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Original research

Different setups of laparoscopic cholecystectomy: Conversion and complication rates: A retrospective cohort study

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HIGHLIGHTS

- Laparoscopic cholecystectomy for acute cholecystitis has higher complication rates.
- Elective laparoscopic cholecystectomy has very low conversion/complication rates.
- Interval laparoscopic cholecystectomy has higher complication rates than elective.
- No other study has defined and compared four laparoscopic cholecystectomy setups.
- We saw higher conversion/complication rates along the Group I to Group III axis.

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the gold standard treatment for gall bladder disease. **Methods**: We retrospectively reviewed charts of patients who underwent LC. Four LC groups were defined: elective LC – Group I; interval LC – Group II; LC during acute cholecystitis – Group III; and LC following percutaneous cholecystostomy (PCC) – Group IV. **Results**: The study comprised 1658 patients [mean age: 51.0 years (range 17–94)]: Group I: 1221 patients (73.6%); Group II: 271 patients (16.3%); Group III: 125 patients (7.6%); Group IV: 41 patients (2.5%). The operative time was significantly different between the groups ($p < 0.05$). The conversion rate was highest in Group III (24.8%) and was significantly higher than all the other groups. Group II had a higher conversion rate than Group I ($p < 0.05$). The length of hospital stay was not significantly different between Groups I and II (1.5 and 1.96 days, respectively), and between Groups III and IV (4.46 and 4.78 days, respectively). The differences between Groups I and II, and between Groups III and IV were significant. Complication rates were significantly different between Groups I (2.2%), II (5.6%), and III (13.6%) ($p < 0.05$.) There were no differences between Groups III and IV and there were no significant differences in 30-day readmission rates between the groups. **Conclusions**: The highest conversion and complication rates were encountered in patients undergoing LC during acute cholecystitis. A gradual increase of conversion and complication rates was noted between the groups of elective LC, interval LC and LC post PCC.

1. Introduction

Laparoscopic cholecystectomy (LC) is the gold standard operation for gall bladder disease. It is a safe and cost effective procedure, with less post-operative pain and an early return to work compared to open surgery [1–3]. It is estimated that over one million patients undergo cholecystectomy each year in the USA, mostly on an elective basis [4–7].

We can identify four LC set-ups. The first and probably most practiced is elective LC. The second is LC performed 6 or more weeks following an episode of acute cholecystitis (AC), also termed interval LC (ILC). The third is LC performed during an acute episode of cholecystitis, and the fourth is LC performed following a percutaneous cholecystostomy (PCC) for severely sick high-risk patients.

It was our impression that of all these groups, the group of patients undergoing LC following a PCC posed the highest technical difficulties to the operating surgeon and hence the highest conversion and complication rates. Based on this assumption and with

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the aim to either endorse or negate it, we decided to review our results in operating on these four different groups of patients.

2. Material and methods

This is a retrospective study performed with the authorization of the Institutional Review Board of our medical center (No. 64/12). All patients who underwent LC during the period from July 2007 to December 2012 entered the study. The indications for surgery were biliary colic, AC, resolved AC, cholecystocholedocholithiasis (resolved obstructive jaundice, resolved biliary pancreatitis, and resolved ascending cholangitis). Patients who underwent LC during another operation such as laparoscopic adjustable gastric banding and any type of colectomy were excluded.

Patient records were reviewed and the data was collected in a computerized database. The following parameters were studied: age, sex, comorbidities, length of surgery, need for perioperative blood transfusion, conversion rate, complication rates, length of hospital stay, 30-day readmission rate, and mortality.

All operations were performed by the same technique, using a four-trocar technique (2 × 10 mm and 2 × 5 mm), insufflating the abdominal cavity to a maximum pressure of 15 mmHg. The use of drains was based on the senior surgeons' judgment. Drains were taken out within 12–24 h depending on the amount and type of discharge (bloody/biliary), or left in situ for a longer period of time in cases of biliary discharge until full clearance.

Patients were divided into four groups: Group I – patients undergoing elective LC, Group II – patients undergoing interval LC following an episode of AC (average of 15.1 weeks); Group III – patients undergoing LC during an episode of AC; and Group IV – patients undergoing LC following PCC performed in very high-risk patients not fit for surgery or not responding to medical treatment during an episode of AC.

Prophylactic antibiotics were used in all operated patients, usually one portion of a third-generation cephalosporin (ceftriaxone 1 g, half an hour before surgery, intra-venous). In cases of AC, a combination of antibiotics was used and continued based on clinical grounds (empyema of gall bladder, gangrenous cholecystitis, or perforation). In cases of conversion from LC to open cholecystectomy (OC), the preferred incision was a subcostal incision.

2.1. Statistical analysis

In order to compare quantitative (continuous) variables between two independent groups, the two sample *t*-test was applied as well as the non-parametric Mann–Whitney test. The comparison of quantitative (continuous) variables between three or more groups was carried out using the ANOVA procedure, with the Bonferroni post hoc test. The association between two categorical variables was assessed using either the Chi-square test or the Fisher's exact test. The logistic regression model was applied in order to test the simultaneous effect of several independent variables on a qualitative, dichotomous dependent variable. All statistical tests applied were two-tailed, and a *p*-value of 5% or less was considered statistically significant.

3. Results

Between July 2007 and December 2012, a total of 1658 patients underwent LC in our medical center. Group I consisted of 1221 patients (73.6%) who underwent elective LC due to biliary colic or following an episode of biliary pancreatitis or resolved obstructive jaundice. Group II consisted of 271 patients (16.3%) who underwent interval LC following an episode of AC. Group III consisted of 125 patients (7.5%) operated during an episode of AC. Group IV consisted of 41 patients (2.5%) who underwent LC following a PCC performed during an episode of AC that did not respond to medical treatment or patients at risk for surgery. For the whole cohort of patients, the female to male ratio was 2.44:1 and the mean age 51.0 years (range 17–94). The mean operative time was 45.8 ± 26 min and the median length of hospital stay was 1 day (range 1–67 days). There was a 5% (83 patients) conversion rate. Complications occurred in 62 patients (3.7%). The 30-day readmission rate was 4.9% (80 patients).

The demographic data, including comorbidities, operative time, conversion rate, length of hospital stay, complications, and readmission rate for the four different groups are summarized in Table 1. The operative data are listed in Table 2.

The patients of Group IV who underwent PCC were the oldest (67 ± 12 years) and had the highest comorbidity rates (63.4%), while the elective group of patients undergoing LC (Group I) were the youngest (50 ± 17 years) and had the lowest comorbidity rates (34%). The difference in mean age was significant ($p < 0.05$). The female/male ratio was significantly different between Group I (3:1 F/M) and the other groups, but this ratio was not significantly different between the other groups (Groups II, III, and IV).

The operative time was significantly different between the groups ($p < 0.05$). It was the shortest in elective LC (39 ± 19 min) and longest in LC following PCC (81 ± 32 min).

The conversion rate was highest in Group III (24.8%). It was significantly higher than for all the other groups ($p < 0.05$). Group II had higher conversion rates (8.5%) than Group I (2.1%) ($p < 0.05$).

The length of the hospital stay was not significantly different between Groups I and II (1.5 and 1.96 respectively), and between Groups III and IV (4.46 and 4.78 respectively). The differences between Groups I and II, and Groups III and IV were statistically significant ($p < 0.05$).

Complication rates were significantly different between Groups I, II, and III (2.2%, 5.6%, and 13.6%, respectively) ($p < 0.05$). Group I had the lowest complication rates (2.2%) while Group III had the highest complication rates (13.6%). There were no statistically significant differences between Groups III and IV. There were no

Table 1
Demographic data.

Demographic data	Group I elective LC	Group II interval LC	Group III AC	Group IV S/P PCC	Overall
Number of patients	1221 (73.6%)	271 (16.3%)	125 (7.5%)	41 (2.5%)	1658
Age (mean in years)	50 ± 17	55 ± 17	57 ± 16	67 ± 12	51
Female to male ratio	3:1	1.4:1	1.2:1	1.15:1	2.4:1
Comorbidities – overall	34%	46.5%	54.4%	63.4%	38.2%
HTN	29.5%	39.1%	42.9%	51.2%	
IHD	7.3%	13.7%	9.5%	34.1%	
DM	13%	19.2%	25.4%	31.7%	

LC, laparoscopic cholecystectomy; AC, acute cholecystitis; S/P PCC, status post percutaneous cholecystostomy; HTN, hypertension; IHD, ischemic heart disease; DM, diabetese mellitus.