigue | 10 (45) | 7 (28) |
| Diarrhoea | 7 (32) | 9 (36) |
| Mucositis | 9 (41) | 5 (20) |
| Hypertension | 6 (27) | 7 (28) |
| Hand foot syndrome | 11 (50) | 2 (8) |
| Dose reduction | 8 (36) | 5 (20) |

commonly with liver enzyme abnormalities, diarrhea, and hypertension, while sunitinib was associated with hand-foot syndrome, fatigue, mucositis, hematological abnormalities, often necessitating dose reductions. Side effect profiles significantly affected quality of life (QoL), especially on long-term treatment in patients with metastatic disease. Studies, such as Escudier et al., have shown that patients on pazopanib generally report better overall QoL due to fewer debilitating side effects [42].

Treatment strategies reflect the realities of resource-limited settings. While international guidelines prioritize combination regimens, cost constraints often limit patients to single-agent therapies. Despite these challenges, the median survival of 12 months for metastatic patients in our cohort is comparable to global real-world data for single-agent treatments [41, 45].

Among biases influencing this analysis, the two-year accrual period represents a significant limitation, as it spans a time of rapid advancements in RCC management, including the introduction of next-generation VEGFR-TKIs and VEGFR-TKI plus ICI combinations. Consequently, this study reflects older therapeutic strategies, predominantly VEGFR-TKI monotherapies and single-agent ICIs. Another limitation is the study's setting in a high-volume referral centre, which likely attracted a fitter patient population and rare clinicopathological variants. This may explain the relatively high proportion of metastatic patients and younger patients under 50 years of age.

Despite these limitations, this study offers valuable insights. Our findings highlight a younger age of presentation, a higher male predominance, and a high prevalence of ccRCC compared to Western data. These observations underscore the importance of region-specific studies for a better understanding of the clinicopathological profile of RCC, especially in developing countries to tailor management strategies accordingly.

In conclusion, this retrospective analysis provides valuable insights into RCC's presentation, treatment pattern, and outcome in the resource-restrained setting. Outcomes varied significantly by risk stratification, as assessed by the IMDC criteria, reaffirming its prognostic utility. The findings highlight the importance of individualized treatment based on risk stratification and the need for continued research to optimize management and improve survival outcomes, particularly for patients with advanced or high-risk disease.

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*Statement of Transparency and Principals*

- Author declares no conflict of interest
- Study was approved by Research Ethic Committee of author affiliated Institute.
- Study's data is available upon a reasonable request.
- All authors have contributed to implementation of this research.

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