

CONVERSION RATE OF LAPAROSCOPIC NEPHRECTOMY TO OPEN NEPHRECTOMY

Original Research

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ABSTRACT

Background: Laparoscopic nephrectomy has gained widespread acceptance in urological surgery over the past two decades, offering notable advantages such as improved visualization, reduced hospital stays, and superior cosmetic outcomes compared to open surgery. Despite these benefits, the approach presents a steep learning curve and a risk of intraoperative complications that may necessitate conversion to open surgery. Limited data exist on unplanned conversions during laparoscopic nephrectomy in developing countries, particularly in South Asian settings.

Objective: To determine the frequency of conversion from laparoscopic nephrectomy to open nephrectomy and identify the intraoperative factors contributing to conversion in a tertiary care center.

Methods: This descriptive study was conducted in the Department of Urology, Institute of Kidney Diseases, Peshawar, from June 2024 to December 2024. A total of 76 patients scheduled for laparoscopic nephrectomy for benign or malignant indications were included using a non-probability convenience sampling technique. Preoperative evaluation included clinical assessment, laboratory tests, and imaging. Conversion to open surgery was performed when complications such as uncontrolled bleeding, visceral injury, or poor progression arose. Data were analyzed using SPSS version 25. Categorical variables were expressed as frequencies and percentages, and continuous variables as mean \pm standard deviation. Statistical significance was set at $p \leq 0.05$.

Results: Of the 76 patients, 55.3% were female and 44.7% were male, with a mean age of 48.2 ± 12.6 years. The overall conversion rate was 6.6% ($n=5$), with a significantly higher rate in radical nephrectomies (17.4%) compared to simple nephrectomies (1.9%) ($p=0.02$). Reasons for conversion included uncontrolled bleeding in 5.3% ($n=4$) and poor progression in 1.3% ($n=1$). Converted cases had a longer operative time (155 ± 7.9 min) and hospital stay (4.0 ± 1.0 days) compared to uneventful laparoscopic cases (98.9 ± 18.7 min, 1.5 ± 0.7 days).

Conclusion: The frequency of conversion to open nephrectomy was within acceptable limits and primarily associated with complex oncological cases. Understanding conversion causes can enhance surgical preparedness and patient safety in laparoscopic nephrectomy.

Keywords: Conversion to open surgery, Hospital stay, Laparoscopic nephrectomy, Operative time, Radical nephrectomy, Surgical complications, Uncontrolled bleeding.

INTRODUCTION

Laparoscopic surgery has significantly transformed the field of urology over the past two decades, with laparoscopic renal procedures first introduced in the early 1990s (1). Since then, the technique has evolved considerably, prompting ongoing comparisons between laparoscopic and open surgical approaches in terms of safety, efficacy, and outcomes. As the field continues to grow, many aspects of the laparoscopic approach remain dynamic and heavily influenced by a steep learning curve, especially in complex urological procedures such as nephrectomy (2). Nephrectomy, whether simple or radical, is a commonly performed intervention. A simple nephrectomy is often indicated for non-functioning kidneys resulting from chronic infection, obstruction, nephrolithiasis, or severe trauma (3), whereas radical nephrectomy is reserved for malignant renal tumors not amenable to nephron-sparing surgery, provided the patient has adequate renal function and a healthy contralateral kidney (4). Traditionally, open radical nephrectomy has been the standard of care for localized renal malignancies, with surgical approach—retroperitoneal or transperitoneal—selected based on surgeon expertise and patient factors (5). However, the rise of minimally invasive techniques, including laparoscopic and robotic-assisted surgeries, has redefined surgical standards by offering advantages such as improved visualization through magnified imaging, reduced postoperative pain, shorter hospitalizations, faster recovery, and superior cosmetic outcomes. Initial concerns about prolonged operative times and elevated costs have diminished over time, especially as surgical proficiency and institutional experience have grown. Subsequently, multiple institutional reports have confirmed that laparoscopic nephrectomy is a safe and feasible option that does not compromise oncologic outcomes when performed by experienced surgeons (6,7).

Despite these advancements, the inherent risk of unplanned conversion from laparoscopic to open surgery persists. Conversions may be necessitated by intraoperative complications such as vascular injuries, inadvertent visceral damage, or lack of procedural progression. Although the overall incidence of conversion is relatively low—reported at around 3.9% to 9% in various studies (8). Its occurrence is associated with increased operative times, greater postoperative pain, longer hospital stays, and higher healthcare costs. Moreover, data suggest that patients undergoing converted procedures experience worse short-term outcomes, including elevated 30-day mortality rates, compared to those who undergo completed laparoscopic surgeries (9). Importantly, conversion is not considered a surgical complication per se but rather a necessary intraoperative decision to ensure patient safety. Understanding when and why conversion becomes necessary is essential, particularly in the context of evolving surgical techniques and growing expertise (10). Despite the growing body of literature on laparoscopic nephrectomy, there remains a paucity of studies specifically analyzing the trends, causes, and risk factors associated with unplanned conversions in urologic laparoscopic procedures (11). This knowledge gap highlights the need for a focused investigation into the frequency and underlying reasons for conversion to open surgery in laparoscopic urologic cases. Therefore, the objective of this study is to evaluate the rate of conversion from laparoscopic to open surgery in nephrectomy cases and to identify the associated intraoperative factors contributing to conversion within our institutional setting.

METHODS

This descriptive study was conducted in the Department of Urology at the Institute of Kidney Diseases, Peshawar, over a period of twelve months, from June 2024 to December 2024. A total of 76 patients undergoing laparoscopic nephrectomy were enrolled using a non-probability convenience sampling technique. Ethical approval was obtained from the Institutional Review Board in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was secured from all participants after a comprehensive explanation of the procedure, risks, and potential benefits. Patients above 18 years of age with clinical or radiological indications for nephrectomy—whether for benign or malignant etiologies—were included. Exclusion criteria comprised patients with chronic obstructive pulmonary disease, congestive heart failure, any absolute contraindications to laparoscopy, malignant tumors invading the inferior vena cava, evidence of distant metastases, or those who declined laparoscopic intervention (2,12). All patients underwent a standardized preoperative evaluation, including detailed history, physical examination, and laboratory investigations such as complete blood count, liver and renal function tests, electrolytes, serum calcium, alkaline phosphatase, and coagulation profiles. When feasible, contrast-enhanced cross-sectional imaging of the abdomen was performed to assess anatomical landmarks and tumor extent. Functional renal imaging, including nuclear scans, was carried out to evaluate split renal function and guide surgical planning.

Laparoscopic nephrectomy was performed under general anesthesia by a consistent surgical team led by experienced urologic laparoscopic surgeons to minimize operator-dependent variability. Patients were placed in the lateral decubitus position at a 45° angle with mild lumbar hyperextension. Prophylactic antibiotics were administered preoperatively. Pneumoperitoneum was established using a Veress needle, and port placement followed the triangulation principle, typically comprising two working ports and one optical port. A fourth port was introduced when needed for retraction or assistance. The colon was mobilized medially via dissection along the white line of Toldt to expose the retroperitoneal space. The gonadal vessels and ureter were identified and followed cranially to the renal hilum. Renal artery and vein were dissected, ligated, and divided. The kidney was then fully mobilized and extracted through an extended optical port incision. The port sites were closed using single non-absorbable sutures, while the retrieval incision was sutured with interrupted non-absorbable stitches (10). Conversion to open surgery was undertaken when intraoperative conditions posed a risk to patient safety or when laparoscopic progress was no longer feasible. The indications included uncontrolled hemorrhage that obscured the operative field and could not be managed laparoscopically (12), visceral organ injury involving the bowel, liver, spleen, or other adjacent structures (13), and failure to achieve critical anatomical milestones such as dissection and control of the renal hilum after reasonable effort and time. In this study, poor progression was defined not solely by operative time exceeding 2.5 hours, but also by failure to safely proceed due to technical difficulty, dense adhesions, or loss of anatomical planes. These criteria provided a more clinically grounded rationale for conversion. In such instances, the laparoscopic procedure was terminated, and an open nephrectomy was performed through a standard incision with appropriate management of any complications.

Operative time was calculated from the induction of anesthesia to the end of anesthesia recovery. The duration of hospital stay was recorded from the day of surgery to the day of discharge. All procedures were performed by the same surgical team to reduce variability in surgical decision-making and technical execution. Data were analyzed using IBM SPSS Statistics version 25. Continuous variables such as age, operative time, and hospital stay were expressed as mean \pm standard deviation (SD). Categorical variables, including sex, laterality, type of nephrectomy, and conversion to open surgery, were presented as frequencies and percentages. The rate of conversion was stratified based on the type of nephrectomy performed, and the Chi-square test was applied to assess statistical significance, with a p-value of ≤ 0.05 considered statistically significant. Results were illustrated using appropriate tables and graphs to ensure clarity and comprehensiveness.

RESULTS

Of the 76 patients included in the study, 55.3% (n=42) were female and 44.7% (n=34) were male. The mean age was 48.2 ± 12.6 years, with a range from 22 to 75 years. The majority of patients (53.9%, n=41) underwent left-sided nephrectomy, while the remaining 46.1% (n=35) underwent nephrectomy on the right side. With respect to the type of surgery, 69.7% (n=53) of the cases were simple nephrectomies, whereas 30.3% (n=23) underwent radical nephrectomy. All patients were initially scheduled for laparoscopic nephrectomy. However, the overall unplanned conversion rate to open surgery was 6.6% (n=5). Conversion was more frequently observed in patients undergoing laparoscopic radical nephrectomy, with a conversion rate of 17.4% (n=4), compared to only 1.9% (n=1) among those undergoing simple nephrectomy. This difference was statistically significant ($p = 0.02$). The causes for conversion included uncontrolled bleeding in 5.3% (n=4) of patients and poor procedural progression in 1.3% (n=1). No conversions due to visceral organ injury were reported during the study period.

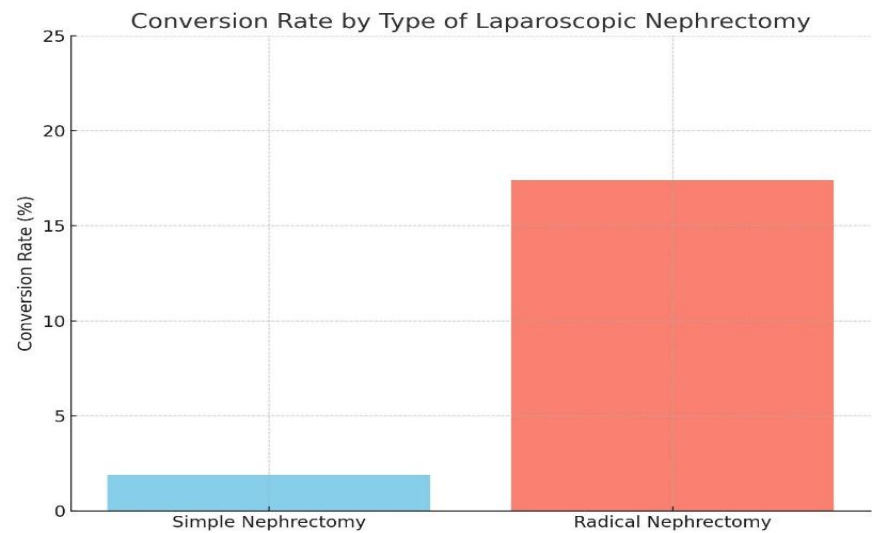
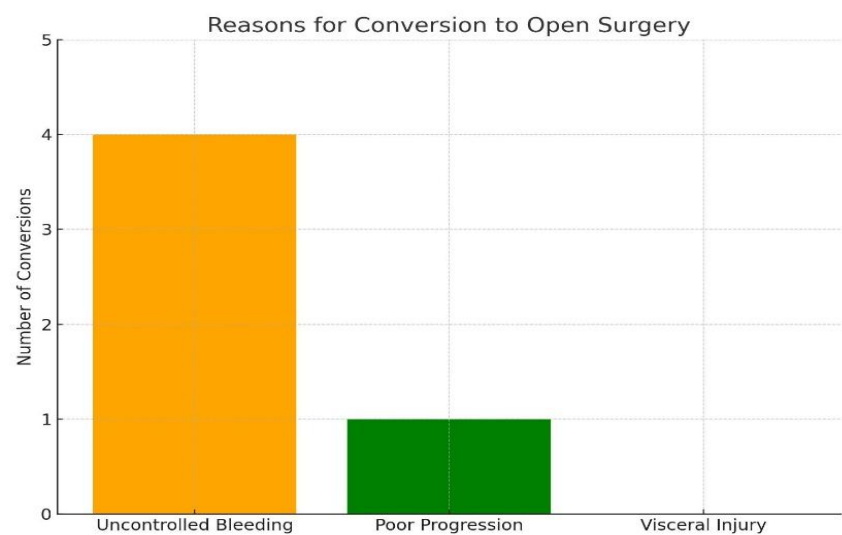
The mean operative time for all surgeries was 102.6 ± 22.9 minutes, with a range from 60 to 165 minutes. The mean operative time for cases that required conversion to open surgery was notably higher at 155 ± 7.9 minutes, while uneventful laparoscopic procedures had a shorter mean duration of 98.9 ± 18.7 minutes. Regarding hospital stay, the overall mean was 1.7 ± 0.9 days, ranging from 1 to 5 days. Patients who underwent unplanned conversion had a significantly prolonged hospital stay with a mean of 4.0 ± 1.0 days, in contrast to a mean stay of 1.5 ± 0.7 days among those with successful laparoscopic procedures. Analysis of the data further revealed notable associations between demographic and surgical factors with the likelihood of conversion from laparoscopic to open nephrectomy. All conversions (n=5) occurred in male patients, corresponding to a conversion rate of 14.7% among males, while no conversions were observed among female participants. Additionally, all conversions were reported in patients who underwent right-sided nephrectomy, indicating a 14.3% conversion rate for right-sided procedures, with zero conversions on the left side. The mean age among patients who experienced conversion was 47.4 years, closely aligning with the overall cohort mean age. These findings suggest a potential influence of sex and laterality on the likelihood of conversion, highlighting areas that may warrant further investigation in larger cohorts.

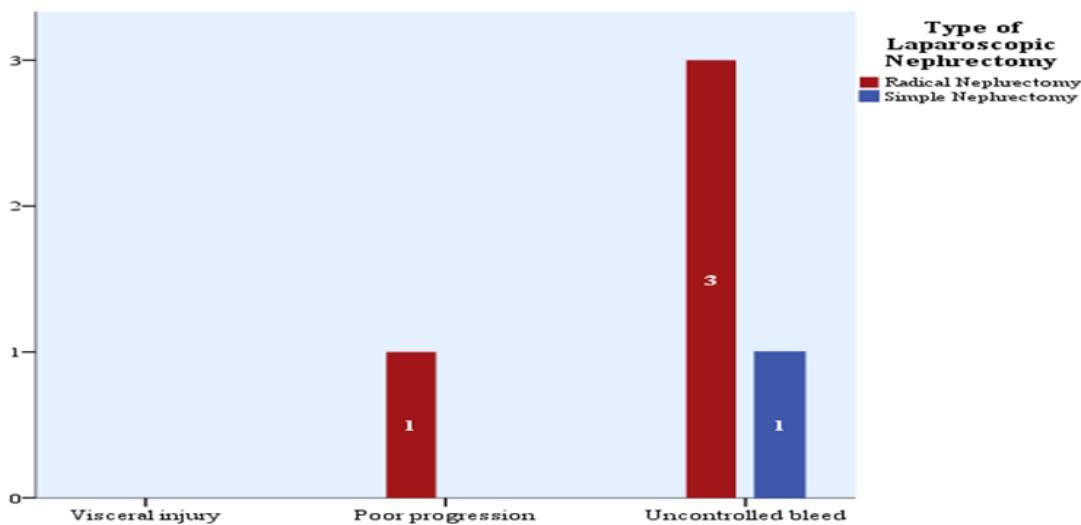
Table 1: Laparoscopic Surgeries and Conversion

Laparoscopic Surgery	Total Cases (%)	Open Conversion (%)	p-value
Simple Nephrectomy	53 (69.7)	1 (1.9)	0.02
Radical Nephrectomy	23 (30.3)	4 (17.4)	
Total	76	5 (6.6)	

Table 2: Conversion Rate Stratified by Sex and Laterality

Sex	Side	Total Cases	Converted Cases	Conversion Rate (%)
Female	Left	41	0	0
Female	Right	1	0	0
Male	Right	34	5	14.7





DISCUSSION

The findings of this study contribute valuable insights into the practical challenges and clinical outcomes associated with laparoscopic nephrectomy, particularly in resource-limited settings where minimally invasive surgical services are still developing. The observed conversion rate of 6.6% aligns with previously published literature, where conversion rates typically range between 1% and 14% (14,15). This reinforces the global consistency in the safety and technical feasibility of laparoscopic nephrectomy, even when performed in lower-middle-income regions. However, variations in conversion rates across different studies appear to be influenced by patient selection, tumor complexity, and surgeon experience. For example, a study conducted in Pakistan reported a conversion rate of 10%, which is comparatively higher than the present study (14), while other large-scale studies from high-volume centers documented rates as low as 3.9% to 6.8% (16). In the current series, the primary reasons necessitating conversion included uncontrolled bleeding and poor intraoperative progression, with no instances of visceral organ injury (17). Most cases of conversion occurred in radical nephrectomies performed for tumors larger than 7 cm, consistent with literature indicating higher conversion risks in complex oncological cases (18). Uncontrolled bleeding was frequently attributed to vascular anomalies or dense adhesions from neoplastic processes, which limited safe laparoscopic dissection. Notably, all conversions were observed on the right side and in male patients, suggesting anatomical or technical challenges specific to these subgroups. The singular case of simple nephrectomy conversion was due to bleeding from a lumbar vein, which underscores that even procedures considered less complex can present unpredictable intraoperative risks.

Compared to databases from developed centers where radical nephrectomy conversion rates remain around 5.5% (21), the 17.4% rate observed in this study is relatively high. This disparity likely reflects the learning curve still being navigated by surgeons working in evolving surgical environments (19). Surgeons in these contexts may adopt a more cautious threshold for conversion to prioritize patient safety, particularly when facing advanced tumors or difficult anatomy. Importantly, the mean operative time and hospital stay were significantly higher in converted cases, underscoring the clinical and logistical implications of unplanned conversion (20). The need for prolonged postoperative monitoring and increased resource utilization also places an added burden on healthcare infrastructure, particularly in high-dependency units (21). The strengths of this study include a clearly defined population, standardized surgical approach, and consistent surgical team, which reduce operator-dependent variability. Furthermore, the study provides locally relevant data, aiding in benchmarking and service development in similar healthcare settings. However, several limitations merit consideration. The sample size was relatively small, limiting the statistical power to explore additional risk factors for conversion. Detailed intraoperative metrics such as blood loss, duration of dissection, and specific anatomical challenges were not quantified. Moreover, the absence of postoperative complication rates and long-term follow-up restricts the ability to evaluate overall surgical outcomes and patient satisfaction.

Future studies should consider multicenter designs with larger cohorts to validate findings and identify predictors of conversion with greater precision. Incorporating surgical grading systems for complexity, such as RENAL nephrometry scores, and assessing surgeon experience levels may further clarify conversion risks. Inclusion of postoperative morbidity, recovery indices, and cost analysis would

provide a more comprehensive evaluation of the impact of conversion. As laparoscopic and robotic-assisted surgeries continue to evolve, continuous audit and skill enhancement are essential to reducing conversion rates and improving patient outcomes.

CONCLUSION

This study highlighted that while laparoscopic nephrectomy is a feasible and effective approach, unplanned conversion to open surgery remains a relevant concern, particularly in complex cases. Converted procedures were associated with increased operative time and extended hospital stay, emphasizing the need for careful patient selection, thorough preoperative planning, and surgical preparedness. The findings reinforce the importance of recognizing intraoperative challenges early and adopting a structured surgical strategy to minimize conversion risks. By understanding the underlying reasons for conversion, surgeons can better anticipate potential complications, optimize decision-making, and improve overall surgical outcomes in evolving urological practice settings.

Author Contributions

Author	Contribution
Muzzamil Sohail	Substantial Contribution to study design, analysis, acquisition of Data
	Manuscript Writing
	Has given Final Approval of the version to be published
Ahmad Nawaz*	Substantial Contribution to study design, acquisition and interpretation of Data
	Critical Review and Manuscript Writing
	Has given Final Approval of the version to be published
Javed Miandad	Substantial Contribution to acquisition and interpretation of Data
	Has given Final Approval of the version to be published
Sulaiman Shah	Contributed to Data Collection and Analysis
	Has given Final Approval of the version to be published
Muhammad Idrees Khan	Contributed to Data Collection and Analysis
	Has given Final Approval of the version to be published
Junaid Shah	Substantial Contribution to study design and Data Analysis
	Has given Final Approval of the version to be published

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