

Introduction

- Laparoscopic cholecystectomy (LC) is one of the safest, most commonly performed surgical procedures
- Postoperative complications including bile leak, retained stone, cholangitis, and gallstone pancreatitis following LC occur in up to 2.6% of cases and may require readmission with possible endoscopic retrograde cholangiopancreatography (ERCP) intervention
- An estimated 22-23% readmissions following LC were for surgical-biliary reasons, 31-46% for surgical-nonbiliary reasons, and 29-46% for non-surgical reasons^{1, 2}
- There is a paucity of literature on factors predictive of need for ERCP following LC
- The goal of this study is to describe the prevalence and risk factors for readmission after LC and describe factors that predict the need for ERCP within 30 days of surgery

Methods

- We queried the ACS/NSQIP 2012-2017 Participant User Files for patients who underwent LC
- The primary outcome was 30-day readmission. The secondary outcomes of interest were 30-day mortality and 30-day readmission with indication for ERCP intervention, defined as readmission within 30 days of the index procedure with an associated diagnosis of choleperitonitis, calculus of bile duct, cholangitis, bile duct obstruction, acute biliary pancreatitis, retained cholelithiasis, bile leak, jaundice, or bile duct perforation
- We used multivariate logistic regressions to identify risk factors for subsequent readmission with indication for ERCP intervention following LC. The model included patient demographic characteristics, preoperative comorbidities, preoperative lab derangements, perioperative morbidity, concurrent intraoperative procedures, and operative outcomes. Operative years were included in the model to account for yearly fixed effects

Results

Table 1. Characteristics of patients undergoing LC at an ACS NSQIP hospital, 2012-2017

	Mean or percent	SD	Median	Min.	Max.
<i>Demographic characteristics</i>					
Age	49.3	17.4	49	18	90
Male	29.7%				
White	71.7%				
Current smoker ^a	17.9%				
Dependent in ADLs	2.04%				
<i>Baseline comorbidities</i>					
Obese (BMI >=30)	28.1%				
Diabetes mellitus ^b	12.6%				
Ventilator dependent	0.052%				
Severe COPD	2.69%				
Dyspnea at rest or with exertion	3.96%				
Ascites ^c	0.14%				
CHF	0.52%				
Hypertension ^b	33.9%				
Acute renal failure	0.15%				
Current dialysis	0.50%				
Disseminated cancer	0.40%				
Open wound	0.42%				
Chronic steroid use	2.08%				
>10% weight loss ^d	0.71%				
Bleeding disorder	2.61%				
<i>Preoperative lab results</i>					
Sodium	139.2	2.88	139	100	170
Blood urea nitrogen	13.2	7.24	12	1	199
Creatinine	0.87	0.59	0.8	0.1	15
Albumin	3.83	0.61	3.9	1	10
Albumin <3.5g/dL	18.8	39.0	0	0	100
Total bilirubin	0.82	0.92	0.6	0.1	15
SGOT	48.6	80.9	24	1	1000
Alkaline phosphatase	98.8	66.5	81	1	1000
WBC	8.58	3.63	7.8	0.1	90.5
Hematocrit	39.3	4.71	39.6	8	60
Platelets	247.7	74.6	241	1	994
PTT	30.2	6.74	29.4	5	120
INR	1.09	0.27	1.0	0.1	10
PT	12.7	2.39	12.4	8.6	42.1
Observations	275,570				

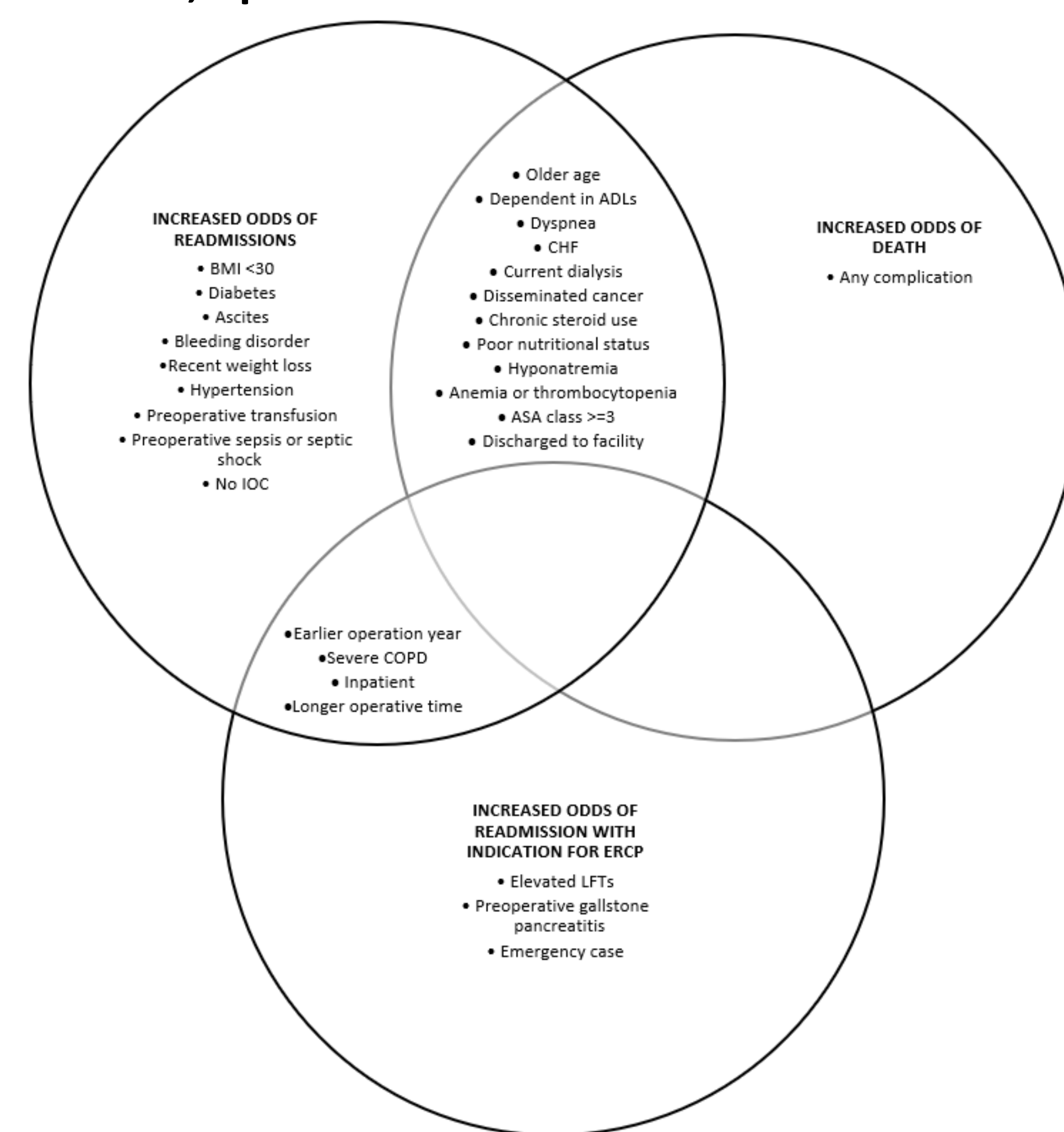
Table 2. Preoperative morbidity

	N (%)
Inpatient	102,389 (37.2%)
Acute renal failure	425 (0.15%)
Blood transfusion ^a	628 (0.23%)
Choledocholithiasis	3,085 (1.12%)
Pancreatitis	3,818 (1.39%)
Sepsis ^b	4,200 (1.52%)
Septic shock ^b	287 (0.10%)
Emergency case	30,757 (11.2%)
ASA class	
ASA 1	31,326 (11.4%)
ASA 2	157,780 (57.3%)
ASA 3	79,897 (29.0%)
ASA 4	6,170 (.24%)
ASA 5	28 (0.010%)
Observations	275,570

Table 3. Operative details of sample

Operative outcomes	Mean or N (percent of total)	SD	Median	Min.	Max.
<i>Concurrent intraoperative procedures</i>					
Cholangiogram	64,065 (23.2%)				
Common bile duct exploration	1,427 (0.5%)				
ERCP	270 (0.1%)				
<i>Operative outcomes</i>					
Total operation time (min)	66.0	39.7	57	0	1224
Hospital length of stay	1.60	3.96	0	0	366
Discharged to home	268,675 (97.5%)				
Any readmission	11,010 (4.0%)				
ERCP indicated with readmission	930 (0.3%)				
Any complication	10,331 (3.8%)				
Superficial incisional SSI	1,600 (0.6%)				
Deep incisional SSI	127 (0.05%)				
Organ space SSI	1,606 (0.6%)				
Wound disruption	143 (0.05%)				
Pneumonia	1,377 (0.5%)				
Unplanned intubation	737 (0.3%)				
Pulmonary embolism	281 (0.1%)				
On ventilator >48 hours	453 (0.2%)				
Progressive renal insufficiency	279 (0.1%)				
Acute renal failure	216 (0.08%)				
Urinary tract infection	1,694 (0.6%)				
Stroke/CVA	131 (0.05%)				
Cardiac arrest requiring CPR	228 (0.08%)				
Myocardial infarction	317 (0.1%)				
Bleeding requiring transfusion	1,459 (0.5%)				
DVT/Thrombophlebitis	374 (0.1%)				
Sepsis	2,259 (0.8%)				
Septic shock	585 (0.2%)				
Death	601 (0.22%)				
Observations	275,570				

Fig 1. Relationship between baseline characteristics, co-morbidities, operative characteristics and outcomes



Conclusions

- Laparoscopic cholecystectomy remains a relatively low-risk procedure with low rates of readmission in the appropriate patient. Odds of readmission not related to LC appear to be declining over time
- Factors associated with readmission include older age, baseline co-morbidities, and inpatient status.
- Patients who underwent intraoperative cholangiogram were less likely to be readmitted
- Roughly 8% of readmitted patients had an indication for ERCP within 30 days of LC
- Patients who were readmitted specifically with an indication for ERCP were more likely to have undergone an emergency surgery, a longer surgery, or to have had elevated LFTs or gallstone pancreatitis prior to surgery (clinical evidence of complicated cholecystitis)
- Postoperative complications were associated with a significantly higher risk mortality within 30 days of surgery

Limitations

- Unable to determine whether a patient ultimately underwent ERCP, including patients who underwent ERCP but were not readmitted
- Facility and geographic variations cannot be studied
- Sampling of LC from ACS NSQIP sites is subject to selection bias
- Use of ERCP depends on many individual and local factors (including availability), none of which are available in the ACS NSQIP data

References

- Manuel-Vázquez A, Latorre-Fragua R, Ramiro-Pérez C, López-Marcano A, Al-Shwely F, De la Plaza-Llamas R, Ramia JM (2017) Ninety-day readmissions after inpatient cholecystectomy: A 5-year analysis. World J Gastroenterol 23:2972–2977 . <https://doi.org/10.3748/wjg.v23.i16.2972>
- Rana G, Bhullar JS, Subhas G, Kolachalam RB, Mittal VK (2016) Thirty-day readmissions after inpatient laparoscopic cholecystectomy: factors and outcomes. Am J Surg 211:626–630 . <https://doi.org/10.1016/j.amjsurg.2015.12.007>