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Initial institutional experience with partial nephrectomy for localized renal tumors: Perioperative and early functional outcomes from a retrospective case series

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Abstract
Background: Partial nephrectomy is the preferred treatment for localized renal tumors whenever technically feasible because it preserves renal function while maintaining oncological efficacy. We report our initial institutional experience and perioperative outcomes following partial nephrectomy.
Methods: This retrospective case series included the first ten consecutive patients who underwent partial nephrectomy for localized renal tumors at a tertiary care center. Demographic, tumor, perioperative, pathological, and functional outcome data were collected and analyzed descriptively.
Results: Ten patients underwent partial nephrectomy during the study period. The mean age was 66.7 ± 9.1 years, and six patients (60%) were female. The mean tumor size was 3.8 ± 0.9 cm, with mean PADUA and RENAL nephrometry scores of 8.9 and 7.8, respectively, indicating predominantly intermediate-complexity tumors. The mean operative time was 198.7 ± 55.0 minutes, mean warm ischemia time 19.7 ± 5.1 minutes, mean estimated blood loss 370.5 ± 176.7 mL, and mean hospital stay 4.8 ± 1.9 days. Blood transfusion was required in three patients (30%). Postoperative complications included Clavien–Dindo Grade I (10%), Grade II (20%), Grade IIIa (20%), and Grade IIIb (10%). Histopathological examination revealed clear cell RCC in five patients (50%), chromophobe RCC in three (30%), and papillary RCC in two (20%), with pT1a disease in seven patients (70%) and pT1b disease in three (30%). Negative surgical margins were achieved in eight patients (80%), and trifecta was achieved in five patients (50%). At a mean follow-up of six months, the mean latest serum creatinine was 1.40 ± 0.40 mg/dL, mean estimated glomerular filtration rate was 68.5 ± 20.5 mL/min/1.73 m², and the mean decline in eGFR was 14.1%. CKD stage progression occurred in one patient (10%), whereas renal function remained stable in the remaining nine patients (90%).
Conclusions: Our initial institutional experience suggests that partial nephrectomy is feasible and can achieve acceptable perioperative, pathological, and short-term functional outcomes during the early learning phase. Despite a relatively higher complication and positive surgical margin rate compared with mature series, satisfactory renal function preservation and trifecta achievement were observed in half of the patients. Larger studies with longer follow-up are required to validate these findings and evaluate long-term oncological and functional outcomes.

Keywords: Partial nephrectomy, renal cell carcinoma, nephron-sparing surgery, warm ischemia time, renal function preservation, trifecta, renal tumor

Introduction

List of Abbreviations

AJU: African Journal of Urology
BMI: Body Mass Index
CKD: Chronic Kidney Disease
CT: Computed Tomography
eGFR: Estimated Glomerular Filtration Rate
PADUA: Preoperative Aspects and Dimensions Used for an Anatomical Classification
RENAL: Radius, Exophytic/Endophytic Properties, Nearness to Collecting System or Sinus, Anterior/Posterior, and Location Relative to Polar Lines
RCC: Renal Cell Carcinoma
WHO: World Health Organization
ISUP: International Society of Urological Pathology
SPSS: Statistical Package for the Social Sciences
WIT: Warm Ischemia Time

Background

The widespread use of cross-sectional imaging has led to increasing detection of localized renal tumors. Partial nephrectomy has emerged as the preferred treatment for T1 renal masses because it provides oncological outcomes comparable to radical nephrectomy while preserving renal function [1–5].

Although partial nephrectomy is now considered standard treatment for appropriately selected patients, the procedure remains technically demanding. Surgical complexity is influenced by tumor size, location, hilar involvement, and collecting system proximity. Potential complications include hemorrhage, urinary leakage, prolonged warm ischemia time, and positive surgical margins [6–10].

Evaluation of perioperative and functional outcomes during the early adoption of nephron-sparing surgery is important for quality assessment and identification of areas for improvement [11–13].

Methods

Aim of the Study

The aim of this study was to evaluate the perioperative, pathological, and early renal functional outcomes of patients undergoing partial nephrectomy for localized renal tumors during the initial phase of establishing a nephron-sparing surgery program at a tertiary care referral center.

Study Design and Setting
This retrospective descriptive case series was conducted at the Institute of Urology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, Tamil Nadu, India. Institutional records of patients who underwent partial nephrectomy between July 2024 and July 2025 were reviewed.

Study Participants
The first ten consecutive patients who underwent partial nephrectomy for localized renal tumors were included in the study.

Inclusion Criteria
- Patients aged ≥18 years.
- Localized renal tumors amenable to partial nephrectomy.
- Availability of complete clinical, radiological, operative, pathological, and follow-up data.

Exclusion Criteria
- Metastatic renal tumors.
- Patients undergoing radical nephrectomy.
- Incomplete medical records.
- Loss to follow-up before 6 months.

Preoperative Evaluation
All patients underwent clinical evaluation, routine hematological and biochemical investigations, and contrast-enhanced computed tomography of the abdomen and pelvis. Tumor complexity was assessed using the PADUA and RENAL nephrometry scoring systems based on preoperative imaging findings.

Data Collection
Data were collected from hospital records and operative databases. Variables included:
1. Demographic characteristics
2. Comorbidities
3. Tumor characteristics
4. PADUA and RENAL nephrometry scores
5. Operative details
6. Warm ischemia time
7. Estimated blood loss
8. Postoperative complications
9. Histopathological findings
10. Renal functional outcomes

Table 1: Baseline Demographic and Tumor Characteristics (n = 10)

Variable	Value
Number of patients	10
Mean age, years	66.7 ± 9.1
Female sex, n (%)	6 (60%)
Male sex, n (%)	4 (40%)
Mean BMI, kg/m²	28.6 ± 2.2
Mean tumor size, cm	3.8 ± 0.9
Mean PADUA score	8.9
Mean RENAL score	7.8
Clear cell RCC, n (%)	5 (50%)
Chromophobe RCC, n (%)	3 (30%)
Papillary RCC, n (%)	2 (20%)

Surgical Procedure
Partial nephrectomy was performed by experienced urologists using standard nephron-sparing surgical principles. Following renal hilar dissection and vascular control, Tumor excision was performed under warm ischemia through an open approach with preservation of uninvolved renal parenchyma. Renorrhaphy was subsequently performed to achieve hemostasis and reconstruction of the renal defect.
The following perioperative variables were recorded:
- Operative time
- Warm ischemia time
- Estimated blood loss
- Blood transfusion requirement
- Length of hospital stay
- Postoperative complications

Postoperative complications were graded according to the Clavien–Dindo classification system.
Histopathological Evaluation
Resected specimens were evaluated by dedicated genitourinary pathologists. Histological subtype, WHO/ISUP grade, pathological stage, and surgical margin status were recorded.

Follow-up and Functional Outcomes
Patients were followed for a minimum of six months following surgery. Follow-up evaluation included serum creatinine measurement and estimation of glomerular filtration rate (eGFR). Estimated glomerular filtration rate was calculated using CKD-EPI equation.
The following functional outcomes were assessed:
- Latest serum creatinine
- Latest eGFR
- Percentage decline in eGFR
- Progression of chronic kidney disease stage

Outcome Measures
The primary outcomes were:
- Operative time
- Warm ischemia time
- Estimated blood loss
- Postoperative complications
- Hospital stay

Secondary outcomes included
- Histopathological findings
- Surgical margin status
- Renal functional outcomes
- Trifecta achievement

Trifecta was defined as
1. Negative surgical margins
2. Absence of major postoperative complications (Clavien–Dindo Grade III or higher)
3. Warm ischemia time less than 25 minutes

Statistical Analysis
Statistical analysis was performed using IBM SPSS Statistics software (IBM Corp., Armonk, NY, USA).
Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were presented as frequencies and percentages.

Given the descriptive nature of this study and the small sample size (n = 10), no comparative statistical testing was performed.

Results

Patient and Tumor Characteristics

Ten patients underwent partial nephrectomy. The mean age was 66.7 years. Females constituted 60% of the cohort.

Mean tumor size was 3.8 cm. The mean PADUA nephrometry score was 8.9, while the mean RENAL nephrometry score was 7.8, indicating predominantly intermediate-complexity renal masses.

Perioperative Outcomes

The mean operative time was 199 ± 55 minutes. Mean warm ischemia time was 19.7 ± 5.1 minutes. Mean estimated blood loss was 371 ± 177 mL. Mean duration of hospital stay was 5 ± 2 days.

Three patients required blood transfusion (30%). Postoperative complications occurred in six patients, including Grade I (10%), Grade II (20%), Grade IIIa (20%), and Grade IIIb (10%) complications.

Table 2: Perioperative Outcomes

Variable	Value
Mean operative time, min	199 ± 55
Mean warm ischemia time, min	19.7 ± 5.1
Mean estimated blood loss, mL	371 ± 177
Mean hospital stay, days	5 ± 2
Blood transfusion, n (%)	3 (30%)
Grade I complication, n (%)	1 (10%)
Grade II complication, n (%)	2 (20%)
Grade IIIa complication, n (%)	2 (20%)
Grade IIIb complication, n (%)	1 (10%)
Positive surgical margin, n (%)	2 (20%)
Trifecta achievement, n (%)	5 (50%)

Pathological Outcomes

Histopathological examination demonstrated clear cell RCC in five patients (50%), chromophobe RCC in three patients (30%), and papillary RCC in two patients (20%).

Five tumors were WHO/ISUP grade 3, three grade 2, one grade 1, and one grade 4. Pathological staging revealed pT1a disease in seven patients (70%) and pT1b disease in three patients (30%). Negative surgical margins were achieved in eight patients (80%), while two patients had positive surgical margins

Table 3: Patient-wise Histopathological Findings

Patient	Histology	WHO/ISUP Grade	Pathological Stage	Surgical Margin
1	Clear Cell RCC	3	pT1a	Negative
2	Clear Cell RCC	2	pT1a	Negative
3	Chromophobe RCC	3	pT1b	Negative
4	Papillary RCC	2	pT1a	Negative
5	Papillary RCC	1	pT1a	Negative
6	Chromophobe RCC	3	pT1b	Positive
7	Chromophobe RCC	3	pT1a	Negative
8	Clear Cell RCC	4	pT1b	Positive
9	Clear Cell RCC	2	pT1a	Negative
10	Clear Cell RCC	3	pT1a	Negative

Functional and Oncological Outcomes

No patient required conversion to radical nephrectomy. Trifecta achievement was observed in five patients (50%).

Short-term follow-up demonstrated preservation of renal function in the majority of patients.

At a mean follow-up of 6.0 months, the mean latest serum creatinine was 1.40 mg/dL and the mean eGFR was 68.5 mL/min/1.73m². The mean percentage decline in eGFR was 14.1%. CKD progression was observed in one patient (10%), whereas nine patients (90%) demonstrated stable renal function without progression of CKD stage.

These findings suggest satisfactory preservation of renal function following partial nephrectomy despite the moderate complexity of tumors included in the study.

Table 4: Six-Month Functional Outcomes

Variable	Value
Mean follow-up duration	6 months
Mean latest serum creatinine, mg/dL	1.40 ± 0.40
Mean latest eGFR, mL/min/1.73m²	68.5 ± 20.5
Mean eGFR decline, %	14.1
CKD progression, n (%)	1 (10%)
No CKD progression, n (%)	9 (90%)

Discussion

Partial nephrectomy has become the preferred treatment for localized renal tumors owing to its nephron-sparing advantages and equivalent oncological efficacy compared with radical nephrectomy [1–5].

The present series represents the initial institutional experience with nephron-sparing surgery. The mean tumor size of 3.8 cm and mean nephrometry scores suggest that many tumors were of moderate surgical complexity. Despite this complexity, acceptable warm ischemia times were achieved, with a mean duration of 19.7 minutes. Previous studies have reported warm ischemia times ranging from approximately 18 to 25 minutes in contemporary partial nephrectomy series [8, 12, 13].

The blood transfusion rate and complication profile likely reflect the learning curve associated with establishing a partial nephrectomy program. Surgical experience, refinement of hilar control techniques, and increasing familiarity with renorrhaphy may contribute to improved outcomes over time [8, 12].

The mean estimated blood loss of 370.5 mL and mean hospital stay of 4.8 days were comparable to those reported in published open partial nephrectomy series. However, the blood transfusion rate of 30% was relatively higher than that reported in contemporary high-volume centers. This finding most likely reflects the initial learning curve associated with the establishment of a nephron-sparing surgery program, where increasing familiarity with hilar dissection, tumor excision, renorrhaphy, and intraoperative hemostatic techniques is expected to improve perioperative outcomes over time [8, 12].

The achievement of negative surgical margins in 80% of patients is encouraging considering that these cases represent the institution's early experience with partial nephrectomy. Although previous studies have reported positive surgical margin rates generally below 10%, the 20% positive surgical margin rate observed in our series is higher than that reported in established centers and likely reflects the early institutional learning curve, compounded by the small sample size. Importantly, positive surgical

margins do not invariably translate into local recurrence or inferior cancer-specific survival, particularly in patients with organ-confined disease; however, they warrant careful postoperative surveillance [11].

Trifecta achievement was observed in 50% of patients. Contemporary series have reported trifecta rates ranging from approximately 50% to 80%, depending on tumor complexity and surgical experience [12, 13].

At six months, the mean decline in estimated glomerular filtration rate was 14.1%, while CKD stage progression occurred in only one patient. These findings demonstrate satisfactory short-term preservation of renal function following nephron-sparing surgery and are consistent with previous reports showing superior functional outcomes after partial nephrectomy compared with radical nephrectomy [5, 9, 15]. Preservation of functioning renal parenchyma remains one of the principal advantages of partial nephrectomy, particularly in elderly patients and those with pre-existing renal impairment or significant medical comorbidities [5, 9, 10, 14, 15].

Overall, the present study demonstrates that the introduction of partial nephrectomy at our institution was technically feasible and resulted in acceptable perioperative and early functional outcomes despite the anticipated challenges associated with the learning curve. Continuous refinement of surgical technique, careful patient selection, and increasing operative experience are expected to improve warm ischemia times, reduce perioperative complications, lower positive surgical margin rates, and enhance trifecta achievement in future patients.

Limitations

The present study has several limitations. First, this was a retrospective single-center case series with a small sample size, limiting the statistical power and generalizability of the findings. Second, the study reflects the institution's initial experience with partial nephrectomy, and the observed perioperative outcomes were likely influenced by the surgical learning curve. Third, the absence of a comparator group, such as patients undergoing radical nephrectomy or a contemporaneous cohort from a mature partial nephrectomy program, precluded comparative outcome analysis. Finally, the relatively short follow-up duration of six months limits assessment of long-term oncological control, renal functional preservation, and recurrence-free survival. Nevertheless, this study provides valuable baseline data regarding the early implementation of a nephron-sparing surgery program in a tertiary referral center and may serve as a benchmark for future institutional audits.

Conclusions

Our initial institutional experience suggests that partial nephrectomy is feasible and can achieve acceptable perioperative and short-term functional outcomes during the early learning phase. However, these findings should be interpreted cautiously owing to the limited sample size. Acceptable perioperative outcomes, preservation of renal function, and satisfactory short-term oncological results were achieved. Larger studies with longer follow-up are required to evaluate long-term functional and oncological outcomes and to assess the impact of increasing surgical experience.

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