

The impact of surgical experience on complications of laparoscopic cholecystectomy

Mamakeev M.M.¹, Zhortuchiev R.K.¹, Beyshenaliev A.S.², Niyazbekov K.I.¹

¹ Kyrgyz National Center of Surgery, Bishkek, Kyrgyzstan

² Department of Propaedeutic Surgery, Kyrgyz State Medical Academy, Bishkek, Kyrgyzstan

Abstract

Objective: Laparoscopic cholecystectomy (LC) is the gold standard option for the surgical treatment of cholecystitis. Meanwhile, experience of surgical center and operator play central role in adequate management of patients with gallbladder disorders. The aim of this study is to analyze complications and conversion rates of laparoscopic cholecystectomy at various periods of implication of the method in a single center.

Methods: We retrospectively analyzed early complications of 6381 patients operated due to various forms of cholecystitis according to periods of implication of LC in Kyrgyz National Center of General Surgery (1996-2019). Patients were divided into 3 groups: first group of patients were operated from 1996 to 2004 during first implementation of technique (n=1446); second group patients underwent operation between 2005-2008, when operators concentrated on technical skills (n=1225); third group of patients operated between 2009 and 2019, when surgical team concentrated on prevention of complications.

Results: Both complication and conversion cases represented strong association with surgical experience. The highest complications (4.8% vs 1.5% and 0.4%, respectively, $p < 0.001$) and conversion to surgical cholecystectomy (11.2% vs 1.5% and 0.1%, respectively, $p = 0.001$) rates were detected in group 1 as compared to groups 2 and 3.

Conclusion: Occurrence of complications and conversion to conventional surgical cholecystectomy reduced over time, depending on surgical experience of operating team and practice of operator.

Key words: cholecystitis, laparoscopic cholecystectomy, intraoperative complications, postoperative complications, conversion, surgical experience

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Introduction

The applicability of laparoscopic cholecystectomy (LC) has become relevant for a number of reasons, among which is the widespread increase in the number of patients with gallstone disease (GD) and inflammation of gall bladder (GB) - acute cholecystitis (AC) (1-3). There is no doubt that the cholelithiasis is one of the most common diseases of our time (4, 5).

According to WHO data, more than 10% of the world's population suffers from it, and the number of patients continues to grow, increasing over each subsequent decade by about two times (6, 7).

According to summary data, with the advent of laparoscopes in developed countries, the number of LC performed reached

95% (8-10). The rapid and ubiquitous introduction of LC was promoted by the advantages of this operation compared to traditional methods: low morbidity, good tolerance by patients, cosmetic sutures, short rehabilitation periods, fewer postoperative complications (2, 11, 12).

The aim of this study is to analyze complications and conversion rates of laparoscopic cholecystectomy at various periods of implication of the method in a single center.

Methods

Study design

Observational retrospective cohort study of postoperative complications and conversion rates following LC on the basis

Address for Correspondence: Zhortuchiev R.K., Kyrgyz National Center of Surgery, Bishkek, Kyrgyzstan

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of retrospectively collected clinical findings.

Study population

Totally, 8250 patients with cholelithiasis, chronic and acute cholecystitis who underwent biliary surgery in Kyrgyz National Center of Surgery (KNCS) from 1996 till 2019 were analyzed.

All patients who underwent LC including further converted to surgical cholecystectomy cases due to any form of cholecystitis were enrolled into study (n=6381), whereas patients operated initially by conventional open surgery were excluded (n=1869). Patients were categorized into three groups according to operated timelines and experience -implementation of LC methods, obtaining of technical skills and development of prevention: first group of patients were operated from 1996 to 2004 during first implementation of LC technique (n=1446); second group of patients underwent operation between 2005 and 2008, when operators focused on technical skills (n=1225); third group of patients were operated between 2009 and 2019, when surgical team applied efforts on prevention of complications.

All patients provided informed consent before undergoing procedures. Ethics permission was obtained from committee of the Kyrgyz National Center of General Surgery.

Data collection

We collected demographic data of patients- sex and age, clinical type of cholecystitis- acute or chronic, calculous or acalculous, clinical-morphological type of GD - acute calculous cholecystitis, acute gangrenous cholecystitis, and acute

phlegmonous cholecystitis. The following intraoperative and postoperative complications: cystic stump leakage, bleeding from vessels of anterior abdominal wall, cystic artery bleeding, bleeding from GB bed, bile leakage from GB bed, vena porta injury, choledochoduodenal fistula, injury of hepatic and common bile ducts as, well as conversion rate to conventional surgical cholecystectomy were obtained from records of patients.

Statistical analysis

Statistical analysis was performed on MS Excel 2016 software. The surgical experience by means of operating period groups was considered as the predictor (independent) variable. Early postop complications were considered as the primary outcome variable. The Chi-square test was used to compare postoperative complications and conversion rates between groups.

Results

Demographic and clinical characteristics of patients

Mean age of patients was 45 years (the older age 82 years, the youngest age – 18 years, age range was 64 years). The main proportion of study population was women and people over 40 years old. As can be seen from Table 1, out of 6381 patients undergoing LC, there were 1243 men (19.5%) and 5138 women (80.5%). In the age aspect, people of young and working age prevailed: from 21 to 30 years old - 317 (5.0%), from 31 to 40 years old - 1419 (22.2%), from 41 to 50 years old - 1800 (28.2%), and from 51 to 60 years - 1202 (18.8%).

Table 1. Gender and age distribution

Sex	Total		Age, years					
	Absolute count	%	<20	21-30	31-40	41-50	51-60	>60
Male	1243	19.5	2	28	331	452	146	284
Female	5138	80.5	36	289	1088	1348	1056	1321
Total, n (%)	6381	100	38 (0.6)	317 (5.0)	1419 (22.2)	1800 (28.2)	1202 (18.8)	1605 (25.2)

Analysis of clinical types of gall bladder diseases in patients undergoing LC demonstrated that acute calculous cholecystitis prevailed. As can be seen from Table 2, AC was present in 4512 (70.7%) patients, of which 4491 (70.4%) were patients with

calculous manifestation, acalculous AC was found in 21 (0.3%) patients, chronic cholecystitis was diagnosed in 1869 (29.3%) patients.

Table 2. Patient distribution according to clinical type of cholecystitis

Clinical type of GD	Patient count	
	Absolute number	%
Calculous CC	1869	29.3
Calculous AC	4491	70.4
Acalculous AC	21	0.3
Total	6381	100

AC – acute cholecystitis, CC – chronic cholecystitis, GD- gall bladder disease

Assessment of clinico-morphological type of gall bladder diseases revealed high prevalence of acute phlegmonous cholecystitis, As can be seen from Table 3, 1026 (21.5%)

patients were operated for acute calculous cholecystitis (ACC), 2999 (66.9%) for acute phlegmonous cholecystitis (APC), 487 (11.6%) for acute gangrenous cholecystitis (AGC).

Table 3. Patient distribution according to clinico-morphological type of GD

Clinical-morphological type	Patient number	
	Abs. count	Percentage
ACC	1026	21.5
APC	2999	66.9
AGC	487	11.6
Total	4512	100

ACC- acute calculous cholecystitis, AGC- acute gangrenous cholecystitis, APC- acute phlegmonous cholecystitis, GD- gall bladder disease

Complications and conversion rates in LC according to surgical experience

The first group included 1446 patients, intervened in the period from 1996 to 2004. The large amount of complication and conversion rates observed during this period: 70 various intra-operative complications and 162 conversion cases. The structure of complications is depicted in Table 4. The most registered pitfall was cystic artery bleeding.

The second group included 1225 patients underwent operation between 2005 and 2008. The total amount of adverse outcomes counted as 18 complications with

prevalence of cystic artery bleeding and bile leakage (both were registered in six cases). Eighteen cases were converted to open surgery.

The third group included 1841 patients, underwent operation between 2009 and 2019. During this period, complications and converted cases greatly reduced with maximum of 8 and 2 cases, respectively (0.4 and 0.1%).

The highest complications (4.8% vs 1.5% and 0.4%, respectively, $p < 0.001$) and conversion to surgical cholecystectomy (11.2% vs 1.5% and 0.1%, respectively, $p = 0.001$) rates were detected in group 1 as compared to groups 2 and 3 (Table 4).

Table 4. Comparative analysis of intra- and post-operative complications and conversion rates on the basis of laparoscopic cholecystectomy development

Complication	1st group (n=1446)		2nd group (n=1225)		3rd group (n=1841)		p
	N	%	N	%	N	%	
Intraoperative and postoperative complications	70	4.8	18	1.5	8	0.4	<0.001
Cystic stump leakage	5	0.3	-	-	-	-	
Bleeding from vessels of anterior abdominal wall	2	0.1	-	-	-	-	
Cystic artery bleeding	33	2.3	6	0.5	-	-	
Bleeding from gall bladder bed	3	0.2	4	0.3	1	0.05	
Bile leakage from gall bladder bed	12	0.8	6	0.5	7	0.4	
Vena porta injury	2	0.1	-	-	-	-	
Choledochoduodenal fistula	2	0.1	-	-	-	-	
Injury of hepatic and common bile ducts	12	0.8	2	0.2	-	-	
Conversion	162	11.2	18	1.5	2	0.1	0.001

Discussion

According to our data, in case of AC, LC was performed 3.5 times more often than with CC. Meanwhile, over the years of the history of laparoscopic surgery, AC has been a contraindication to LC. Obviously, LC with AC always belonged to the category of "difficult" LC, particularly in outpatient settings in developed countries (13). Furthermore, destructive forms of AC were found in 3486 (77.3%) of our patients.

During the implementation period, there was an active development of LC methods, development of optimal terms for the operation, indications and contraindications were reviewed. The vast majority of complications were occurred especially in the group of patients underwent operation in this period.

During the period of provision of technical skills, the surgical team has been guided by pioneers of this field and concentrated on improving surgical experience for performing LC.

Recent period, when the surgical team took into account all the shortcomings and pitfalls of previous periods characterized by lesser complication and conversion rates. Basically, during this period, the preventive manners were taken into account. The complications rates were significantly lower ($p < 0.001$) during later periods and as compared with first period of implementation of LC.

According to Kaushik (14) bleeding complications following LC constituted up to 10% and can occur at any time during operation, both in intraoperative and postoperatively.

In our study, bleeding from the cystic artery in the first period occurred in 33 (2.3%) and in the second period - in 6 (0.5%) patients. In recent years, with the improvement of qualification and development of preventive techniques, these complications became ceased.

Bleeding from the gallbladder bed was observed quite rarely in contrast to cystic artery bleeding. Some case reports informed the impact of middle hepatic artery as a potential source of bleeding (15). In some cases, with acute phlegmonous and gangrenous cholecystitis with difficulties in stopping bleeding from the gallbladder bed, we used Tachocomb. Thus, this complication in our cases did not depend on the operating surgeon, but depends on the morphological form of acute cholecystitis.

Bile leakage from the gallbladder bed was found in all three groups. In the first group - in 12 (0.8%), in the second - in 6 (0.5%) and in the third group - in 7 (0.4%) patients. In all three groups, bile flow from the gallbladder bed was stopped conservatively. It depended on the fact that after LC the subhepatic space was well drained.

On the first day, when bile flow started, we prescribed detoxification, antibiotics, strict bed rest and dynamic observation. In all cases, bile flow from the bed of the gallbladder gradually reduced the amount of secreted bile and closed spontaneously for 4-5 days.

Some authors published results on the superiority of subtotal cholecystectomy in prevention of bile duct injury (16).

Conversion also decreased with the gaining of experience. If in the first period, the period of mastering LC, the conversion occurred in 162 patients (11.2%), then in the second period - in 18 patients (1.5%) and in the 3rd period-in 2 patients (0.1%) ($p=0.001$).

Study limitations

In this work we could only retrospectively and comparatively analyze the complication rates among experiencing periods due to scarcity of baseline data, but exact predisposing factors and long-term outcomes following operation must be defined by other measuring tools, such as regression and survival analytic models in future prospective investigations.

Conclusion

LC has its own limitations and contraindications, which the surgeon of any professional experience needs to consider. Occurrence of complications and conversion to conventional surgical cholecystectomy reduced over time, depending on surgical experience of operating team and practice of operator. The central role in intraoperative and postoperative management of patients depends on surgical experience of team and operator.

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