Cost Analysis and Utilization of Emergent Minimally Invasive Cholecystectomy Among Privately Insured Patients: A Retrospective Cohort Study from 2016 to 2021

Nathnael Abera Woldehana [1], Theethawat Thanawiboonchai [1], Andrew Jung [1], Alisa Mae Coker [1], Brett Colton Parker [1], Michael Schweitzer [2], Gina L. Adrales [1]

[1] Division of Minimally Invasive Surgery, Department of Surgery, Johns Hopkins University School of Medicine, Baltimore, MD, USA

[2]Department of Surgery, Johns Hopkins Bayview Medical Center, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Introduction

The objective was to assess the trend in surgical preferences and evaluate differences in net payments between robotic-assisted cholecystectomy (RAC) and laparoscopic cholecystectomy (LC) in the context of emergent minimally invasive cholecystectomy from 2016 to 2021.

Methods

A retrospective cohort analysis was conducted using the IBM® MarketScan® database, focusing on patients who underwent emergent minimally invasive cholecystectomy (either LC or RAC) between 2016 and 2021. Statistical analysis was performed using inverse probability of treatment weighting (IPTW) to adjust for potential confounders, including patient age, sex, Charlson Comorbidity Index (CCI), insurance type, and regional variation. The primary outcome was the mean difference in net payment for the two surgical techniques after adjusting for inflation. The trends in the adoption of RAC and LC over the study period were also analyzed.

Net Payment: Payment received by the provider excluding patient out-of-pocket and coordination of benefits (i.e., employer or plan liability).

IPTW: is a statistical technique that balances covariates in observational studies by weighting individuals based on the inverse probability of receiving a given treatment

Results

Table 1—Baseline Demographic Characteristics of Commercially Insured Individuals Undergoing Minimally Invasive Cholecystectomy in Acute Care Surgery from 2016 through 2021

	LC (n=809,391)	RAC (n=35,037)	SMD
Age Group			0.02
18-34	182,539 (22.6)	8,139 (23.2)	
35-44	164,605 (20.3)	7,523 (21.5)	
45-54	216,162 (26.7)	9,371 (26.7)	
55-64	246,085 (30.4)	10,004 (28.6)	
Sex			0.04
Male	284,093 (35.1)	12,670 (36.2)	
Female	525,298 (64.9)	22,367 (63.8)	
Admission Type			0.03
Inpatient	700,713 (86.6)	33,498 (95.6)	
Outpatient	108,678 (13.4)	1,539 (4.4)	
Region			-0.02
Northeast	127,290 (15.7)	3,072 (8.8)	
North Central	209,776 (25.9)	6,589 (18.8)	
West	348,527 (43.1)	20,813 (59.4)	
South	121,973 (15.1)	4,539 (12.9)	
Unknown	1,825 (0.2)	24 (0.1)	
Insurance Plan			0.06
PPO	390,284 (48.2)	15,611 (44.6)	
POS	91,260 (11.3)	5,117 (14.6)	
CDHP	91,141 (11.2)	3,133 (8.9)	
HMO	78,315 (9.7)	4,186 (12.0)	
Others[a]	140,073 (17.3)	6,389 (18.2)	
Unknown	18,318 (2.3)	601 (1.7)	
CCI Score			0.09
CCI = 0	582,398 (72.0)	24,255 (69.2)	
CCI = 1	168,017 (20.7)	7,345 (21.0)	
CCI >= 2	58,976 (7.3)	3,437 (9.8)	
Mean Net Payment			0.07
Mean ± SD	861.80 ± 2704.98	906.16 ± 2833.92	

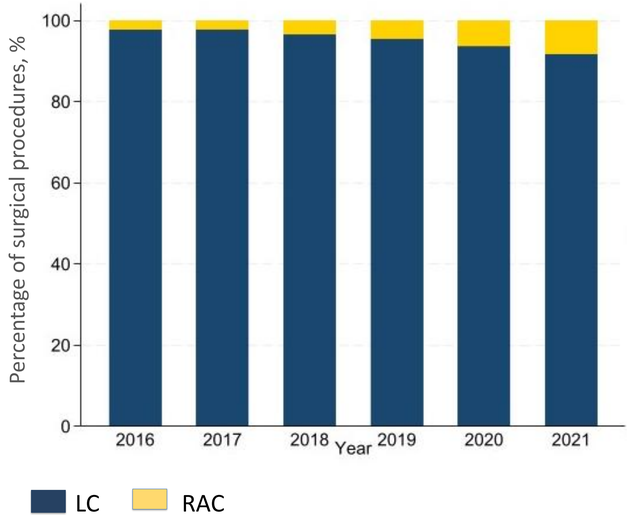


Fig. 1—Distribution of Minimally Invasive Cholecystectomy Techniques Used in Acute Care Surgery Among Commercially Insured Individuals from 2016 through 2021

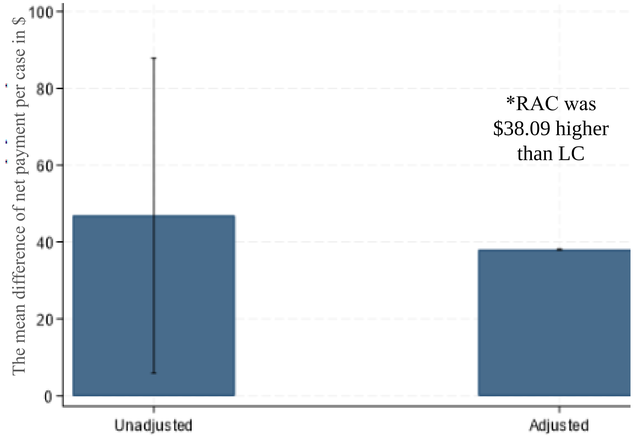


Fig. 2—Mean Difference and 95% CI of Minimally Invasive Cholecystectomy Techniques Used in Acute Care Surgery Among Commercially Insured Individuals from 2016 through 2021 after IPTW adjustment

Conclusion

The study demonstrates that LC remained the predominant approach, comprising 91.8% of emergent cholecystectomy cases in 2021, despite a growing trend in the adoption of RAC. While RAC utilization increased over time, LC remained more cost-effective, with a net payment that was $38 lower than RAC after adjusting for clinical and demographic factors. These findings highlight the persistent cost differential between the two techniques and raise important considerations regarding the financial implications of increasing RAC adoption. Further research is needed to assess the cost-effectiveness of RAC in acute surgical care.