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Laparoscopic cholecystectomy after a quarter century: why do we still convert?

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Abstract

Background—Laparoscopic cholecystectomy (LC) is the gold standard procedure for gallbladder removal. However, conversion to open surgery is sometimes needed. The factors underlying a surgeon's decision to convert a laparoscopic case to an open case are complex and poorly understood. With decreasing experience in open cholecystectomy, this procedure is however no longer the “safe” alternative it once was. With such an impending paradigm shift, this

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study aimed to identify the main reasons for conversion and ultimately to develop guidelines to help reduce the conversion rates.

Methods—Using the National Surgical Quality Improvement Program (NSQIP) database and financial records, the authors retrospectively reviewed 1,193 cholecystectomies performed at their institution from 2002 to 2009 and identified 70 conversions. Two independent surgeons reviewed the operative notes and determined the reasons for conversion. The number of ports at the time and the extent of dissection before conversion were assessed and used to create new conversion categories. Hospital length of stay (LOS), 30-day complications, operative times and charges, and hospital charges were compared between the new groups.

Results—In 91% of conversion cases, the conversion was elective. In 49% of these conversions, the number of ports was fewer than four. According to the new conversion categories, most conversions were performed after minimal or no attempt at dissection. There were no differences in LOS, complications, operating room charges, or hospital charges between categories. Of the six emergent conversions (9%), bleeding and concern about common bile duct (CBD) injury were the main reasons. One CBD injury occurred.

Conclusions—In 49% of the cases, conversion was performed without a genuine attempt at laparoscopic dissection. Considering this new insight into the circumstances of conversion, the authors recommend that surgeons make a genuine effort at a laparoscopic approach, as reflected by placing four ports and trying to elevate the gallbladder before converting a case to an open approach.

Keywords

Conversion; Gallbladder removal; Laparoscopic cholecystectomy

After the introduction of laparoscopic cholecystectomy (LC), this approach rapidly became the gold standard for gallbladder removal [1, 2]. Despite advances in training and increased clinical experience, however, conversion rates reaching 10% still are reported, with little improvement during the past decade [3–11].

Several studies, including one by our group, have shown that converted cases are associated with a longer hospital stay and higher costs [3, 12]. Few studies have investigated the reasons for conversion. Many think that a decision to convert should be made early in a laparoscopic case to avoid a complication, believing that a long laparoscopic case is associated with greater complications. Such attitudes are reflected in medicolegal cases, with a long laparoscopic case used to argue for a poor surgical judgment [13]. As experience with open cholecystectomy continues to decrease in surgical training programs, we believe that converting to open cholecystectomy is no longer associated with increased safety.

This study aimed to provide a contemporary review of the timing and reasons for conversions in a large academic institution and to develop possible guidelines for determining when conversions should be considered.

Methods

Data source and reviewers

After receiving Institutional Review Board approval, we used Current Procedural Terminology codes (47562, 47600) and our institutional National Surgical Quality Improvement Program (NSQIP) database to identify 1,192 cholecystectomies performed and entered into the database between January 2002 and September 2009. The NSQIP is a nationally collected standardized clinical registry system designed and launched by the

American College of Surgeons. The NSQIP database allows reliable and standardized follow-up assessment for 30-day postoperative complications and was therefore used in our study.

We identified 70 converted cases after failed attempts at a standard four-port LC. The postgraduate year (PGY) of assisting residents was recorded. Two blinded, independent reviewers (minimally invasive surgical fellows with experience performing more than 100 LCs) examined the operative reports and identified the surgical effort at dissection undertaken before conversion to open surgery (Effort score) as well as the reasons behind the conversion and the number of ports placed at the time of conversion (Table 1). Cases were categorized according to definitions given in the following sections.

Effort scores

Conversion was classified as “minimal” if it was performed immediately after entrance to the abdomen without any attempt at gallbladder retraction. A case was categorized as “some dissection” if conversion occurred after an attempt at exposing and possibly dissecting structures at Calot's triangle. Finally, a case was identified as “extensive dissection” if conversion followed near complete dissection of Calot's triangle.

Number of ports placed

All cases also were reviewed by the blinded reviewers, who estimated the number of ports placed before conversion.

Reasons for conversion

The reason for conversion was categorized as elective if the conversion was performed before a complication developed or emergent if it was performed after a complication such as bleeding or bile duct injury had occurred. Elective conversions were further subcategorized into three groups: those due to an inflammatory process, those due to noninflammatory adhesions, and those due to unusual anatomy.

Using our data on the laparoscopic effort by the surgeon and the number of ports placed before the conversion, the conversions were recategorized using a new system. A case was labeled as category 1 if the surgeon was unable to access the peritoneal cavity. Category 1 cases were excluded from further analysis ($n = 4$). Category 2 reflected cases in which pneumoperitoneum was created and attempts at laparoscopic dissection were undertaken. This category was subdivided into 2A and 2B, based on the degree of dissection attempted. Category 2A was assigned to a case if minimal effort was made to dissect structures laparoscopically, as reflected in a case converted immediately or with fewer than four ports in place at the time of conversion. Category 2B was defined as lack of exposure of critical structures despite efforts at laparoscopic dissection and placement of four or more ports.

Finally, emergent conversions due to an intraoperative complication were placed in category 3. Postoperative complications, hospital length of stay (LOS), total operating room (OR) cost, and total hospital cost were compared among the different categories.

Statistical analysis

An interrater reliability test was performed to determine agreement between the findings of the two independent reviewers. The kappa coefficient was calculated using SPSS version 16.0 (SPSS, Chicago, IL, USA). A kappa value of 0.6 or higher was considered as showing substantial agreement, and a value of 0.8 or higher was considered as showing excellent agreement. For cases with differences between the two reviewers, the senior author reviewed the operative note independently and determined the final category, blinded to the

other reviewers' comments. For comparison of the three categories, analysis of variance (ANOVA) was used for continuous variables such as LOS, OR time, OR cost, and hospital cost. Complication rates were compared using the nonparametric Kruskal–Wallis test. A *P* value less than 0.05 was considered significant.

Results

From the 1,192 cholecystectomies performed at our institution, we identified 70 converted cases (CPT code 47600), and 1,122 LC cases (CPT code 47562). This corresponds with an overall conversion rate of 5.8%. Before conversion, all the procedures were planned to be multiport cholecystectomies.

The mean operative time was 70 min for the LC cases and 104 min for the converted (CONV) cases ($P < 0.01$). The two groups differed significantly in overall 30-day morbidity rates (LC 4% vs. CONV 10%; $P < 0.01$), and LOS was longer for converted cases (1 vs. 5 days; $P < 0.01$).

All the converted cases were analyzed by the two independent reviewers. As mentioned earlier, cases converted because of failure to access the abdomen were eliminated from further analysis ($n = 4$). No intraoperative cholangiogram was performed in the 70 studied cases. Regarding level of assistance, 12 cases had no available data about resident involvement (missing data). In 57 cases, residents—whose PGY level varied between 1 and 5—operated with an attending physician. In only one case was no resident present. We calculated means for the PGY levels of the assisting residents, which were similar between the three groups (2.9 vs. 2.6 vs. 2.4 for categories 2A, 2B, and 3, respectively).

Conversions then were categorized based on the Effort score and deemed immediate in 36 cases (48%). In 26 cases (39%), conversion was performed after some dissection. Only eight cases (13%) were converted after an extensive dissection. The kappa correlation coefficient for effort classification was 0.603, showing substantial agreement between the reviewers (Table 1).

The number of trocars, also evaluated by the reviewers, showed excellent interrater agreement (kappa, 0.875). In 22 cases (33%), only one trocar had been inserted when the conversion occurred. All of these cases involved immediate conversions. Two or three trocars were used in 10 cases (15%), and four or more trocars were used in 34 cases (52%) (Table 2).

Conversion was regarded as elective in 60 cases (91%) and as emergent in 6 cases (9%). This measure showed substantial agreement between the reviewers (kappa, 0.63). The reasons for elective conversions are shown in Table 3. Of these elective conversions, 20 were because of noninflammatory adhesions (30%), 37 because of inflammatory processes (56%), and 3 because of unusual anatomy/intraoperative findings (5%). Cases that led to conversion due to unusual anatomy/intraoperative findings included two cases in which the gallbladder was deeply intrahepatic and one case in which an enlarged liver and an incarcerated ventral hernia containing the transverse colon made adequate visualization difficult. For the six emergent conversions (9%), the reasons for conversion were bleeding and concern for common bile duct (CBD) injury. The majority of these secondary conversions (4/6, 66%) were performed after an extensive dissection time. One CBD injury occurred in this group.

Using Effort scores and number of trocars, cases were categorized according to the new system described in Table 4. Category 1 had 4 cases (6%); category 2A had 34 cases (49%); category 2B had 26 cases (37%); and category 3 had 6 cases (8%).

Comparison of the different categories in terms of complication rate, LOS, total OR room and hospital charges, and operative time showed differences among the categories (Table 5). The total number of complications in category 2A was 5 (15% within the group): one in category 2B (4% within group) and one in category 3 (17% within the group). However, this difference did not reach significance. The numbers within each group also were too small to compare severity of complications in each group. There was one CBD injury in category 3. The average LOS was 4.9 ± 2.5 days for category 2A, 4.6 ± 2.5 days for category 2B, and 3.5 ± 1.4 days for category 3. The mean operative time was significantly shorter for category 2A (94 min) than for category 2B (124 min) ($P < 0.05$). The three categories did not differ significantly in terms of total OR cost or total hospital cost.

Discussion

Laparoscopy is the dominant approach in many abdominal surgical procedures including cholecystectomy [1, 2]. After its introduction in 1986 and a quarter century of training and practice, conversion rates reaching 10% continue to be reported in large contemporary series [4, 9, 14, 15]. Conversion is associated with increased hospital costs and LOS [3, 16, 17] as well as likely increases in postoperative pain and long-term complications such as hernias. Despite these disadvantages, it still is unclear why conversions occur. Thus, recommendations to reduce their rate remain elusive.

Although in some cases an “emergency” conversion is necessary, in many circumstances conversion is performed “electively” due to an anticipated difficulty, with many recommending a quick decision to convert a laparoscopic case to open procedure to avoid complications thought to be associated with a long laparoscopic case [17, 18]. However in the current era of increased laparoscopic training and decreased experience with open cholecystectomy, we are facing a paradigm shift in which we believe surgeons are more comfortable with a difficult laparoscopic approach than with an open procedure. To support this hypothesis, we have previously shown that a prolonged laparoscopic case does not lead to more complications than a converted case but in fact offers patients and the health care system advantages by shortening the hospital stay and reducing hospital costs [12]. In this study, we aimed to provide a better understanding of the circumstances surrounding conversion and to highlight opportunities for attempts to lower this rate.

Our data show that the majority of conversions were elective (91%), with inflammatory processes as the primary reason for conversion (56% of cases). We found it interesting that in 48% of cases, conversion was performed after minimal or no effort at laparoscopic dissection, with no retraction of the gallbladder (minimal Effort score; Table 1). This emphasizes the general principle that some surgeons follow: favor a quick decision to convert without a significant attempt at laparoscopic dissection. This guiding principle is further highlighted by the fact that in a similar number of cases (49%), fewer than the standard four ports were placed before a conversion was performed. We believe such data highlight the prevailing attitude that encourages an early conversion in cases of an anticipated difficult laparoscopic case.

Taking into account the effort expended to perform a dissection (Effort score) and the number of ports placed before conversion, we subsequently developed a new set of conversion categories (Table 4). Category 1 includes the few cases in which access to the peritoneal cavity is not obtained and open surgery is pursued. Because clinicians in these circumstances do not have the opportunity to make an effort at a laparoscopic approach despite their predisposition, we excluded category 1 cases from further analysis.

Category 2A includes cases in which our blinded reviewers felt no effort at a laparoscopic dissection was made. We believe that these cases, accounting for 49% of conversions, provide an opportunity for changes in attitude and advice that could lead to a reduction in conversion rates. The recommendation for these cases is that surgeons, whenever possible, should place the standard number of ports and try to identify and elevate the gallbladder before making a decision to convert to open surgery.

The concern about such advice is that it could lead to increased complications as surgeons pursue increasingly difficult laparoscopic cases. Our data however show that cases in which a surgeon made a genuine effort at a laparoscopic approach (4 ports placed and Calot's triangle visualized) (category 2B) did not have an increase in the total number of complications compared with category 2A. Although the OR time for these cases was longer, this was not associated with an increase in overall hospital cost.

These data prompted us to recommend that in laparoscopic cases, surgeons should give the approach a genuine chance by placing four trocars and attempting to expose the gallbladder instead of converting to an open approach at the anticipation of difficulty. We anticipate that such an approach will reduce the number of cases in category 2A. In some 2A cases, the surgeon may be able to accomplish the case laparoscopically, which will be of great advantage to the patient even if management of the case takes longer. If the case is ultimately converted to open surgery (category 2B), there is no disadvantage to the patient (similar complication rates) or health care system (similar hospital costs).

Although recent single-incision approaches have promoted the use of fewer trocars, we believe that for complex cases, surgeons should attempt the traditional four-port technique before contemplating conversion to open surgery. Once the appropriate number of ports is placed and attempts at exposure are made, surgeons should use judgment as to when to convert. We acknowledge that conversion can be a sign of good surgical judgment, provided a genuine effort at the laparoscopic approach has been made.

Our study showed that 66% of emergency conversions (category 3) occurred after prolonged dissection, suggesting that moderation needs to temper enthusiasm for the laparoscopic approach. It should also be noted, however, that even in category 3, LOS, cost of care, and postoperative complications were comparable with those in category 2A.

This study had several limitations. Most importantly, the sample size was relatively small compared with the volume of LCs performed. Although we could have used the larger national NSQIP database or other similar sources, we would not have been able to obtain individual operative reports or to determine reasons for conversion, number of ports placed, or cost. We also have not taken into account the degree of laparoscopic training or the experience of the surgeons who participated in the study. We can state, however, that all the surgeons involved in this analysis routinely performed LC, with several years of clinical experience. Investigating the impact of surgical subspecialty and minimally invasive surgical training on conversion rates could be an interesting focus for a future study.

Based on the presented data, we believe that a conversion should be considered after the appropriate number of ports have been placed and some effort at gallbladder identification and retraction has been made. We acknowledge, however, that these findings need to be validated with larger cohorts in different settings (nonacademic) before they can be fully implemented. Other factors, including the surgeon's judgment and comfort level, need to be considered and respected as the ultimate determinant of conversion.

In an era of increasingly limited experience with open cholecystectomy [19–21], when surgeons often are well trained in laparoscopic techniques, we believe the old

recommendation that a quick conversion to open surgery is better than a prolonged laparoscopic case may no longer be true. We do not believe that a decision on conversion should be based on anticipated difficulty or arbitrary time lines of 15 or 30 min of laparoscopic dissection before conversion is considered. We believe that all laparoscopic cases should be genuinely attempted, the correct number of ports placed, and some effort made at dissection. To help improve on our conversion rates, which have remained stubbornly stable over the past decade, we should not only evaluate the rate of conversion but also consider the category of conversion (Table 4).

A quarter century after the introduction of LC, decisions regarding conversion continue to be made early and after minimal to no effort at adhesiolysis or dissection. With the circumstances of conversion precisely understood, a significant number of conversions can be prevented for the potential benefit to the patient and improvement in the field of minimally invasive surgery.

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Table 1

Extent of dissection before conversion of the case (Effort score)

	No of cases (<i>n</i> = 66)	%
Minimal	32	48
Some dissection	26	39
Extensive dissection	8	13

Table 2

Number of trocars placed before conversion

	No. of cases (<i>n</i> = 66)		%
1	22	33	
2	3	5	
3	7	11	
4-5	34	51	

Table 3

Reasons for conversion

	No. of cases (<i>n</i> = 66)	%
Elective		
Inflammatory process	37	56
Noninflammatory adhesions	20	30
Unusual anatomy/intraop findings	3	5
Emergent (bleeding, concern for CBD injury)	6	9

intraop intraoperative, *CBD* common bile duct

Table 4

New conversion categories taking into account Effort score and number of ports

Category code	Definition
1	Inability to access peritoneal space
2A	Lack of effort to dissect to achieve appropriate exposure
2B	Lack of exposure despite the effort to dissect
3	Emergent conversion

Table 5

Comparison of outcomes and costs between the different conversion categories

	2A (n = 34)	2B (n = 26)	3 (n = 6)	P Value
OR time (min)	94 ± 37	124 ± 41	122 ± 39	<0.05
No. of total complications	5	1	1	NS
LOS (days)	4.9 ± 2.5	4.6 ± 2.5	3.5 ± 1.4	NS
Total OR charge (\$)	14,140 ± 5,326	15,039 ± 5,403	15,493 ± 5,154	NS
Total hospital charge (\$)	37,961 ± 19,039	38,647 ± 33,494	29,980 ± 7,983	NS

NS not significant, OR operating room, LOS length of hospital stay