A Contemporary Analysis of Utilization, Clinical Outcomes and Costs of Robotic-Assisted, Laparoscopic, and Open Partial Nephrectomy Using the National Inpatient Sample

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Introduction

- Robotic-assisted partial nephrectomy (RAPN) has become more prevalent than laparoscopic partial nephrectomy (LAPN) or open surgery for surgical renal cancer treatment
- RAPN is preferred to preserve as much healthy kidney tissue as possible
- This study compared current utilization, clinical outcomes, and costs associated with RAPN, LAPN, and open surgery in patients with renal cancer

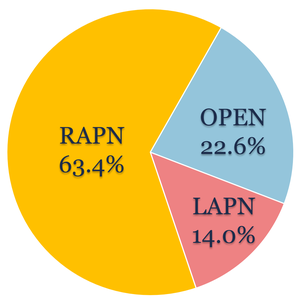
Methods

- The 2016-2019 National Inpatient Sample (NIS) database was used to identify renal cancer patients
- Patients who underwent LAPN, RAPN, or open surgery were identified using ICD-10-CM and PCS codes
- A descriptive analysis was performed on patient and hospital characteristics, with results presented as mean, median, 1st & 3rd quartiles [Q1, Q3], and percentages
- Regression analyses adjusted for patient and hospital covariates were conducted to compare the surgical types on perioperative complications, Length of stay (LOS), and hospital costs

Results

- There were records on 17,858 procedures identified, representing 89,290 sample weighted patients who underwent PN. RAPN consistently accounted for over 60% of the surgeries, followed by open surgery and LAPN (Figure 1.)

Figure 1. Proportion of PN surgery type from 2016-2019



- The average age was 59.4 years, preponderantly male (60.4%) and white (68.9%). LAPN was more common in older patients and those with more comorbidities, while RAPN was more frequent among females and those with private insurance (Table 1.)

Results

Table 1. Patients baseline & hospital characteristics

	LAPN n = 12,505	RAPN n = 56,620	OPEN n = 20,165	TOTAL n = 89,290
Age (SD)	62.1 (14.0)	59.1 (12.7)	58.4 (15.0)	59.4 (13.5)
Sex				
Male	62.4%	58.8%	63.4%	60.4%
Race				
White	64.6%	70.0%	68.2%	68.9%
Black	12.9%	10.8%	11.7%	11.3%
Other	19.0%	15.8%	16.5%	16.4%
Primary Payer				
Medicare	45.9%	36.0%	38.6%	38.0%
Private Insurance	36.1%	50.7%	45.5%	47.5%
Medicaid	12.1%	8.3%	10.3%	9.3%
Other	5.7%	4.9%	5.5%	5.2%
Comorbidities				
0	12.1%	22.3%	18.3%	20.0%
1	24.2%	30.4%	30.2%	29.5%
2	25.9%	26.8%	26.6%	26.6%
3+	37.9%	20.4%	24.9%	23.9%

Table 2. Clinical Outcomes & Medical Costs

	LAPN n = 12,505	RAPN n = 56,620	OPEN n = 20,165	TOTAL n = 89,290
Median LOS [Q1, Q3]	3 [2, 7]	2 [1, 3]	4 [3, 5]	2 [2, 4]
Transfusions	7.0%	2.0%	6.1%	3.6%
Death	0.8%	0.1%	0.4%	0.2%
Complications				
Total	7.6%	6.0%	12.1%	7.6%
Cardiac	0.4%	0.4%	0.7%	0.4%
Genitourinary	3.2%	1.2%	3.2%	1.9%
Respiratory	1.1%	1.2%	2.6%	1.5%
Wound or Infection	0.8%	0.8%	1.5%	0.9%
Misc Surgical	3.0%	3.0%	5.4%	3.5%
Complication Count				
0	92.4%	94.0%	87.9%	92.4%
1	6.2%	5.2%	10.4%	6.5%
2+	1.4%	0.8%	1.8%	1.1%
Costs				
Median Costs [Q1, Q3]	$14,627 [$10,126, $21,549]	$15,187 [$11,597, $20,325]	$15,364 [$11,433, $21,849]	$15,174 [$11,380, $20,768]

Results

- Patients treated with RAPN and LAPN were less likely to experience perioperative complications compared to open surgery. RAPN patients experienced lower likelihood of blood transfusion or mortality and had shorter average LOS. Hospital costs for RAPN and LAPN were not statistically significantly different from those for open surgery (Table 3)

Table 3. Odds Ratios (unless otherwise noted) of outcomes when comparing LAPN, RAPN to Open (ref)

	Odds Ratio (95% CI)	*P* Value
Blood transfusions		
LAPN	0.97 (0.78-1.21)	0.794
RAPN	0.38 (0.31-0.47)	<.0001
Any Complications		
LAPN	0.51 (0.43-0.61)	<.0001
RAPN	0.48 (0.43-0.55)	<.0001
Wound/Infection Complications		
LAPN	0.41 (0.24-0.70)	0.001
RAPN	0.51 (0.36-0.73)	0.0002
Length of Stay (Days)*		
LAPN	1.02 (0.95-1.09)	0.609
RAPN	0.78 (0.74-0.82)	<.0001
Death		
LAPN	1.32 (0.59-2.94)	0.505
RAPN	0.24 (0.10-0.58)	0.002
Costs*		
LAPN	0.98 (0.94-1.02)	0.283
RAPN	0.99 (0.96-1.02)	0.345

*LOS and Costs were log-transformed, regressed, and estimates were anti-logged.

Conclusions

- RAPN was the most utilized minimally invasive surgery approach for renal cancer patients
- Compared to open surgery, RAPN was associated with superior clinical outcomes
- Further analyses are warranted to explore the cost-effectiveness of RAPN and LAPN relative to open surgery

References

- Bahler CD et al. Assessing cost of robotic utilization in partial nephrectomy. J Endourol. 2018

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