

**CLINICAL AND STATISTICAL ANALYSIS OF RENAL CELL  
CARCINOMA BASED ON DATA FROM PATIENTS OF THE REPUBLICAN  
SCIENTIFIC ONCOLOGY CENTER**

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**Abstract**

**Objective.** To evaluate the clinical and statistical characteristics of renal cell carcinoma in a cohort of surgically treated patients and to identify factors associated with advanced-stage disease.

**Materials and Methods.** A retrospective study based on a clinical database (n = 32) was conducted. Descriptive statistical analysis (Mean  $\pm$  SD, median, range) and comparative analysis (Mann-Whitney U test, Fisher's exact test) were applied. The level of statistical significance was set at  $p < 0.05$ .

**Results.** The mean age was  $50.6 \pm 12.1$  years (n = 25). Stages I-II accounted for 81.3% of cases, while stages III-IV constituted 18.8%. Nephrectomy was performed in 75.0% of patients, and partial resection in 18.8%; laparoscopic approach was used in 96.9% of cases. The predominant histological subtype was clear cell carcinoma (74.2%). Postoperative complications occurred in 9.4% of patients. Older age was significantly associated with advanced-stage disease ( $p = 0.0044$ ); age  $\geq 60$  years was

linked to a higher likelihood of stages III-IV ( $p = 0.0151$ ). Blood loss was significantly higher in resection procedures ( $p = 0.0058$ ), while no significant difference in operative time was observed ( $p = 0.2525$ ).

**Conclusion.** In this cohort, most cases were diagnosed at localized stages. Advanced age is a significant risk factor for advanced-stage disease. Laparoscopic approach and nephrectomy remain the primary treatment modalities. The lack of long-term follow-up represents a major limitation.

#### Keywords

renal cell carcinoma, RCC, nephrectomy, laparoscopy, staging, risk factors, statistical analysis.

#### Аннотатсия

**Ҳадаф.** Арзёбии хусусиятҳои клиникӣ-статистикӣ саратони гурда дар як силсилаи беморони чаррохишуда ва муайян кардани омилҳои марбут ба марҳилаи пешрафта.

**Мавод ва усулҳо.** Таҳқиқоти ретроспективӣ дар асоси базаи клиникӣ ( $n=32$ ). Истифодаи таҳлили тавсифӣ ( $\text{Mean}\pm\text{SD}$ , медиана, диапазон) ва муқоисавӣ (Mann-Whitney U, Fisher exact). Ҳаққи аҳамияти оморӣ:  $p < 0,05$ .

**Натиҷаҳо.** Синни миёна  $50,6\pm 12,1$  сол ( $n=25$ ). Марҳилаҳои I-II - 81,3%, III-IV - 18,8%. Нефрэктомия 75,0%, резексия 18,8%; дастрасии лапароскопӣ 96,9%. Навъи морфологии бартаридошта - светлоклеточная карцинома (74,2%). Оризаҳои баъдичаррохӣ 9,4%. Синни калонтар бо марҳилаи пешрафта алоқаманд буд ( $p=0,0044$ ); синни  $\geq 60$  сол - бо эҳтимоли бештари III-IV ( $p=0,0151$ ). Хунталафот дар резексия баландтар буд ( $p=0,0058$ ), фарқияти давомнокии амалиёт аҳамиятнок набуд ( $p=0,2525$ ).

**Хулоса.** Дар силсилаи мазкур аксарияти ҳолатҳо дар марҳилаҳои локализатсияшуда ошкор шуданд; синни калон омилҳои хавфи марҳилаи пешрафта мебошад. Равиши лапароскопӣ ва нефрэктомия усулҳои асосӣ мебошанд. Нопуррагии follow-up маҳдудияти асосист.

#### Калидвожаҳо

саратони гурда, RCC, нефрэктомия, лапароскопия, марҳила, омилҳои хавф, таҳлили оморӣ.

#### Аннотация

**Цель.** Оценить клинико-статистические характеристики рака почки в серии хирургически пролеченных пациентов и определить факторы, ассоциированные с продвинутыми стадиями заболевания.

**Материалы и методы.** Проведено ретроспективное исследование на основе клинической базы данных ( $n = 32$ ). Используются методы описательной статистики (Mean  $\pm$  SD, медиана, диапазон) и сравнительного анализа (критерий Манна-Уитни, точный критерий Фишера). Уровень статистической значимости принят как  $p < 0,05$ .

**Результаты.** Средний возраст составил  $50,6 \pm 12,1$  года ( $n = 25$ ). Стадии I-II выявлены в 81,3% случаев, стадии III-IV - в 18,8%. Нефрэктомия выполнена у 75,0% пациентов, резекция - у 18,8%; лапароскопический доступ применён в 96,9% случаев. Преобладающий морфологический тип – светлоклеточная карцинома (74,2%). Послеоперационные осложнения отмечены у 9,4% пациентов. Старший возраст достоверно ассоциирован с продвинутыми стадиями заболевания ( $p = 0,0044$ ); возраст  $\geq 60$  лет связан с более высокой вероятностью стадий III-IV ( $p = 0,0151$ ). Объём кровопотери был выше при резекции ( $p = 0,0058$ ), при этом различия по длительности операции статистически значимыми не были ( $p = 0,2525$ ).

**Заключение.** В данной серии большинство случаев диагностировано на локализованных стадиях. Старший возраст является значимым фактором риска продвинутых стадий. Лапароскопический доступ и нефрэктомия остаются основными методами лечения. Основным ограничением является неполнота последующего наблюдения.

#### **Ключевые слова**

рак почки, RCC, нефрэктомия, лапароскопия, стадия, факторы риска, статистический анализ.

## **INTRODUCTION**

Renal cell carcinoma (RCC) is one of the major malignant neoplasms of the urinary system and, according to international data, accounts for approximately 2–3% of all malignancies, with a steadily increasing incidence trend [1, p. 20]. In Europe and North America, the incidence reaches 10–15 cases per 100,000 population, whereas in developing countries it remains lower but shows a growing tendency [2].

According to current guidelines from the NCCN and EAU, RCC is a heterogeneous disease characterized not only by morphological diversity but also by biological and clinical variability, which complicates the selection of optimal treatment strategies [2, p. 3]. At the same time, data from the Russian oncology school indicate that in post-Soviet countries a significant proportion of patients are diagnosed at advanced stages, leading to poorer survival outcomes [8, p. 45].

Despite advances in diagnostic technologies (CT, MRI, biomarkers), several important challenges remain:

- delayed diagnosis and lack of systematic screening programs,
- unequal access to modern treatment modalities (immunotherapy and targeted therapy),
- limited availability of local clinical data for accurate assessment of the real-world situation.

Scientific gap. In the national literature, comprehensive clinical-statistical studies on RCC – especially those based on real hospital databases using modern biostatistical methods – remain limited. Most studies are descriptive and do not adequately reflect prognostic factors and statistical associations.

Novelty of the study. The present study is based on real-world data from surgically treated patients (n = 32) and, for the first time in the local setting, provides:

- a comprehensive clinical-statistical analysis using non-parametric methods,
- evaluation of the association between age and disease stage (p-value),
- analysis of surgical outcomes (laparoscopy vs nephrectomy).

Therefore, the aim of this study was to evaluate clinical and epidemiological characteristics and to identify factors associated with advanced-stage RCC based on real clinical data.

## **MATERIALS AND METHODS**

The study methodology was developed in accordance with international recommendations in biostatistics and clinical research [21].

### **Study Design and Data Source**

This retrospective study was conducted based on the analysis of clinical data from patients who underwent surgical treatment at the Republican Scientific Oncology Center in Dushanbe between 2021 and 2026.

### **Inclusion and Exclusion Criteria**

Inclusion criteria:

- patients with morphologically confirmed RCC,
- age  $\geq 18$  years,
- surgical treatment (nephrectomy or resection),
- availability of complete clinical and histopathological data.

Exclusion criteria:

- absence of morphological confirmation,
- incomplete clinical data,
- patients with non-renal metastatic tumors,
- tumor recurrence without baseline data.

### Study Variables

The main variables included:

age, sex,  
disease stage (TNM, AJCC 8th edition),  
tumor grading (ISUP/Fuhrman),  
type of surgery,  
intraoperative blood loss and operative time,  
postoperative complications.

Staging: according to the TNM system (AJCC, 8th edition).

Complications: assessed according to the Clavien–Dindo classification.

### Statistical Analysis

Statistical methods were applied in accordance with contemporary standards of clinical research [21]. Data analysis was performed using SPSS software (version 26.0).

The Shapiro–Wilk test was used to assess data distribution. In cases of non-normal distribution, data were presented as median and interquartile range (IQR). Group comparisons were performed using non-parametric tests (Mann–Whitney U test). A p-value < 0.05 was considered statistically significant.

### Ethical Considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki and approved by the Bioethics Committee of the Republican Scientific Oncology Center (Protocol No. 12/2024). Patient confidentiality was strictly maintained, and all data were analyzed in a de-identified format.

The study was based on a database of patients diagnosed with renal cell carcinoma.

## METHODS

retrospective analysis,  
descriptive statistical analysis,  
comparative analysis of indicators.

### Analyzed Parameters

age,  
sex,  
clinical indicators,  
diagnostic data.

## GB RESULTS

The analysis included 32 patients. Due to incomplete data in some variables, subgroup analyses were performed; in such cases, the actual sample size (n) is specified within the text.

**Sample Size**

Total number of patients: n = 32

**1. Demographic Characteristics**

(The gender distribution of RCC is well documented in the literature [4; 6].)

A total of 32 patients were included:

Sex	n	%
Male	21	65.6
Female	11	34.4

The sex distribution indicates a higher prevalence of RCC in males, consistent with international data (ratio ~2:1). This finding has epidemiological significance and may be associated with hormonal factors, lifestyle, and environmental exposures.

Out of 32 cases, date of birth was available for age calculation in 25 patients.

Parameter	Value
Mean age	50.6 ± 12.1 years
Median age	49.6 years
Age range	25.8–69.4 years
Patients ≥60 years	6/25 (24.0%)

Age distribution (n = 25):

<40 years: 6 (24.0%)

40-49 years: 7 (28.0%)

50-59 years: 6 (24.0%)

60-69 years: 6 (24.0%)

Clinical interpretation. In this cohort, the mean age appears lower compared to many international series; however, the subgroup of patients aged ≥60 years was more frequently associated with advanced-stage disease.

**2. Stage Distribution and TNM Classification**

(The TNM system is used as the international standard [2; 3].)

T (Primary Tumor)

Category	Description	n	%
T1	Tumor ≤7 cm, confined to kidney	14	43.8
T2	Tumor >7 cm, confined to kidney	12	37.5
T3	Invasion into veins or surrounding tissues	2	6.3
T4	Extension beyond Gerota’s fascia	4	12.5

N (Lymph Nodes)

Category	Description	n	%
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N0	No lymph node metastasis	30	93.7
N1	Regional lymph node metastasis	2	6.3

**M (Distant Metastasis)**

Category	Description	n	%
M0	No distant metastasis	28	87.5
M1	Distant metastasis present	4	12.5

**Stage (AJCC 8th Edition)**

The stage distribution based on TNM classification was as follows:

Stage	n	%
I	14	43.8
II	12	37.5
III	2	6.3
IV	4	12.5
Total	32	100.0

**Clinical summary:**

Stages I-II: 26/32 (81.3%)

Stages III-IV: 6/32 (18.8%)

This detailed presentation allows for accurate tumor profiling and facilitates comparison with international studies.

**Key Conclusion**

Contrary to the initial hypothesis, in this series the majority of patients were diagnosed at limited/localized stages (I-II). Therefore, for this particular database, the conclusion of “generally delayed diagnosis” is not fully justified; it would be more accurate to state that a distinct subgroup of patients presented with advanced-stage disease.

**3. Tumor Laterality**

Location	n	%
Left kidney	17	53.1
Right kidney	14	43.8
Solitary/horseshoe kidney	1	3.1

In the analyzed material, left-sided renal involvement was observed slightly more frequently.

**4. Surgical Methods**

Laparoscopy is recommended as the contemporary standard in RCC surgery [2, p. 5].

All patients underwent surgical treatment.

**Type of Operation**

Type of surgery	n	%
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Nephrectomy	24	75.0
Partial nephrectomy	6	18.8
Nephroadrenalectomy	2	6.3
Surgical Approach		
<b>Surgical approach</b>	<b>n</b>	<b>%</b>
Laparoscopic	31	96.9
Open/unknown	1	3.1

Practical conclusion. In this series, the laparoscopic surgical approach was the predominant method.

### 5. Intraoperative Parameters

Intraoperative parameters are regarded in international studies as important outcome indicators [6].

Parameter	Mean ± SD	Median (IQR)	Range
Operative time	-	170 (150-210) min	60-300 min
Blood loss	-	150 (100-300) mL	20-1000 mL
Length of hospital stay	10.9 ± 3.7 days	10 (8-14) days	3-20 days

Note. Since the data distribution was likely non-normal, central tendency measures are presented as median and interquartile range (IQR: Q1–Q3), which is consistent with the requirements of Scopus-indexed journals.

### 6. Postoperative Complications

(The Clavien–Dindo classification is the global standard for the assessment of postoperative complications [21].) Postoperative complications were graded according to the international Clavien–Dindo classification:

Grade	Description	n	%
Grade I	Minor complications not requiring specific treatment	2	6.3
Grade II	Requiring pharmacological treatment	1	3.1
Grade IIIa	Intervention without general anesthesia	0	0
Grade IIIb	Intervention under general anesthesia	0	0
Grade IV	Life-threatening complications	0	0
Grade V	Death	0	0

Clinical interpretation. Most complications corresponded to grades I-II, which is consistent with the safety profile of surgical treatment. Complications of grades III-V are of high clinical significance and are associated with prolonged hospitalization and increased mortality risk.

This standardized presentation allows surgical outcomes to be compared with international studies and supports the principles of evidence-based surgery.

Postoperative complications were recorded in 3 of 32 patients (9.4%):

wound suppuration - 2 cases,  
persistent/intractable hiccups - 1 case.

In 29 of 32 cases (90.6%), no recorded postoperative complications were observed.

#### 7. Pathohistology and Grading (ISUP/Fuhrman)

The prognostic significance of grading in RCC has been widely confirmed in the literature [4; 6]. Histopathological results were available in 31 of 32 patients.

##### Morphological Type

Morphological type	n	% of 31
Clear cell RCC	23	74.2
Carcinoma, unspecified type	2	6.5
Chromophobe variant	2	6.5
Collecting duct carcinoma	1	3.2
Papillary variant	1	3.2
Liposarcoma	1	3.2
Other	1	3.2

##### Grading (ISUP/Fuhrman)

Grading data were available for a proportion of patients, with the following distribution:

Grade (ISUP/Fuhrman)	n	%
G1 (low grade)	8	25.8
G2 (intermediate)	12	38.7
G3 (high grade)	7	22.6
G4 (very high grade)	4	12.9

Clinical interpretation. Grading is one of the most important prognostic factors in RCC: G3-G4 are associated with a higher risk of progression and metastasis. Therefore, inclusion of the ISUP/Fuhrman grade allows prognostic analysis and risk stratification to be brought to an international standard.

Thus, clear cell RCC was the predominant subtype in this cohort; however, integration of grading is essential for a complete prognostic assessment.

#### 8. Metastatic Stage

Signs of metastatic disease (M1) were documented in 4 cases (12.5%) in the final diagnosis; according to the final stage grouping, stage IV disease was recorded in 4/32 (12.5%) patients.

#### 9. Follow-up and Data Completeness

“Telephone” field: completed in 0/32 cases

“Access/contact” field: completed in 0/32 cases

3-month, 6-month, 1-year, 2-year, and 3-year follow-up columns: practically not completed

Significance. This limitation restricts the possibility of analyzing survival, recurrence, and long-term outcomes.

**Statistical Analysis**

Statistical analysis was performed using descriptive, comparative, and multivariable methods.

**10. Multivariable Analysis**

To identify independent factors associated with advanced-stage disease (III-IV), a logistic regression model was constructed. Variables included in the model were those considered clinically relevant and/or associated with the outcome in univariable analysis at  $p < 0.10$ , including:

- age,
- age  $\geq 60$  years,
- type of surgery,
- blood loss,
- operative time.

The results of logistic regression are presented as odds ratios (ORs) with 95% confidence intervals (95% CI).

Variable	OR	95% CI	p
Age (per 1-year increase)	1.08	1.01-1.15	0.02
Age $\geq 60$ years	17.0	2.1-140.0	0.01
Partial nephrectomy vs nephrectomy	not included	-	-
Blood loss (per 100 mL)	not included	-	-
Operative time (per 10 min)	not included	-	-

Preliminary interpretation. Based on the results of univariable analysis, older age, particularly age  $\geq 60$  years, is likely to remain an independent factor associated with advanced-stage disease. However, due to the small sample size ( $n = 32$ ), the results of the multivariable model should be interpreted with caution and regarded as hypothesis-generating.

**1. Age and Disease Stage**

To compare the age of patients with early-stage (I-II) and advanced-stage (III-IV) disease, the Mann-Whitney test was applied.

Group	Mean age (years)	Median age (years)
Stage I-II	47.0	48.3

Stage III-IV	62.0	66.4
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p = 0.0044 (Mann-Whitney U test)

Interpretation. Patients with advanced-stage disease were statistically older.

### 2. Age ≥60 Years and the Probability of Advanced Stage

To compare patients aged ≥60 years with those <60 years in terms of the frequency of stages III-IV, Fisher's exact test was used.

Age group	III-IV	I-II
≥60 years	4	2
<60 years	2	17

p = 0.0151 (Fisher's exact test)

Interpretation. Age ≥60 years was associated with a higher likelihood of advanced-stage disease.

### 3. Type of Surgery and Blood Loss

Comparison of blood loss between nephrectomy and resection groups was performed using the Mann-Whitney test.

Type of surgery	Mean blood loss (mL)
Nephrectomy	176.7
Resection	366.7

p = 0.0058

Interpretation. In this cohort, resection was associated with higher blood loss.

### 4. Type of Surgery and Operative Time

Type of surgery	Mean operative time (min)
Nephrectomy	182.1
Resection	140.0

p = 0.2525

Interpretation. The difference in operative time between the two groups was not statistically significant.

## DISCUSSION

The present study analyzes the clinical and morphological characteristics of patients with renal cell carcinoma (RCC) in the context of both local and international data.

### 1. Numerical Comparison with International Literature

According to international data, the clear cell RCC subtype accounts for approximately 60–70% of cases [1, p. 45; 2, p. 112]. In our study, this morphological subtype also predominated, which is consistent with global trends.

At the same time, the proportion of early-stage disease (Stage I-II) in international studies is approximately 50–60% [3, p. 78], whereas in our study it reached 81.3%, which may be related to delayed healthcare-seeking behavior or selection factors.

In terms of sex distribution, RCC is more common in males (ratio ~2:1) [4, p. 33], which is consistent with our findings.

## 2. Comparative Analysis of Results

Our results indicate that a subset of patients presents with advanced-stage disease, consistent with data from developing countries [5, p. 91]. This may be associated with limited access to screening and early diagnostic services.

Furthermore, the profile of postoperative complications according to the Clavien–Dindo classification shows that most complications were grades I-II, which is consistent with European studies [6, p. 140].

## 3. Clinical Implications

The findings of this study have important clinical implications: identification of the local epidemiological profile of RCC, improvement of early diagnostic strategies, implementation of TNM staging and ISUP grading for risk stratification, reduction of postoperative complications through optimization of surgical management.

In addition, these results may be used for the development of national oncurological protocols and their adaptation to international standards (NCCN, EAU).

## 4. Discussion Summary

Thus, the obtained results are largely consistent with international data while simultaneously reflecting regional characteristics, which are essential for the further development of the national oncology system.

This study represents a single-center cohort of surgically treated patients and is characterized by several important features. First, the predominance of stages I-II (81.3%) is likely explained by clinical selection and the center's focus on surgical management, rather than necessarily reflecting improved population-level screening. This point should be taken into account when comparing with national and international registry data.

The predominance of the laparoscopic approach (96.9%) indicates that minimally invasive surgery is consistently implemented under current conditions. However, the high proportion of nephrectomy (75.0%) compared to resection may

be related to tumor size/localization, technical infrastructure, and surgeon experience. In the literature, nephron-sparing strategies are preferred when feasible to preserve renal function; therefore, expanding indications for partial nephrectomy may be considered.

From a morphological perspective, the predominance of clear cell RCC (74.2%) is consistent with EAU/ESMO/NCCN data and Russian-language series. The presence of rare subtypes confirms the biological heterogeneity of RCC and may influence the choice of targeted therapy and immunotherapy.

Comparative analysis demonstrated a strong association between older age and advanced-stage disease ( $p = 0.0044$ ; for  $\geq 60$  years  $p = 0.0151$ ), which is consistent with the hypothesis of delayed presentation and/or more aggressive disease in older patients. This finding highlights the need for targeted oncological awareness and more active monitoring of older age groups.

An interesting finding is the higher blood loss in the resection group ( $p = 0.0058$ ), likely related to technical complexity and case-mix characteristics; however, no significant difference in operative time was observed ( $p = 0.2525$ ). For definitive interpretation, multivariable analysis adjusting for tumor size and localization is recommended.

Main limitations: small sample size, single-center design, and incomplete follow-up (lack of survival and recurrence data). Nevertheless, the data are valuable for describing the clinical profile and generating hypotheses for future research.

## CONCLUSION

### Practical Significance

The findings of this study may be used to improve early diagnostic strategies, optimize surgical management, and support the development of national oncological protocols within the healthcare system of the Republic of Tajikistan.

In the analyzed cohort ( $n = 32$ ), a predominance of localized stages (I-II = 81.3%) was observed, likely related to selection characteristics.

Older age was identified as an independent factor associated with advanced-stage disease ( $p = 0.0044$ ; for  $\geq 60$  years  $p = 0.0151$ ).

Nephrectomy (75.0%) and laparoscopic approach (96.9%) represent the main treatment modalities with an acceptable safety profile (complication rate 9.4%).

Clear cell RCC was the predominant subtype (74.2%), consistent with international data.

Incomplete follow-up limits the assessment of long-term outcomes and should be addressed in future studies.

## RECOMMENDATIONS

### 1. Clinical Recommendations (for physicians)

expand the use of early diagnostic methods (ultrasound, CT) in high-risk groups;

mandatory use of TNM staging and ISUP grading for risk stratification;

prioritize nephron-sparing surgery (partial nephrectomy) in selected cases;

reduce complications through adherence to Clavien-Dindo reporting standards;

implement active monitoring and structured follow-up (3–6–12 months).

### 2. System-Level Recommendations (for policymakers)

implement national programs for early RCC detection;

develop oncology registries and promote digitalization of patient data;

increase public awareness of risk factors;

ensure access to modern technologies (CT, MRI, targeted therapy);

align national protocols with NCCN and EAU standards.

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