Surg Endosc (2000) 14: 755–760
DOI: 10.1007/s004640000182

Surgical Endoscopy
Ultrasound and
Interventional Techniques

Laparoscopic cholecystectomy for acute cholecystitis: Can the need for conversion and the probability of complications be predicted?

A prospective study

A. Brodsky, I. Matter, E. Sabo, A. Cohen, J. Abrahamson, S. Eldar

Department of Surgery, Bnai Zion Medical Center, the Faculty of Medicine, and the Faculty of Industrial Engineering and Management, the Technion, Israel Institute of Technology 47 Golomb Street, Post Office Box 4940, Haifa 31048, Israel

Received: 14 July 1999/Accepted: 21 December 1999/Online publication: 10 July 2000

Abstract
Background: Laparoscopic cholecystectomy (LC) in acute cholecystitis is associated with a relatively high rate of conversion to an open procedure as well as a high rate of complications. The aim of this study was to analyze prospectively whether the need to convert and the probability of complications is predictable.
Methods: A total of 215 patients undergoing LC for acute cholecystitis were studied prospectively by analyzing the data accumulated in the process of investigation and treatment. Factors associated with conversion and complications were assessed to determine their predictive power.
Results: Conversion was indicated in 44 patients (20.5%), and complications occurred in 36 patients (17%). Male gender and age >60 years were associated with conversion, but these factors had no sensitivity and no positive predictive value. The same factors, together with a disease duration of >96 h, a nonpalpable gallbladder, a white blood count (WBC) of >18,000/cc^3, and advanced cholecystitis, predicted conversion with a sensitivity of 74%, a specificity of 86%, a positive predictive value of ~40%, and a negative predictive value of 96%. However, these data became available only when LC was underway. Male gender and a temperature of >38°C were associated with complications, but these factors had no sensitivity and no positive predictive value. Progression along the stages of admission and therapy did not add predictive factors or improve the predictive characteristics. Male gender, abdominal scar, bilirubin >1 mg%, advanced cholecystitis, and conversion to open cholecystectomy were associated with infectious complications. Their sensitivity and positive predictive value remained 0 despite progression along the stages of admission and therapy.
Conclusion: Although certain preoperative factors are associated with the need to convert a LC for acute cholecystitis, they have limited predictive power. Factors with higher predictive power are obtained only during LC. The need to convert can only be established during an attempt at LC. Preoperative and operative factors associated with total and infectious complications have no predictive power.

Key words: Laparoscopic cholecystectomy — Cholecystitis — Conversion — Complications — Gallbladder

Correspondence to: S. Eldar

Laparoscopic cholecystectomy (LC) for acute cholecystitis may be technically difficult and is associated with relatively high conversion and complication rates [3, 9]. In this situation, open cholecystectomy may be preferable. Accurate predictors of conversion and complications of LC in acute cholecystitis would allow selection of the optimal approach; the earlier the predictors are available, the safer and more cost-effective the approach will be.

In an earlier report [3], we established the factors associated with the need for conversion and complications of LC. For the present study, we collected the data in a prospective manner—i.e., in the sequence they are acquired clinically from admission to surgery. This methodology enabled us to test how various factors identified in the process of investigating and treating acute cholecystitis could predict the eventual need for conversion.

Materials and methods

Study group

Between January 1994 and February 1997, 956 patients underwent LC at the Department of Surgery, Bnai Zion Medical Center, Haifa, Israel. Of these, 215 patients (22%) were treated for acute cholecystitis. The clinical diagnosis was based on right upper quadrant pain and/or tenderness, fever,

Table 1. Patient characteristics

Number of patients	215
Female/male ratio	125 (58%)/90 (42%)
Age range (mean ± SD)	18–92 yr (54.5 ± 15.8)
Previous history of biliary pathology	94 (44%)
Associated diseases	88 (41%)
Range of duration of complaints (mean ± SD)	6–480 h (82 ± 74.75)
Range of temperature (mean ± SD)	36–40°C (37.5 ± 0.9)
Palpable gallbladder	71 (33%)
Abdominal scar	36 (17%)
Range of WBC (mean ± SD) x 1000	5.6–29/cc^3 (12.8 ± 4.1)
Range of bilirubin (mean ± SD)	0.38–5.8 mg% (1.06 ± 0.8)
Range of alkaline phosphatase (mean ± SD)	35–350 U/L (87.5 ± 40.5)
Range of diastase (mean ± SD)	22–2865 U/L (113.6 ± 235.7)

WBC, white blood cell count

and/or leukocytosis. It was supported by ultrasound in 201 cases (93.5%), by HIDA studies in 35 cases (16%), and by CT scan in four cases (2%). The patient characteristics are presented in Table 1.

All patients underwent an emergency LC as soon as the diagnosis was established. The diagnosis of empyema or hydrops of the gallbladder was based on the content of pus or mucus in the gallbladder (when aspirated laparoscopically); gangrenous cholecystitis was diagnosed by the presence of gangrenous patches on the gallbladder wall (observed laparoscopically and confirmed pathologically).

For the present study, the diagnosis of acute cholecystitis was based on (a) symptoms and signs suggesting clinical acute cholecystitis; (b) ultrasound or CT findings of a thickened and edematous gallbladder wall, or a nonfilling gallbladder on HIDA scan; (c) laparoscopic intraoperative findings of acute inflammation, hydrops, or empyema of the gallbladder; (d) histopathological evaluations showing moderately to severely neutrophilic infiltration (compatible with acute cholecystitis or with acute exacerbated chronic cholecystitis). The following groups were excluded from the study: asymptomatic patients diagnosed as having acute cholecystitis, patients who were diagnosed intraoperatively as suffering from acute cholecystitis, patients with acute cholecystitis and choledocholithiasis diagnosed intraoperatively and converted for exploration of the CBD, and patients with no histopathological evidence of neutrophilic infiltration.

All patients received a preoperative dose of cephazolin, 1 g every 8 h, which was discontinued once the temperature had dropped to normal and/or the white blood count (WBC) had started to descend.

Operative technique

The LC was performed by one of four senior surgeons, each of whom had experience of at least 200 laparoscopic cholecystectomies. The standard four-trocar technique used in LC was modified slightly for acute cholecystitis, as previously reported [3, 19, 20]. In a selected subgroup of 40 patients (18.5%), intraoperative cholangiography was performed, but no common duct stones were found. This subgroup was included in the study. Bile spillage was noted. When lacerations were extensive and stones dropped into the peritoneal cavity, the gallbladder as well as any dropped stones were collected in an endoscopic bag and extracted through the umbilical cannula site, which often had to be extended. The decision to leave a closed-system suction drain was left to the individual surgeon. Fascial closure was performed at the umbilical cannula site only. The skin at all the cannula sites was closed with staples.

Data collection

Data sheets were completed prospectively for all patients with a preoperative diagnosis of acute cholecystitis. They were arranged according to the sequence of the diagnostic and therapeutic processes (Table 2).

At **stage 1,** the early stage of admission, the data were based on history and physical examination.

Table 2. Data obtained at each of the diagnostic and therapeutic stages

Stage 1. Early admission: history and physical examination
age
gender
past history of biliary disease
previous abdominal surgery
other associated disease
duration of present biliary episode
palpation of inflamed gallbladder
temperature on admission
Stage 2. Advanced admission: laboratory data
WBC
serum bilirubin
amylase
alkaline phosphatase
Stage 3. Early laparoscopic surgery
type of the inflamed gallbladder
Stage 4. Late laparoscopic procedure
uncontrolled perforation of the gallbladder and spillage of bile
intraperitoneally lost stones
conversion to open cholecystectomy

At **stage 2,** the advanced stage of admission, laboratory data were added to the original information available.

At **stage 3,** the beginning of laparoscopic surgery, intraoperative observations were available.

At **stage 4,** as the laparoscopic procedure progressed, further data were gained, including the need to convert from LC to an open procedure.

Some of these data have been previously reported [3]. The information was entered into a database as either continuous or categorical variables. Gangrenous cholecystitis and empyema of the gallbladder were grouped together as "advanced cholecystitis". Acute cholecystitis and hydrops of the gallbladder were grouped together as "early cholecystitis".

Complications were classified as surgical infections (e.g., wound infection, subphrenic or subhepatic abscess), noninfectious surgical accidents (e.g., bile duct injury, hemorrhage), remote infections (e.g., urinary or respiratory), and miscellaneous problems (e.g., atelectasis, deep vein thrombosis).

Conversion of LC to open cholecystectomy was analyzed in a stepwise manner in relation to the data accumulated in stages 1 to 3. Total complications and surgical infectious complications were studied similarly in relation to the data accumulated in stages 1 to 4. These parameters are outlined in Table 2.

Statistical analysis

Conversion of LC to open cholecystectomy and total and infectious complications (dependent factors) were analyzed in a stepwise fashion in relation to the parameters accumulated at the different stages of admission and treatment (independent factors) by univariate and multivariate analysis. For univariate analysis, comparing qualitative data of two groups; chi-square analysis and Fisher's exact test were used when appropriate. For multivariate analysis, the forward stepwise logistic regression analysis was applied. A probability of up to 0.05 was accepted as statistically significant. The predictive characteristics (sensitivity, specificity, positive predictive value, negative predictive value, and total accuracy) of conversion, complications, and infectious complications of LC were obtained and calculated from the logistic model, using the regression coefficients of the relevant independent variables (predictors), and from their two-by-two tables.

Results

The intraoperative findings and overall outcome of LC is reported in Table 3. The mean length of operation was 66 ± 36 min in the LC group and 120 ± 44 min in the converted group. In 49 patients (29%) of the LC group, duration of surgery was up to 30 min, in 111 (65%) up to 1 h, and in 164

Table 3. Intraoperative findings and outcome of laparoscopic cholecystectomy

Simple cholecystitis	87 (40.5%)
Gangrenous cholecystitis	67 (31%)
Hydrops of the gallbladder	29 (13.5%)
Empyema of the gallbladder	32 (15%)
Acalculous cholecystitis	16 (7.5%)
Small gallstones	126 (58.5%)
Large gallstones	73 (34%)
Spillage of bile	76 (35%)
Lost gallstones	30 (14%)
Length of operation: range (mean ± SD)	15–300 min (80 ± 45)
Conversion to open surgery	44 (20.5%)
Use of drains	65 (30%)
Use of antibiotics (mean ± SD)	1–13 days (2.9 ± 2.1)
Use of meperidine (mean ± SD)	0–1450 mg (130 ± 151.5)
Use of dipyrone (mean ± SD)	0–40 g (1.5 ± 2.3)
Complications	36 (17%)
Infectious complications	13 (6%)
Bile leak	8 (4%)
Postoperative hospital stay (mean ± SD)	1–47 days (4 ± 4.5)

patients (96%) up to 2 h. In seven cases (4%), the laparoscopic procedure extended over 2 h. There were no deaths.

Conversion to open cholecystectomy was necessary in 44 patients (20.5%). Technical difficulties were the reason for conversion in 27 cases (61%), anatomical uncertainty in 11 cases (25%), uncontrolled bleeding in four cases (9%), and bile duct injury in two cases (4.5%).

Complications occurred in 36 patients (17%). Of these, surgical infectious complications (36%) included prolonged fever in two cases, subhepatic abscess in one case, and wound infection in 10 cases; noninfectious complications (28%) included bile leak in eight cases and acute pancreatitis in two cases; remote infectious complications (25%) included pneumonia in seven cases, urinary tract infection in one case, and pseudomembranous enterocolitis in one case; the miscellaneous complications (11%) comprised four cases of atelectasis.

Complaints of various duration from the onset of acute cholecystitis to surgery were associated with different rates of conversion and complications, though they were statistically insignificant (Fig. 1). When the duration of symptoms ranged between 49 and 96 h, the conversion rate to open cholecystectomy, the total complication rate, and the infectious complication rate were the lowest (Fig. 1).

Table 4 shows the relation of various conditions at the different stages of admission and treatment to conversion of LC to open cholecystectomy, with total and with infectious complications (univariate analysis).

Factors associated with conversion (multivariate analysis) (Table 5)

During stage 1, conversion of LC to open cholecystectomy was associated with male gender and age >60 years, but these factors had no sensitivity and no positive predictive value (PPV).

During stage 2, a nonpalpable gallbladder and WBC >18,000/cc^3 were additional predictors, and together with the two factors of stage 1, achieved a sensitivity of 22% and a PPV of 4.6% for conversion.

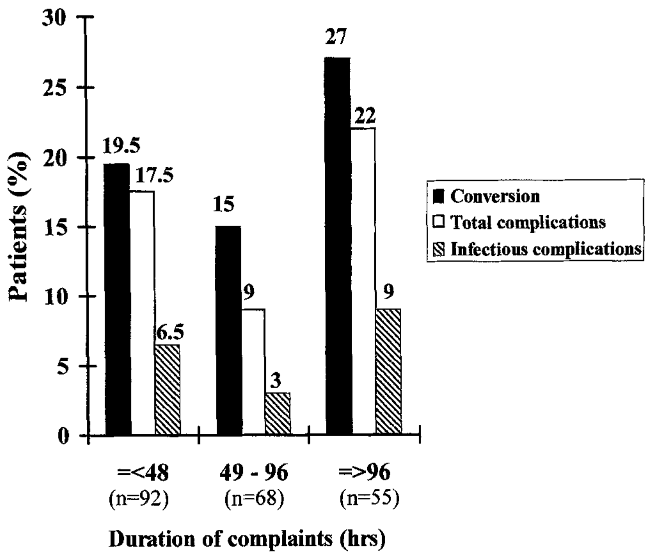

Fig. 1. Influence of delayed surgery on the conversion rate of LC to open cholecystectomy, the total complication rate, and the infectious complication rate.

During stage 3, information regarding the severity of disease (gangrenous cholecystitis vs uncomplicated acute cholecystitis or hydrops) became available. Combining these intraoperative findings with the preoperative factors led to the following risk factors: male sex, age >60 years, duration of the present biliary episode >96 h, a nonpalpable gallbladder, WBC >18,000/cc^3, and advanced gallbladder disease. These risk factors predicted conversion with a sensitivity of 74%, a specificity of 86%, a positive predictive value of 39.5%, a negative predictive value of 96%, and a total accuracy of 85% of the cases.

Factors associated with total complications (multivariate analysis) (Table 6)

During stage 1, the complication rate was associated with male gender and temperature >38°C, with no sensitivity and no positive predictive power. Laboratory data from stage 2 and data obtained in the earlier stage of laparoscopy (stage 3) as well as in the later stage of the laparoscopic procedure (stage 4) did not add predicting factors and did not improve the predictive power.

Factors associated with infectious complications (multivariate analysis) (Table 7)

Male gender and abdominal scars (indicating previous surgery) were factors in stage 1 associated with infectious complications, though with no sensitivity and no positive predictive power. Of the laboratory data of stage 2, elevated bilirubin (>1 mg%) was an additional predictive factor for infectious complications, but it had no better predictive characteristics. The prediction of infectious complications did not improve in stages 3 and 4, although the predictors differed slightly from stage to stage. During the early laparoscopic procedure (stage 3), male gender, abdominal scars, elevated bilirubin, and advanced cholecystitis were

Table 4. Prevalence of conversion to open cholecystectomy and of total and infectious complications at different stages of admission and treatment for acute cholecystitis (univariate analysis)

	LC group	Converted group	*p* value	Noncomplicated group	Complicated group	*p* value	Noninfected group	Group with infectious complications	*p* value
No. of patients	171	44		179	36		202	13	
Stage 1									
Age <50 yr	72	9		73	8				
>50 yr	99	35	0.008	106	28	0.04			
Male	64	26		69	21		79	11	
Female	107	18	0.009	110	15	0.03	123	2	0.001
Without associated disease	107	20							
With associated disease	64	24	0.04						
Temperature <38°C				152	24				
>38°C				27	12	0.01			
Stage 2									
WBC <18,000/cc^3	156	33							
>18,000/cc^3	15	11	0.003						
Bilirubin <1 mg%	121	24					141	4	
>1 mg%	50	20	0.04				61	9	0.004
Stage 3									
Acute cholecystitis	130	17					141	6	
Advanced cholecystitis	41	27	<0.0001				61	7	0.08
Stage 4									
No perforation of gallbladder							127	12	
Perforation of gallbladder							75	1	0.03
LC group							167	4	
Converted group							35	9	<0.0001

Table 5. Predictive factors for conversion to open cholecystectomy at progressive stages of diagnosis and treatment and their predictive characteristics (multivariate analysis)

	p value	Odds ratio[a]	Sensitivity	Specificity	PPV	NPV	Total accuracy
Stage 1							
Male gender	0.009	2.5					
Age >60 yr	0.005	2.7	0%	79.7%	0%	100%	79.7%
Stage 2							
Male gender	0.008	2.7					
Age >60 yr	0.008	2.7					
Nonpalpable gb	0.016	3.1					
WBC >18,000/cc^3	0.014	5.2	22.2%	79.7%	4.6%	95.8%	77.2%
Stage 3							
Male gender	0.007	3.1					
Age >60 yr	0.013	2.8					
Disease >96 h	0.046	2.4					
WBC >18,000/cc^3	0.0008	6.3					
Nonpalpable gb	0.0002	7.6					
Advanced cholecystitis	<0.00001	9.4	73.9%	86.1%	39.5%	96.4%	84.8%

gb, gallbladder; *PPV,* positive predictive value; *NPV,* negative predictive value
[a] The odds ratio reveals the strength of association between the independent factors and the conversion as an outcome

predictive factors of infectious complications. The predictors of stage 4 were male gender, abdominal scars, and conversion of LC to open cholecystectomy. The factors of all the stages predicted infectious complications with a sensitivity of 0%, a specificity of 93.8%, a positive predictive value of 0%, a negative predictive value of 100%, and a total accuracy of 93.8%.

Discussion

LC has been established as the treatment of choice for acute cholecystitis [2, 3, 9, 15]. However, because the conversion rate for acute cholecystitis is significantly higher than that for elective LC [1, 13], the ability to predict cases unsuitable for LC preoperatively could be of value. Factors associated with conversion and complications of LC have been studied in relation to elective cholecystectomy [4, 16] as well as to acute cholecystitis [3, 6, 8, 11, 15]. In the setting of LC and acute cholecystitis, greater age, a history of previous biliary disease, the finding of a nonpalpable gallbladder, leukocytosis, and gangrenous cholecystitis were all associated with higher conversion rates [2, 3, 4, 8, 15, 16, 17]. Male gender, elevated WBC, elevated serum bilirubin and the presence of large bile stones were found to be associated with higher rates of complications [3]. Obesity was a risk factor for

Table 6. Predictive factors for complications of laparoscopic cholecystectomy at all stages of diagnosis and treatment of acute cholecystitis and their predictive characteristics (multivariate analysis)

	p value	Odds ratio[a]	Sensitivity	Specificity	PPV	NPV	Total accuracy
Male gender	0.019	2.5					
Temperature >38°C	0.004	3.4	0%	83.9%	0%	100%	83.9%

PPV, positive predictive value; *NPV,* negative predictive value
[a] The odds ratio reveals the strength of association between the independent factors and the complications as an outcome

Table 7. Predictive factors for infectious complications of LC at different stages of diagnosis and treatment of acute cholecystitis and their predictive characteristics (multivariate analysis)

	p value	Odds ratio[a]	Sensitivity	Specificity	PPV	NPV	Total accuracy
Stage 1							
Male gender	0.003	11.4					
Abdominal scar	0.036	4.3	0%	93.8%	0%	100%	93.8%
Stage 2							
Male gender	0.008	8.9					
Abdominal scar	0.05	4.1					
Bilirubin >1 mg%	0.038	3.8	0%	93.8%	0%	100%	93.8%
Stage 3							
Male gender	0.004	14.8					
Abdominal scar	0.017	6.9					
Bilirubin >1 mg%	0.017	4.9					
Advanced cholecystitis	0.016	5.5	0%	93.8%	0%	100%	93.8%
Stage 4							
Male gender	0.005	18.9					
Abdominal scar	0.004	15.8					
Conversion	0.0005	18	0%	93.8%	0%	100%	93.8%

PPV, positive predictive value; *NPV,* negative predictive value
[a] The odds ratio reveals the strength of association between the independent factors and the infectious complications as an outcome

wound infection [8], and duration of complaints before surgery correlated with conversion as well as total complications [6, 7, 11].

The duration of complaints from the onset of acute cholecystitis and the timing of LC have been the subject of a number of studies. Koo and Thirlby [7] and Lo et al. [11, 12] compared the outcome of LC performed within 72 h from the onset of symptoms to that performed after a longer delay period. According to the first investigators, patients who were operated on earlier had a lower conversion rate, a shorter operative time, and a faster convalescence. According to the second study, the earlier operated group showed a tendency toward a lower conversion rate, a lower complication rate, and a shorter hospital stay. Hashizume et al. [6] and Garber et al. [5] reported similar observations when they compared groups with a delay period of up to 4 days and >4 days from the onset of symptoms. In a recent study, Willsher at al. [18] also found an association between a delay in surgery and conversion from LC to open cholecystectomy. In our series (Fig. 1), a delay in surgery of 49–96 h from the onset of symptoms was associated with the lowest conversion and complication rates. The improved outcome in comparison to longer delay periods is in accordance with other studies. When surgery is delayed, an inflammatory process and fibrosis may develop, negatively influencing the conversion and the compilation rates. With shorter delay periods, a minimal recovery and stabilization period is needed (following ressuscitation and the administration of antibiotics) before the initiation of surgery.

Lai et al. [10] and Lo et al. [12] addressed the question of interval LC following acute cholecystitis. They compared patients who were operated on during the acute phase of acute cholecystitis with those operated on at a later stage, following recovery from the acute stage, as an interval procedure. Both studies found that during the acute phase, LC was associated with a longer operative time and a prolonged hospital stay, but with comparable conversion and complication rates.

Table 4 shows the risk factors in our study that according to univariate analysis were associated with conversion of LC to open cholecystectomy, with total complications, and with infectious complications. It is worth noting that male gender was associated with conversion as well as with total and infectious complications; patients with comorbidity were more frequently converted than those with no comorbidity; elevated temperature was associated with total complications, while elevated white cell count was associated with conversion; advanced cholecystitis was associated with conversion and tended to be associated with infectious complications; and perforation of the gallbladder and conversion to open cholecystectomy were associated with infectious complications.

All of these risk factors, however, are of limited practical use. Most were studied retrospectively and by univariate analysis only, and none of them was validated as a predictor. The disadvantage of univariate analysis is that it does not take into account the interrelationship and the interdependence between the various risk factors when analyzing their association with the outcome. This problem is specifically addressed by adjustments made with multivariate analysis. In order to establish prognostic factors as early as possible and to evaluate their prognostic power, we followed these factors sequentially as they accumulated during admission and treatment and applied multivariate analysis to them.

When considered as a group, male gender, age >60 years, duration of disease >96 h, a nonpalpable gallbladder, a white cell count >18,000/cc^3, and advanced cholecystitis were associated with reasonable predictive characteristics. However, this group of factors was completed and became available only after the laparoscope had already been introduced. Therefore, these parameters had little clinical utility. Even when these factors were present, the chance of completing the LC was still 60%. At this early stage of the procedure, it seems justifiable to continue with the LC as long as an experienced team is performing the procedure and is ready to convert immediately when indicated. According to Ransom, laparoscopic subtotal cholecystectomy is a safe and effective alternative to conversion to open cholecystectomy in cases of acute cholecystitis associated with severe inflammation [14].

The factors associated with complications of LC were male gender and elevated temperature. Their sensitivity and positive predictive power, however, were too low to be of clinical significance. Before conversion, infectious complications were associated with male gender, previous abdominal surgery, bilirubin >1 mg%, and advanced cholecystitis. Following conversion, the infectious complications were most significantly associated with the conversion itself, male gender, and previous abdominal surgery. The pre- and postconversion factors were all associated with limited predictive characteristics and were of no clinical use.

In conclusion, we have confirmed that LC can be performed safely in acute cholecystitis, with acceptable conversion and complication rates. However, predictors of conversion and complications were not reliable in the prospective clinical setting. Therefore, LC should be attempted in essentially all cases of acute cholecystitis, and the decision to convert to open cholecystectomy should be made intraoperatively.

References

1. Chahin F, Elias N, Paramesh A, Saba A, Godziachvili V, Silva YJ (1999) The efficacy of laparoscopy in acute cholecystitis. J Soc Laparoendosc Surg 3: 121–125
2. Cox MR, Wilson TG, Luck AJ, Jeans PL, Padbury RTA, Toouli J (1993) Laparoscopic cholecystectomy for acute inflammation of the gallbladder. Ann Surg 218: 630–634
3. Eldar S, Sabo E, Nash E, Abrahamson J, Matter I (1997) Laparoscopic cholecystectomy for acute cholecystitis: prospective trial. World J Surg 21: 540–545
4. Fried GM, Barkun JS, Sigman HH, Joseph L, Clas D, Garzon J, Hinchey EJ, Meakins JL (1994) Factors determining conversion to laparotomy in patients undergoing laparoscopic cholecystectomy. Am J Surg 167: 35–39
5. Garber SM, Korman J, Cosgrove JM, Cohen JR (1997) Early laparoscopic cholecystectomy for acute cholecystitis. Surg Endosc 11: 347–350
6. Hashizume M, Sugimachi K, MacFadyen BV (1998) The clinical management and results of surgery for acute cholecystitis. Semin Laparosc Surg 5: 69–80
7. Koo KP, Thirlby RC (1996) Laparoscopic cholecystectomy in acute cholecystitis: what is the optimal timing for operation? Arch Surg 131: 540–544
8. Koperna T, Kisser M, Schulz F (1999) Laparoscopic versus open treatment of patients with acute cholecystitis. Hepatogastroenterology 46: 753–757
9. Kum CK, Goh PMY, Isaac JR, Tekant Y, Ngoi SS (1994) Laparoscopic cholecystectomy for acute cholecystitis. Br J Surg 81: 1651–1654
10. Lai PB, Kwong KH, Leung KL, Kwok SP, Chan AC, Chung SC, Lau WY (1998) Randomized trial of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Br J Surg 85: 764–767
11. Lo CM, Liu CL, Fan ST, Lai EC, Wong J (1998) Prospective randomized study of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Ann Surg 227: 461–467
12. Lo CM, Liu CL, Lai EC, Fan ST, Wong J (1996) Early versus delayed laparoscopic cholecystectomy for treatment of acute cholecystitis. Ann Surg 223: 37–42
13. Lujan JA, Parrilla P, Robles R, Torralba JA, Garcia Ayllon J, Liron R, Sanchez-Bueno F (1995) Laparoscopic cholecystectomy in the treatment of acute cholecystitis. J Am Coll Surg 181: 75–77
14. Ransom KJ (1998) Laparoscopic management of acute cholecystitis with subtotal cholecystectomy. Am Surg 64: 955–957
15. Rattner DW, Ferguson C, Warshaw AL (1993) Factors associated with successful laparoscopic cholecystectomy for acute cholecystitis. Ann Surg 217: 233–236
16. Sanabria JR, Gallinger S, Croxford R, Strasberg SM (1994) Risk factors in elective laparoscopic cholecystectomy for conversion to open cholecystectomy. J Am Coll Surg 179: 696–704
17. Singer JA, McKeen RV (1994) Laparoscopic cholecystectomy for acute or gangrenous cholecystitis. Am Surg 60: 326–328
18. Willsher PC, Sanabria JR, Gallinger S, Rossi L, Strasberg S, Litwin DE (1999) Early laparoscopic cholecystectomy for acute cholecystitis: a safe procedure. J Gastrointest Surg 3: 50–53
19. Zucker KA, Bailey RW, Flowers J (1992) Laparoscopic management of acute and chronic cholecystitis. Surg Clin North Am 72: 1045–1067
20. Zucker KA, Flowers JL, Baily RW, Graham SM, Buell J, Imbembo AL (1993) Laparoscopic management of acute cholecystitis. Am J Surg 165: 508–514