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Research Article

COVID Impact: A Natural Experiment Decreasing Length of Stay of Robotic Partial Nephrectomy

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Abstract

Purpose: To compare the 30-day readmission and emergency department visit rates of patients who underwent robotic partial nephrectomy before and after March 31, 2020.

Methods: Patients treated for renal cell carcinoma between 2017 and 2023 were reviewed. The patients were assigned to two groups: Group A underwent surgery between February 1, 2017, and March 31, 2020, and Group B underwent surgery between April 1, 2020, and May 2023. All the data were collected using REDCAP database.

Results: A total of 210 patients were reviewed (105 in Group A and 105 in Group B). There was no statistically significant difference between emergency department visits and readmission rates between Group A and Group B. Group B had a significantly shorter length of stay than Group A (2.32 days and 1.34 days, $p<0.001$), with no other differences between the groups.

Conclusions: There was no increase in 30-day emergency department visits and readmission rates when patients who underwent robotic partial nephrectomy were discharged on postoperative day one, when compared with those discharged on postoperative day two. Our preliminary data suggest that this is a safe and effective change that will allow for more open hospital beds.

Keywords: Renal Cell Carcinoma; Robotic Partial Nephrectomy; Retrospective; Hospital Stay; COVID-19

Introduction

The Coronavirus disease (COVID-19) pandemic has led to systematic healthcare changes and the need for adaptation to patient care. COVID-19 significantly increased the urgent need for hospital beds, overwhelming emergency department crowding, with intensive care units and floor beds being over-occupied. The critical need for ward expansion, amplified necessity for supply of beds and COVID-19 pandemic protection was required [1]. Reduction in length of stay helps increase availability of hospital beds, decreases the chance of virus contact, and improves bed turnover. Shortening hospital length of stay may inversely impact 30-day readmission rates [2]. Therefore, reduction in hospital length of stay must provide optimal care and the best patient safety without prolonging hospital readmissions, emergency room visits, or compromising the quality of healthcare delivery.

Robotic Partial Nephrectomy (RPN) is preferred for Renal Cell Carcinoma (RCC) treatment, with expanding indications of T1a/b and T2 renal masses with the goal of optimizing renal function while maximizing cancer removal. Robotic Partial nephrectomy requires advanced surgical skills and judgement to minimize complications. Historically, patients were admitted to the hospital for two nights after surgery to observe complications such as drain output, return of bowel function, and monitor vital signs and stable laboratory values.

The COVID-19 pandemic has affected many aspects of the healthcare system. Many strategies have been used to reduce the demand for hospital care, such as limiting elective surgery cases, promoting self-prevention, enhancing self-hygiene, isolating

suspected patients, and changing postoperative protocols. To increase bed availability, we initiated a strategy to discharge these patients on postoperative day one starting in the spring of 2020, if they met goals. This represents a prospective intervention during COVID that has persisted to the present day with the aim of increasing postoperative day one discharges. However, changes in postoperative care must be evaluated in the context of patient care, complications, and outcomes to ensure that there is no significant increase in readmissions or emergency room visits.

We compared 30-day readmission and emergency department visit rates between patients who underwent robotic partial nephrectomy prior to March 2020 and those who underwent the same surgery after March 2020. The secondary outcomes were complications after surgery, which were stratified by the Clavien-Dindo classification.

Materials and Methods

Study Design

This retrospective study was conducted at the University of Arizona College of Medicine, Department of Urology. Institutional Review Board approval (IRB00000291) was obtained prior to the commencement of the study.

Data Source

All data were collected using the Research Electronic Data Capture (REDCap) database, a secure web-based application designed for building and managing online surveys and databases. The REDCap database was used to collect demographic and clinical data of patients who underwent robotic partial nephrectomy for renal cell carcinoma at the University of Arizona Department of Urology from 2017 to 2023.

Study Population

The study population included 210 patients who underwent robotic partial nephrectomy for renal cell carcinoma. These patients were assigned into two groups based on the date of surgery: Group A (n=105) comprised patients who underwent surgery between February 2017 and March 2020, and Group B (n=105) comprised a cohort of patients who were specifically planned to be discharged on postoperative day one. This represents a prospective intervention for the Group B arm. The patients underwent surgery between April 2020 and May 2023. Patient characteristics are shown in Table 1.

VARIABLES		Feb2017-Mar2020 (Group A) N=105	Apr2020-May2023 (Group B) N=105
Gender	Female (96,45.7%)	47 (44.7%)	49 (46.7%)
	Male (114, 54.3%)	58 (55.2%)	56 (53.3%)
Hypertension	Yes (123, 58.6%)	61 (58.1%)	62 (59.0%)
Diabetes	Yes (59, 28.1%)	36 (34.3%)	23 (21.9)
Chronic Kidney Disease	Yes (24, 11.4%)	11 (10.5%)	13 (12.4%)
Smoking	Yes (90, 42.9%)	43 (41%)	47 (44.8%)
Side	Right (105, 50%)	50 (47.6%)	55 (52.4%)
	Left (105, 50%)	55 (52.4%)	50 (47.6%)
Age (mean, min-max)		61 (26-85)	63 (23-86)
BMI[1] (mean, min-max)		31.5 (19.1- 61.8)	29.15 (17.9-48.7)
Size of Mass (mean, min-max)		3.67 (1.0-11.8)	3.48 (0.9-10.0)
Nephrometry Score (mean, min-max)		7.35 (4-12)	7.62 (4-12)
Length of Stay (mean, min-max)		2.32 (0-6)	1.34 (1-6)
Ischemia Time (mean, min-max)		17.07 (0-35)	18.42 (0-35)
Blood Loss (mean, min-max)		151.83 (5-500)	165.94 (0-1700)
GFR[2] Pre-Op (mean, SD)		67.82 (22.96)	67.17 (20.67)
GFR Post-Op (mean, SD)		61.88 (23.07)	60.09 (21.86)

ER visit within 30 days		8 (3.8%)	5 (4.8%)
Readmission within 30 days Causes for Readmission	5 (2.4%)	4 (3.8%) 1 Pulmonary embolus, 1 Arrhythmia 1 pseudoaneurysm	3 (2.9%)
Clavien-Dildo classification	I (27, 12.9%)	19 (18.1%)	1 (0.9%)
	II (7, 3.3%)	7 (6.7%)	8 (7.6%)
	III (4, 1.9%)	3 (2.9%)	0 (0%)
	IV (0, 0%)	0 (0%)	
	V (0, 0%)	0 (0%)	

Table 1: Patient Characteristics.

Data Collection

Demographic data, including age and body mass index (BMI), and clinical data, including the R.E.N.A.L score, warm ischemia time, length of stay, and blood loss, were collected for each patient. The R.E.N.A.L score is a grading system used to assess the complexity of renal tumors based on five variables: radius (R), exophytic/endophytic properties (E), nearness to the collecting system or sinus (N), anterior/posterior location (A), and location relative to polar lines (L).

Outcome Measures

The primary outcome measures were 30-day readmission rates and emergency department visit rates. The secondary outcome measures were length of hospital stay and blood loss.

Statistical Analysis

Descriptive statistics were used to summarize the patient demographics and clinical characteristics. Continuous variables are reported as means and standard deviations, and categorical variables are reported as frequencies and percentages. The chi-square test was used to compare categorical variables, and the t-test was used to compare continuous variables between the two groups. Statistical significance was set at $p < 0.05$. All statistical analyses were performed using SPSS version 27.

Ethical Considerations

This study was conducted in accordance with the ethical standards of the institutional and/or national research committee. Patient confidentiality was maintained throughout the study.

Results

We analyzed 210 patients treated at the University of Arizona Department of Urology for renal cell carcinoma between 2017 and 2023. Patients were divided into two groups: Group A (n=105) between February 2017 and March 2020 and Group B (n=105) between April 2020 and May 2023. The mean age of the patients was 62 years (range: 23–86 years). The mean body mass index, R.E.N.A.L score, warm ischemia time, length of stay, and blood loss were 30.32 (19.0-61.8), 7.52 (4-12), 17.76 minutes (0-35), 1.81 days (0-8), and 159.43 ml. (0-1700), respectively. Group B had a significantly shorter length of stay than Group A (2.32 days and 1.34 days, $p<0.001$), with no other differences between the groups. The percentage of patients who stayed longer than one day in Group B was 24.5%.

Five patients returned to the emergency room within 30 days of surgery. There were three readmissions in Group A, one for pulmonary embolus, one for arrhythmia, and one for pseudoaneurysm, whereas Group B had no readmissions. The two groups were compared using validated measures included within the Charleson Comorbidity Indices, such as age, diabetes, and chronic kidney disease, and there were no differences in the factors that increased emergency room visits. There was no statistically significant difference between emergency department visits and readmission rates between groups A and B.

This study had some limitations, including its retrospective design and small sample size. This study was conducted at a single institution, which may limit the generalizability of the results to other settings. Additionally, this study did not assess patient satisfaction or quality of life after discharge.

[1]Body mass index

[2]Glomerular filtration rate

Discussion

Partial nephrectomy provides a nephron-sparing surgical option for select patients with renal masses and has been shown to result in minimal changes in renal function, with optimal preservation of nephrons [1]. Discharge from an inpatient hospital stay must meet several criteria, including tolerating regular diet, stable vital signs and labs such as hematocrit and creatinine, as well as minimal drain output and ability to ambulate. The timeframe for achieving these goals must be balanced against an assessment of whether a complication would manifest within that timeframe or whether the patient is stable for discharge. Furthermore, there are several complications unique to nephron-sparing surgery, including renal artery pseudoaneurysm and urine leak [2]. Providers and patients alike should be aware of these complications and their associated signs and symptoms. In a large meta-analysis of partial nephrectomy studies, Uzzo et al. found postoperative bleeding and urine leak/urinary fistula rates to be 2.8% and 7.4%, respectively [3]. A high drain output postoperatively must be assessed to determine if this represents urinary fistula vs residual irrigation fluid vs ascites. Often, the drain is left in place until the day of discharge to allow for assessment. As the phase shift from open partial nephrectomy to laparoscopic and robotic partial nephrectomy has occurred, the duration of the average postoperative hospital stay has become shorter [4]. In an effort to monitor for these and other complications, patients who underwent robotic partial nephrectomy at our institution were previously observed in the hospital for two nights after surgery, based on the presumption that significant early complications of the surgery could be identified together with assessment of achievement of target discharge criteria. No evidence of fistula was found in any of the patients in this study.

The COVID pandemic has been an impetus for changes in many realms of healthcare. During the pandemic, various surgical specialties attempted to reduce hospital bed usage by shortening hospital length of stay after surgery, to open up additional hospital beds for COVID patients [5-7]. One way our department sought to do our part in the COVID pandemic by attempting to expedite discharge of our robotic partial nephrectomy patients home on postoperative day one. This change was initiated in March 2020, at the time of the first nationwide COVID wave. Patients with immediate postoperative complications or those who deviated from the normal recovery pathway were admitted to the hospital for additional time. We did not set forth specific criteria that patients had to meet in order to be discharged on postoperative day one; this was left to the discretion of the attending surgeon and the care team. This effort at earlier discharge resulted in a significantly shorter average hospital stay between Group A (prior to April 2020) of 2.32 days down to 1.34 days in Group B (after March 2020). Notably, there was no significant difference in the R.E.N.A.L. nephrometry score between the two groups; and there were no significant differences in age, body mass index, or rates of diabetes or chronic kidney disease. In addition, there was no increase in readmissions or emergency room visits.

In a multi-institutional study, Hyams, et al. found that iatrogenic vascular lesions (i.e. pseudoaneurysms and arteriovenous fistulae) occur, on average, 14.5 days postoperatively, presenting with gross hematuria with clots [8]. Urine leaks, however, tend to be identified earlier, at a median of 3.5 days postoperatively; often discovered as a result of high drain output [9]. Given these findings it can be ascertained that the majority of iatrogenic vascular injuries would not be identified during a patient's postoperative hospital stay regardless of whether the patient was kept in the hospital for one or two nights. However, early identification of urine leaks could potentially be unrecognized in patients who were sent home on postoperative day one. After further analysis, there was no increased in the fistula rate, and there was no significant difference between the two groups with regards to readmission rates and emergency room visits within 30 days after surgery.

In our limited sample, there was no significant difference in Clavien-Dindo Grade 1-3 complications between the two groups, and there were no Clavien-Dindo Grade 4 complications among all patients. We acknowledge that our sample size was limited; however, these preliminary data support early hospital discharge following robotic partial nephrectomy.

Conclusions

In conclusion, this section outlines a retrospective study conducted at the University of Arizona Department of Urology comparing 30-day readmission and emergency department visit rates for patients who underwent robotic partial nephrectomy before and after March 2020. The findings showed no increase in 30-day emergency department visits and readmission rates when patients who underwent robotic partial nephrectomy were discharged home on postoperative day one, supporting the change in care as a safe and effective measure that is now integrated into our standard pathway plan.

Funding: No funding was received for this study.

Data Availability Statement: Data supporting the study results can be provided followed by request sent to the corresponding author's e-mail.

Ethical Guidelines: Arizona Institutional Review Board approval (IRB00000291) was obtained prior to the commencement of the study.

Conflict of Interest: Authors have no conflict of interest to report.

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