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Original Research Article

Surgical Outcomes of Laparoscopic Radical Nephrectomy

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Abstract: *Laparoscopic radical nephrectomy is an established minimally invasive surgical approach for localized renal cell carcinoma. Evaluation of perioperative outcomes is essential to determine its safety and feasibility in routine clinical practice.* ***Objective:*** *To determine the surgical outcomes of laparoscopic radical nephrectomy among renal tumor patients.* ***Methods:*** *This descriptive case series included 63 patients diagnosed with renal cell carcinoma with renal tumor size <12 cm who were planned for laparoscopic radical nephrectomy in Sindh Institute of Urology and Transplantation from 11-Dec-2018 to 11-June-2019. Patients aged 20–70 years were included after routine preoperative history, clinical examination, and baseline assessment. The study was conducted at the study hospital during the defined study period. Data were collected regarding age, gender, body mass index, tumor side, and tumor stage. Perioperative outcomes, including operative time and estimated intraoperative blood loss, were recorded during surgery, while postoperative hospital stay was documented after surgery. Data were analyzed using SPSS version 25. Continuous variables were presented as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Independent-samples t-test was applied where appropriate, and a p-value <0.05 was considered statistically significant..* ***Results:*** *Mean age of patients was 50.94+11.99 years. There were 42 (66.7%) male patients and only 21 (33.3%) female patients. There were 29 (46%) patients who were having stage T1 RCC and only 34 (54%) patients were having T2 RCC. Mean operative time of patients was 171.59+33.91 minutes. Mean intra-operative blood loss was 139.29+48.15 mL. Mean hospital stay of patients was 2.94+0.53 days.* ***Conclusion:*** *The present study demonstrated that surgical outcomes of laparoscopic radical nephrectomy are very acceptable among patients with renal cell carcinoma (RCC), with mean operative time 171.59+33.91 minutes, mean blood loss 139.29+48.15 mL was and mean hospital stay 2.94+0.53 days.*

Keywords: Renal Cell Carcinoma, laparoscopic radical nephrectomy, Operative time, Blood loss, hospital stay

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Introduction

Renal tumours establish a varied group of neoplasms influencing the kidney among which renal cell carcinoma (RCC) signifies the most commonly occurring malignancy among the adults. Historically denoted as hypernephroma or Grawitz tumour, RCC emerges from epithelial lining of renal tubules. More than ten histological variations have been recognized and are classified as per Heidelberg classification system. Each subtype establishes distinct biological behaviour and characteristic immunohistochemical as well as cytogenetic features. Amongst such clear cell renal cell carcinoma (ccRCC) is the major subtype and is accountable for the majority of kidney cancer-associated mortality across the globe (1-3).

The identification and staging of renal tumours are mainly attained by means of contrast enhanced CT scanning of the chest and pelvis which remains widely utilised diagnostic imaging modality in evaluating the disease extent and metastatic spread (4,5). The standard surgical management for renal tumours till early 1990s was open radical nephrectomy. Though, the introduction of laparoscopic radical nephrectomy first described within 1991, provided a minimally invasive alternative that progressively gained the widespread acceptance. Numerous studies have shown that laparoscopic radical nephrectomy offers oncological outcomes in comparison to with open radical nephrectomy. In addition to the equivalent cancer control, laparoscopic surgery delivers numerous clinical benefits such as reduced postoperative pain, minimum intra-operative blood loss, shorter length of hospitalisation, earlier return to daily activities and improved cosmetic results. Therefore, laparoscopic radical nephrectomy has progressively been observed by many clinicians as preferred surgical technique for patients with stage T1 and T2 renal cell carcinoma (6-10).Apart from the long term oncological outcomes, early postoperative parameters are also considered significant indicators of quality of surgical care delivered to cases undergoing nephrectomy (10,11).

Such differences highlight considerable variation that exists in reported literature concerning the perioperative outcomes of laparoscopic radical nephrectomy. Such discrepancies may emerge from the differences within the surgical expertise, patient characteristics, institutional protocols, and perioperative care practices. Laparoscopic radical nephrectomy is routinely performed at the Sindh Institute of Urology and Transplantation (SIUT). Locally generated evidence regarding surgical outcomes following this procedure remains limited. Therefore, the present study has been designed to evaluate the operative outcomes of laparoscopic radical nephrectomy in the Pakistani population and to contribute regional data that may assist in improving clinical practice and patient management. The findings of this study will aid to generate out local data and will help to compare our results with internationally published literature. In this way we will be able to identify either our surgical outcomes are comparable with the modern world or not. If worst outcomes are found then this study will help to divert our attention towards improving the surgical outcomes in our patients and in this way will help to reduce morbidity in our patients.

Methodology

This study was conducted as a descriptive case series in Sindh Institute of Urology and Transplantation from 11-Dec-2018 to 11-June-2019., after taking ethical approval from the hospital. The sample size of the current study was 63, which was calculated using a web-based sample size

calculator, by taking estimated intra-operative blood lose 125.8 ± 19.6 ml11 and margin of error 5%. For patient's selection, non-probability consecutive sampling technique was used.

Eligible patients were aged 20 to 70 years, having either gender, with renal tumor <12 cm maximum diameter, who underwent laparoscopic radical nephrectomy. Patients with renal tumors with vascular invasion or extrarenal spread were excluded.

A written informed consent was taken from all patients before including them in the study.

LRN was done by consultant urologist having a minimum 3 years of laparoscopic surgery experience. The reseacher served as assistant in all procedures. Routine history and examination were conducted for all patients before surgery. Standard surgical techniques was used to perform the procedure. During the procedure, peri-operative parameters such as blood loss and operative time was recorded. Post-surgery, hospital stay was also noted. It was measured from the time of first skin incision to the time of shifting the patient in the recovery unit. The mean operative time was measured in minutes. The lost of blood during surgery was collected in atrium bottle using a vacuum operated suction tube and at the end of surgery and before shifting the patient in recovery unit the volume of blood in the atrium bottle was noted to measure intra-operative blood loss. It was measured in ml. Hospital stay was measured from the day of surgery to the day of discharge of the patient from the hospital. Hospital stay was noted in days. Data regarding patients age, gender, BMI, side of RCC, and stage of RCC were also collected.

Statistical analysis was performed using the SPSS software version 25. Mean and standard deviation were calculated for continuous variables such as age, height, weight, BMI, operative time, blood loss and hospital stay. Frequency and percentages was calculated for gender, side of RCC and stage of RCC. Confounding variables such as age, gender, BMI, side of RCC and stage of RCC were controlled by stratification. Post-stratification independent sample t-test was applied. P-value <0.05 was taken as significant.

Results

Mean age of the 63 patients included in this study was 50.94+11.99 years. Mean Body mass index (BMI) of patients was 24.28+4.28 kg/m2. In the present study, there were more male patients as compared to female patients. There were 42 (66.7%) male patients and only 21 (33.3%) female patients (Figure 1).

There were 22 (34.9%) patients who were presented with right sided RCC and remaining 41 (65.1%) were having left sided RCC. There were 29 (46%) patients who were having stage T2 RCC and only 34 (54%) patients were having T1 RCC
(Table 1).

Regarding the surgical outcomes, mean operative time of patients was 171.59+33.91 minutes. Mean intra-operative blood loss was 139.29+48.15 mL. Mean hospital stay of patients was 2.94+0.53 days (Table 2).

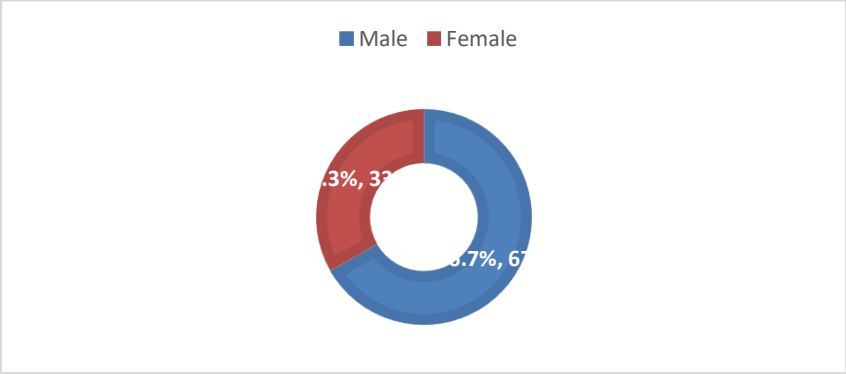

Figure 1: Gender distribution

Table 1: Clinical presentation of the patients regarding renal cell carcinoma

Clinical presentation		n	%
Side of RCC	Left	22	34.9%
	Right	41	65.1%
Stage of RCC	T1	29	46.0%
	T2	34	54.0%

Table 2: Surgical outcomes

Surgical outcomes	N	Mean	Std. Deviation
Operation time (mins)	63	171.59	33.910
Blood loss (ml)	63	139.29	48.158
Hospital stay (Days)	63	2.94	.535

Table 3: Stratification of surgical outcomes with age

Surgical outcomes	Age groups (Years)	N	Mean	Std. Deviation	P value
Operation time (mins)	20 to 50	29	174.66	36.079	0.51
	> 50	34	168.97	32.258	
Blood loss (ml)	20 to 50	29	135.69	44.915	0.58
	> 50	34	142.35	51.231	
Hospital stay (Days)	20 to 50	29	2.97	.626	0.69
	> 50	34	2.91	.452	

Table 4: Stratification of surgical outcomes with gender

Surgical outcomes	Gender	N	Mean	Std. Deviation	P value
Operation time (mins)	Male	42	176.19	32.192	0.12
	Female	21	162.38	36.146	
Blood loss (ml)	Male	42	140.83	44.171	0.72
	Female	21	136.19	56.345	
Hospital stay (Days)	Male	42	2.98	.468	0.40
	Female	21	2.86	.655	

Table 5: Stratification of surgical outcomes with side of RCC

Surgical outcomes	Side of RCC	N	Mean	Std. Deviation	P value
Operation time (mins)	Left	22	178.18	36.792	0.26
	Right	41	168.05	32.169	
Blood loss (ml)	Left	22	156.82	59.872	0.03
	Right	41	129.88	38.120	
Hospital stay (Days)	Left	22	3.05	.653	0.23
	Right	41	2.88	.458	

Table 6: Stratification of surgical outcomes with stage of RCC

Surgical outcomes	Stage of RCC	N	Mean	Std. Deviation	P value
Operation time (mins)	T1	29	163.62	32.947	0.08
	T2	34	178.38	33.704	
Blood loss (ml)	T1	29	123.45	32.872	0.01
	T2	34	152.79	55.065	
Hospital stay (Days)	T1	29	2.79	.491	0.04
	T2	34	3.06	.547	

Table 7: Stratification of surgical outcomes with BMI

Surgical outcomes	BMI distribution	N	Mean	Std. Deviation	P value
Operation time (mins)	18.5 to 24.9	35	177.14	34.327	0.14
	> 24.9	28	164.64	32.658	
Blood loss (ml)	18.5 to 24.9	35	129.00	39.104	0.05
	> 24.9	28	152.14	55.602	
Hospital stay (Days)	18.5 to 24.9	35	2.94	.591	0.91
	> 24.9	28	2.93	.466	

Discussion

Laparoscopic radical nephrectomy has become a standard in the surgical management of renal cell carcinoma evolving significantly since its introduction over three decades ago. Studies consistently affirms its role as a safe and effective option compared to open surgery, with advantages in postoperative recovery and comparable long-term oncological outcomes. Deane et al. provided a comprehensive historical overview explaining the progression of laparoscopic nephrectomy from its inception for small low-stage tumors to its application in more advanced disease. Their review demonstrated that transperitoneal, retroperitoneal and hand-assisted approaches all exhibited favorable outcomes with a major complication rate of approximately 10% and a very low incidence of port-site recurrence when meticulous extraction techniques are employed. They emphasized that while the procedure is minimally invasive its complexity is not minimal and complications although rare, but can be severe if not promptly recognized. Their study also emphasized that the use of the LigaSure device and en bloc stapling of the renal hilum, has further refined the safety profile of the operation.(12)

Nguyen et al. in their study focused on the retroperitoneal approach for renal cell carcinoma. Their findings validated the safety of this technique across various stages including T3a tumors and cases which required lymph node dissection. They reported mean operative time of 86.8 minutes and a low intraoperative complication rate of 7.3%, with minimal conversions to open surgery. Importantly their analysis of extended lymph node dissection showed that while it prolonged operative time it did not increase intraoperative complications or length of hospital stay.(13) The 5-year recurrence-free and overall survival rates reported by Nguyen et al. for stage I II and III patients were excellent further validating the efficacy of the laparoscopic technique. Their work is particularly valuable as it provides data from a lower-middle-income country demonstrating that advanced laparoscopic techniques can be successfully implemented and yield results comparable to those from high-volume centers in developed nations.(13)

The mean operative time of 171.59 minutes in the present study is slightly higher than the 86.8 minutes reported by Nguyen et al. for their retroperitoneal approach and the 133-149 minutes reported by Haehn et al.(14) This variation can be attributed to differences in surgical technique, patient body habitus tumor complexity and the inclusion of a learning curve period.

The mean intra-operative blood loss of 139.29 mL in the present study is consistent with the 128 mL reported by Deane et al. in their retroperitoneal laparoscopic nephrectomy apporach.(12) This highlights the advantage of the laparoscopic approach in minimizing hemorrhagic morbidity.

The mean hospital stay of 2.94 days in the present study is excellent, which compares very favorably to the 4.6 days reported by Hsu et al. This early discharge reported in the present study reflects perioperative care pathways that emphasized early ambulation and pain control and it is in agreement with the findings of Dunn et al. who noted significantly shorter hospital stays for laparoscopic patients compared to open surgery.(16) The distribution of tumor stages in the current cohort with 54% T1 and 46% T2 demonstrates that the procedure was successfully applied to both smaller and larger localized tumors.

Conclusion

In conclusion the findings from this study demonstrated that surgical outcomes of laparoscopic radical nephrectomy are very acceptable among patients with renal cell carcinoma (RCC). In the present study the mean operative time was 171.59+33.91 minutes, mean blood loss was 139.29+48.15 mL and mean hospital stay time was 2.94+0.53 days. Future efforts should focus on prospective multicenter data collection to further refine patient selection standardize outcome reporting and explore the long-term oncological results which remain the ultimate measure of success in cancer surgery.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned.
Consent for publication
Approved
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Conflict of interest

The authors declared the absence of a conflict of interest.

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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