Research Article
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The rationality of mini-laparotomy cholecystectomy in symptomatic gallbladder disease: a retrospective cohort study

Abstract

Background: Mini-laparotomy cholecystectomy (MC) has recently gaining acceptance with increasing popularity as an alternative to open cholecystectomy (OC). The aim of the present study was to analyze the rationality of MC in gallbladder disease by comparison with laparoscopic cholecystectomy (LC) and OC.

Material and methods: Between January 2009 and January 2015, patients who underwent LC, OC or MC were retrospectively analyzed. In the MC group, the abdominal skin incision was ≤6cm.

Results: Two-hundred-thirty patients underwent OC, 154patients LC, and 48patients MC. The ASA III score was significantly higher in the MC group when compared to the OC and LC groups ($P<0.05$, $P<0.05$). The frequency of acute cholecystitis was significantly higher in the MC and OC groups than the LC group ($P<0.01$, $P<0.05$). The number of patients with coronary artery disease (CAD) was significantly higher in the MC group when compared to LC and OC groups ($P<0.01$, $P<0.05$). No significant difference was found between the groups regarding the development of postoperative complications ($P>0.05$). The hospitalization period was significantly shorter in the LC group when compared with the OC and MC groups ($P<0.001$, $P<0.05$). Return to normal daily activity was significantly shorter in the LC group when compared with the OC and MC groups ($P<0.001$, $P<0.05$). Cost of treatment was significantly less in the MC group than the LC and OC groups ($P<0.05$, $P<0.001$).

Conclusion: MC is a safe, practical, and cost effective procedure which can be considered where LC is not applicable.

Keywords: cholelithiasis, mini-laparotomy, cholecystectomy, cost

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Introduction

LC has become the gold standard in the treatment of symptomatic gallstones since last two decades. Today, well known advantages of LC over conventional cholecystectomies are reduced postoperative pain, better cosmetic results, shorter hospital stay and faster return to normal daily activities.[1,2] However, LC is an expensive operation because of the need for high technological equipment.[3,4] On the other hand, although, less performed day by day, OC still holds an important place -particularly- in developing countries.[5] Another open technique called MC consisting of a shorter abdominal skin incision has gaining acceptance with increasing popularity as an alternative to OC.[6,7] The basic perspective in this technique is to achieve less pain, shorter convalesce period, better cosmesis, reduced risk of bile duct injury and wound infection.[8–11]

The main purpose of the present retrospective study was to analyze the rationality of MC in gallbladder disease by comparison with LC and OC according to operative time, postoperative pain, complications, hospitalization period and treatment cost.

Material and methods

After approval by the Ethical Committee of the Sakarya University, all patients who underwent cholecystectomy by a single surgeon due to symptomatic cholelithiasis or acute cholecystitis were retrospectively analyzed. Patients were categorized in to three groups whether they underwent LC, OC or MC. Standard LC was *done by using four-trocar technique. OC was performed through a 6 to 8 cm subcostal incision. For the MC procedure, the skin incision was ≤6 cm (Figure 1).*

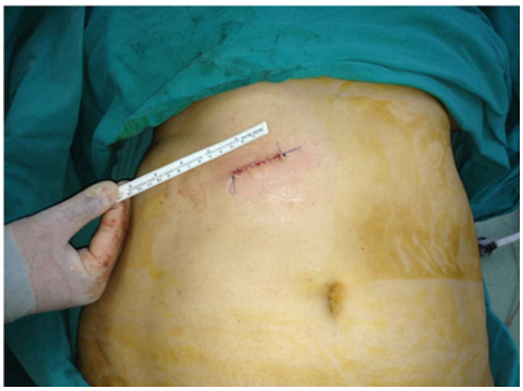

Figure 1 Image of the surgical technique. The length of the subcostal incision is ≤6cm.

The three cholecystectomy procedures were compared according

to age, gender, ASA score, co-morbidities, whether the operation was done in acute or elective circumstances, operation time, postoperative complications, hospitalization period, return to normal daily activity and cost analysis.

Statistical analysis

Data analysis was performed by using SPSS for Windows, version 11.5 (SPSS Inc., Chicago, IL, United States). Whether the distributions of continuous variables were normally or not was determined by Kolmogorov Smirnov test. Levene test was used for the evaluation of homogeneity of variances. Continuous variables were shown as mean ±SD or median (min-max), where applicable. Nominal data were expressed as number of cases and percentages. While, the mean differences among groups were compared by One-Way ANOVA, otherwise, Kruskal Wallis test was applied for comparisons of the medians. When the p value from One-Way ANOVA or Kruskal Wallis test statistics are statistically significant post hoc Tukey HSD or Conover's non-parametric multiple comparison test were used to know which group differ from which others. Nominal data were analyzed by Pearson's Chi-square, Fisher's exact or Likelihood Ratio test, where appropriate. Whether the differences between first and second VAS levels were statistically significant or not was evaluated by Wilcoxon Sign Rank test. A *P* value less than 0.05 was considered statistically significant.

Results

Between January 2009 and December 2014, 432patients underwent cholecystectomy by a single surgeon in Sakarya University Teaching and Research Hospital. Of these, 230patients underwent OC, 154patients LC, and the remaining 48patients MC.

LC was converted to OC in 6patients with acute cholecystitis due to edema and inflammation around the gallbladder. Two patients in the MC group; one patient in the LC group; and one patient in the OC group underwent postoperative endoscopic sphincterotomy by endoscopic retrograde pancreatography (ERCP) for removal of common bile duct stones and clearance of choledochal sludge. In the OC group, 2patients underwent choledocoduodenostomy due to fibrosis in the sphincter of Oddi in one patient and long segment stricture in the common bile duct in the other ones. Four patients in the OC group underwent common bile duct exploration. Of these, 3patients had common bile duct stones and the remained one patient had Mirizzi syndrome.

The mean age in the OC and MC groups was significantly higher when compared with the LC group (OC *vs* LC (*P*<0.001); MC *vs* LC (*P*<0.001)). The distribution of genders significantly alter because of the high male/female ratio in the OC group compared to the LC group (*P*=0.014). The frequency of emergency surgery was significantly higher in the OC and MC groups than the LC group (OC *vs* LC (*P*<0.001); MC *vs* LC (*P*<0.001)). However, the difference between the OC and MC groups was not significant (*P*=0,297). The distribution of histopathological diagnosis whether the patients had an acute or chronic cholecystitis was significantly different that was related due to high chronic /acute cholecystitis ratio in the OC group compared to the LC group (*P*=0.002). The ASA II score was significantly lower in the OC group than the LC group (*P*<0.001). The ASA III score was significantly higher in the MC group when compared to the OC and LC groups (MC *vs* OC (*P*<0.05); MC *vs* LC (*P*<0.05)). The median operation time period in the OC and MC groups was significantly lower than the LC groups (OC *vs* LC (*P*<0.001), MC *vs* LC (*P*=0.022)). However, the operation time was similar between the MC and OC groups (*P*=0.074). The follow-up period was significantly longer in the OC and MC groups when compared with the LC group (OC *vs* LC (*P*<0.001); MC *vs* LC (*P*<0.001)). The follow-up period also was significantly longer in the OC group than the MC group (P<0.003), (Table 1).

Table 1 Patient's demographics

Variables	LC (n=154)	OC (n=230)	MC (n=48)	P value
Age (year)	48.2±14.0[a,b]	54.3±15.0[a]	58.2±17.6b	<0.001†
Gender				0.036‡
Female	125 (81.2%)[a]	161 (70.0%)[a]	38 (79.2%)	
Male	29 (18.8%)[a]	69 (30.0%)[a]	10 (20.8%)	
Surgery				<0.001‡
Emergency	6 (3.9%)[a,b]	70 (30.4%)[a]	11 (22.9%)b	
Elective	148 (96.1%)[a,b]	160 (69.6%)[a]	37 (77.1%)b	
Pathology				0.007‡
Acute choecystitis	137 (89.0%)[a]	175 (76.1%)[a]	39 (81.3%)	
Chronic Cholecytitis	17 (11.0%)[a]	55 (23.9%)[a]	9 (18.8%)	
ASA score				<0.001‡
1	36 (23.4%)	67 (29.1%)	7 (14.6%)	
2	106 (68.8%)a	103 (44.8%)a	27 (56.3%)	
3	12 (7.8%)a,b	57 (24.8%)a	14 (29.2%)[b]	
4	0 (0.0%)	3 (1.3%)	0 (0.0%)	
Operation time	52.5 (25-75)a,b	40 (20-133)a	45 (30-80)[b]	<0,001¶
Follow-up (month)	27 (8-68)a,b	57 (1-72)a,c	32 (2-78)[b,c]	<0,001¶

†One-Way ANOVA, ‡ Pearson's Chi-square test, ¶ Kruskal Wallis,

a:The difference between LC and OC groups are statistically significant (P<0.05),

b: The difference between LC and MC groups are statistically significant (P<0.05),

c: The difference between OC and MC groups are statistically significant (P<0.003).

If the groups were compared according to the co-morbidities, no significant difference was found between groups in the frequency of DM (*P*=0.848). CORD was significantly more present in the MC group than the OC group (*P*=0.013). HT was significantly more frequent in the MC group than the LC and OC groups (MC *vs* LC (*P*=0.005); MC *vs* OC (*P*=0.010)). However the difference between the LC and OC groups was not significant (*P*=0.613). The frequency of acute cholecystitis requiring emergency surgery was significantly higher in the MC and OC groups than the LC group (MC *vs* LC (*P*<0.01); OC *vs* LC (*P*<0.05)). The frequency of cholecystitis did not significantly differ between the MC and OC groups (*P*=0.214). The number of patients with CAD was significantly higher in the MC group when compared to LC and OC groups (MC *vs* LC (*P*<0.01); MC *vs* OC (*P*<0.05)). However no significant difference was found between the LC and OC groups (*P*=0.267). CRD was significantly more frequent in the MC and OC groups compared to the LC group (MC *vs* LC (*P*<0.01); OC *vs* LC (*P*<0.05)). The difference between MC and OC groups was not significant (*P*=0.187), (Table 2).

No significant difference was found between the groups regarding the development of postoperative complications such as abscess, bile leakage and incisional hernia, (P>0.05), (Table 3). The hospitalization

period was significantly shorter in the LC group when compared with the OC and MC groups (OC *vs* LC (P<0.001); MC *vs* LC (P<0.05). The hospitalization period also was significantly shorter in the MC group than the OC group (P<0.001). Return to normal daily activity was significantly shorter in the LC group when compared with the OC and MC groups (LC *vs* OC (P<0.001); LC vs MC (P<0.05). Return to normal daily activity also was significantly shorter in the MC group than the OC group (P<0.001). Cost of treatment was significantly less in the MC group than the LC and OC groups (MC *vs* LC (P<0.05); MC *vs* OC (P<0.001)). The cost also was significantly higher in the OC group when compared with the LC group (P<0.001), (Table 4).

Table 2 Comparison of the groups according to the co-morbidities

Co-morbidity	LC (n=154)	OC (n=230)	MC (n=48)	P value†
DM	35 (22.7%)	56 (24.3%)	10 (20.8%)	0.848
CORD	8 (5.2%)	7 (3.0%)[a]	6 (12.5%)[a]	0.021
HT	55 (35.7%)[b]	88 (38.3%)[a]	28 (58.3%)[a,b]	0.017
Acute cholecystitis	15 (9.7%)[b,c]	94 (40.9%)[c]	15 (31.3%)[b]	<0.001
CAD	6 (3.9%)[b]	15 (6.5%)[a]	10 (20.8%)[a,b]	<0.001
CRD	2 (1.3%)[b,c]	12 (5.2%)[c]	5 (10.4%)[b]	0.018

† Pearson's Chi-square test
DM, diabetes mellitus; CORD, chronic obstructive respiratory disease; HT, hypertension; CAD, coronary artery disease; CRD, chronic renal disease
a: The difference between OC and MC groups are statistically significant (P<0.05);
b: The difference between LC and MC groups are statistically significant (P<0.01);
c: The difference between LC and OC groups are statistically significant (P<0.05).

Table 3 The frequency of the complications according to the groups

Complications	LC (n=154)	OC (n=230)	MC (n=48)	P value†
Abscess	3 (1.9%)	1 (0.4%)	1 (2.1%)	0.306
Hemorrhage	2 (1.3%)	3 (1.3%)	0 (0.0%)	0.553
Bile leakage	1 (0.6%)	3 (1.3%)	1 (2.1%)	0.689
Incisional hernia	1 (0.6%)	7 (3.0%)	2 (4.2%)	0.156

† Likelihood Ratio test.

Table 4 Distribution of the clinical characteristics according to the groups

Variables	LC (n=154)	OC (n=250)	MC (n=50)	P value†
Hospitalization period (day)	1 (1-7)[a,b]	3 (2-23)[a,c]	2 (1-7)[b,c]	<0.001
Return to daily activity (day)	14 (9-18)[a,b]	25 (0-40)[a,c]	15 (12-25)[b,c]	<0.001
Cost (TL)	1100 (808-2448)[a,b]	1252 (129-7115)[a,c]	836 (792-2236)[b,c]	<0.001

† Kruskal wallis test, TL, Turkish lira
a, The difference between LC and OC groups are statistically significant (P<0.001);
b, The difference between LC and MC groups are statistically significant (P<0.05);
c, The difference between OC and MC groups are statistically significant (P<0.001)

Discussion

This retrospective study compared the results of 454 patients who undergo cholecystectomy with laparoscopic, open and mini laparotomy procedures. The LC procedure is introduced in our country at the end of nineties and grows up during the millenniums. However, the distribution of this development stage differs by regions across the country. The founding date of the Faculty of Medicine in the Sakarya University was 2008 and laparoscopic devices could be used since 2009. In the initial dates -during the learning curve-LC was only used in elective cases and OC was performed in emergency operations. Over time, with growing experience and new added laparoscopic devices, OC was replaced with LC in the majority of the cases. This situation is explaining why the majority of cases of the present study underwent OC.

Although, performed with increasing frequency, LC is still inappropriate in the case of high risk elderly or sometimes unsuccessful with a high conversion rate due to visceral conditions such as adhesions.

Since 1992, first reported by Kunz et al.,[12] mini-laparotomy for cholelithiasis has gained access with a high success rate which was initially accepted as an alternative to OC but also over time to LC.[13,14] A length of an abdominal subcostal incision from 4cm up to 6-8cm is defined as MC whereas incision smaller than 4 cm is defined as micro-laparotomy.[15–17] In the present study, all abdominal incisions were ≤6cm.

Results of the present study as well as reports of several previous studies have been pointed out that there is a shift of being younger age in LC performed patients in contrast to OCs and MCs.[2,18] This is a natural result due to increased frequency of co-morbidities (congestive heart failure, chronic obstructive pulmonary disease, cirrhosis, etc.) with aging, which are relative contraindications for laparoscopic pneumoperitoneum.[19] In the present study, MC is significantly more preferred to LC in patients with ASA III score regarding HT, CAD, CRD and CORD diseases. In the retrospective study by Amato et al.,[20] MC was probably preferred to LC in 121 consecutive high risk elderly patients with ASA score ≥3, due to avoidance of pneumoperitoneum related possible complications.

Results of the present study indicate that postoperative complication rate is equal after LC, OC or MC whereas hospitalization period and return to normal daily activities were significantly longer after MC and OC than LC. This is in accordance with other studies.[14,18,21,22]

Like other studies, MC was found more cost effective than LC. Further OC was significantly more expensive than LC and MC strongly associated with longer hospitalization period.[6,9] The present study has some limitations. First, it is in retrospective nature. Secondly, postoperative pain assessment couldn't be done. Third, the sample size is small. On the other hand, it gives valuable information regarding the preference of MC to LC in patients with ASA III, which couldn't be stated in prospective randomized controlled studies due to regular matching of the groups.

In conclusion, MC is a safe, practical, and cost effective procedure which can be considered where LC is not applicable or not preferred due to higher cost and elderly patients having risk for pneumoperitoneum.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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