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Early *Versus* Delayed Laparoscopic Cholecystectomy for Treatment of Acute Cholecystitis

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Objective
The current study compared the results of early *versus* delayed laparoscopic cholecystectomy for treatment of acute cholecystitis.

Summary Background Data
Although recent reports have suggested the use of laparoscopic cholecystectomy for acute cholecystitis, the complication and conversion rates remain high. No data are available on whether initial medical treatment can improve the results.

Method
Among 497 patients who underwent laparoscopic cholecystectomy, 52 (10.5%) had a clinical diagnosis of acute cholecystitis confirmed by ultrasonography. Twenty-seven of these patients had early surgery, that is, within 120 hours of admission, and 25 had interval cholecystectomy after initial medical treatment.

Results
The early group required modifications in operative technique more frequently ($p < 0.001$). The conversion rate (7.4%) and minor complication rate (22%) were comparable. Successful early laparoscopic cholecystectomy required a longer operative time (137.2 minutes *vs.* 98.0 minutes; $p < 0.05$) and postoperative hospital stay (4.6 days *vs.* 2.5 days; $p < 0.005$) but reduced the total hospital stay (6.4 days *vs.* 12.4 days; $p < 0.001$).

Conclusions
Early laparoscopic cholecystectomy for the treatment of acute cholecystitis has no adverse effect on complication and conversion rates. Although it is technically demanding and time consuming, this procedure provides the economic advantage of a markedly reduced total hospital stay.

Table 1. CLINICAL DATA AND LABORATORY RESULTS ON ADMISSION

	Early (n = 27)	Delayed (n = 25)
Age (yr)*	58.7 ± 18.2	61.6 ± 15.5
Sex (female)	16	17
Body weight (kg)*	63.9 ± 10.7	60.0 ± 11.8
Previous biliary symptoms	9	6
Previous abdominal surgery	3	5
Duration of acute symptoms (days)*	2.2 ± 1.7	2.8 ± 2.3
Fever ≥37.5C	19	19
WBC ≥10 × 10^9/L	20	20
WBC (10^9/L)*	12.5 ± 3.5	12.9 ± 4.0
Total bilirubin (umol/L)*	16.0 ± 7.7	19.8 ± 19.8
Alkaline phosphatase (IU/L)*	91.0 ± 30.7	99.6 ± 43.8
Urea (mmol/L)*	5.6 ± 2.1	5.7 ± 2.0

WBC = white blood cell.
* ± Standard deviation.
$p > 0.1$ for all variables.

Laparoscopic cholecystectomy has increasingly been accepted as the procedure of choice for treatment of symptomatic gallstones and chronic cholecystitis.[1,2] Its role and its timing in the management of acute cholecystitis, however remain controversial. The potential hazard of severe complications as a result of distorted anatomy caused by acute inflammation is a major concern.[3,4] Performing this procedure during the phase of acute inflammation is associated, even in expert hands, with a high incidence of conversion to open surgery.[4–7] This conversion may result in the loss of all of the potential economic advantages of this minimally invasive procedure. Theoretically, with use of medical treatment during the acute phase, a safer elective procedure can be performed several weeks afterward, when inflammation and edema have subsided. In the current study, we reviewed our experience with laparoscopic cholecystectomy for patients with acute cholecystitis and compared the results of early *versus* delayed surgery.

PATIENTS AND METHODS

From March 1991 to July 1994, 497 patients underwent laparoscopic cholecystectomy in the Department of Surgery, the University of Hong Kong at Queen Mary Hospital. Prospective documentation and recording of preoperative, operative, and postoperative data were made on a standard code sheet and stored in a computer data base. Fifty-two patients (10.5%) were the subjects of the current study. They were admitted on an emergency basis with a diagnosis of acute cholecystitis based on (1) acute upper abdominal pain with tenderness under the right costal margin; (2) fever above 37.5 C. and/or leukocytosis greater than 10 × 10^9/L (normal, <10 × 10^9/L); and (3) ultrasonographic evidence[8,9] (thickened gallbladder wall, edematous gallbladder wall, distended gallbladder, presence of gallstones, ultrasonographic Murphy's sign, and pericholecystic fluid collection). All the above criteria had to be satisfied. Patients with incidental findings of acute inflammation of the gallbladder during elective surgery were not included. In addition, all patients who underwent early surgery had histologic confirmation of acute cholecystitis.

Twenty-seven patients had laparoscopic cholecystectomy performed within 120 hours of admission (early group) (mean ± SD = 35.9 ± 24.7 hours), whereas 25 patients were treated conservatively, discharged, and readmitted for surgery after an interval of 110.4 ± 68.0 days (delayed group). The demographic data, medical history, and laboratory results on admission were comparable between the two groups (Table 1). Ultrasonographic findings during the acute phase also were similar, except for a significantly higher proportion of patients with edematous gallbladder wall in the early group (Table 2). The supportive treatment during the acute phase consisted of intravenous fluid infusion, antibiotics and nasogastric suctioning when necessary. Laparoscopic cholecystectomy was performed with the technique previously described.[10] An open technique was used in all cases to introduce the subumbilical cannula. Special modifications to the procedure[5] were adopted when deemed necessary by the surgeon. After surgery, on the

Table 2. ULTRASONOGRAPHIC FINDINGS ON INITIAL ADMISSION

	Early (n = 27)	Delayed (n = 25)
Thickened gallbladder wall	22	25
Edematous gallbladder wall	24	9*
Distended gallbladder	26	20
Presence of gallstones	27	25
USG Murphy's sign	23	16
Pericholecystic fluid	2	4

USG = ultrasonographic.
* $p < 0.001$.

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patient's request, dextropropoxyphene administered intramuscularly (1 mg/kg) or orally (32.5–65 mg every 4 hours) was given for pain relief.

All continuous variables were expressed as mean ± SD and were compared by means of the Mann–Whitney *U* test. Proportions were compared with use of the chi square test with Yates' correction. Statistical analysis was performed with the SPSS/PC+ program (SPSS Inc., Chicago, IL) on an IBM-compatible computer, and a probability value of less than 0.05 was considered statistically significant.

RESULTS

Recurrent Symptoms Before Interval Cholecystectomy

Four of 25 patients (16%) in the delayed group had recurrent symptoms while waiting for elective surgery. Two patients had recurrent acute cholecystitis and one had biliary colic; all were treated conservatively. One patient who had developed acute cholangitis was treated with endoscopic retrograde cholangiopancreatography and sphincterotomy. All of these patients subsequently underwent elective laparoscopic cholecystectomy.

Operative Findings and Procedures

At operation, a perforated gallbladder was found in two patients in the early group. In the early group, the gallbladders were more often tensely distended ($p < 0.001$) and filled with turbid bile or pus ($p < 0.001$). However, severe adhesions were more frequently encountered among patients in the delayed group (44%) than among patients in the early group (26%) ($p > 0.1$), whereas for five patients in the delayed group, empyema of gallbladder was found during elective surgery (Table 3).

Significantly more modifications in operative technique, including gallbladder decompression, close suction drainage of subhepatic space, and use of endoscopic pouches to retrieve specimen, were required in the early group ($p < 0.001$). An additional cannula was used for two patients in the early group to facilitate retraction of viscera.

In the early group, histologic examination showed gangrenous cholecystitis (6), acute cholecystitis (6) and acute or chronic cholecystitis (15) of the gallbladder. In the delayed group, three of the specimens evidenced features of acute cholecystitis, whereas the other 22 revealed chronic cholecystitis.

Table 3. OPERATIVE FINDINGS AND MODIFICATIONS OF TECHNIQUE

	Early (n = 27)	Delayed (n = 25)	p Value
Operative findings			
Severe adhesions	7	11	NS
Tensely distended gallbladder	24	3	<0.001
Turbid bile/pus in gallbladder	24	9	<0.001
Maximum gallstone size (mm)*	14.4 ± 12.3	15.4 ± 10.0	NS
Modifications of technique			
Use of 5th cannula	2	0	NS
Gallbladder decompression	21	1	<0.001
Use of sutures to control cystic duct	6	3	NS
Use of endoscopic pouches to retrieve specimen	17	3	<0.001
Enlargement of subumbilical incision	17	10	NS
Use of closed suction drainage	23	8	<0.001

NS = not significant.
* ± Standard deviation.

Evaluation of the Common Bile Duct

Five of the 27 patients in the early group underwent intraoperative cholangiography based on clinical features, laboratory results, and ultrasonographic findings, and no ductal stones were detected. One other patient underwent postoperative endoscopic retrograde cholangiopancreatography and sphincterotomy with removal of ductal stones. In the delayed group, 11 patients underwent preoperative endoscopic retrograde cholangiopancreatography, and three of these patients had ductal stones detected and removed endoscopically, whereas postoperative endoscopic retrograde cholangiopancreatography was performed for two patients to remove retained ductal stones.

Operative Time and Conversion Rate

The total operative time in the early group was 141.5 ± 55.2 minutes, and that in the delayed group was 108.8 ± 47.4 minutes ($p < 0.05$). For successful laparoscopic procedures, the operative time was 137.2 ± 55.0 and 98.0 ± 39.4 minutes in the early and delayed groups, respectively ($p < 0.05$). The overall conversion rate was 13.5%. Two patients in the early group and five in the delayed group required conversion to open surgery (7.4% *vs.* 20.0%; $p > 0.1$). The most common reason for conver-

Table 4. POSTOPERATIVE COMPLICATIONS

Complication	Early (n = 27)	Delayed (n = 25)
Wound infection	3	1
Subhepatic collection	1*	0
Chest infection	0	2
Urinary tract infection	1	0
Retained CBD stone	1	2
Total	6 (22%)	5 (20%)

CBD = common bile duct.
* Aspirated under ultrasound guidance.

sion was difficulty in exposing the gallbladder and dissection because of severe adhesions (two in the early group and three in the delayed group). The remaining two patients in the delayed group required conversion to open surgery because of cholecystoduodenal fistula and bile leakage from accessory cystic duct, respectively.

Outcome

There were no bile duct injuries or other major complications (Table 4). Minor complications occurred in 11 of 52 patients (21%), 6 patients in the early group and 5 in the delayed group. The most common complication was wound infection. One patient in the early group developed a subhepatic fluid collection, which was aspirated under ultrasound guidance. There were no operative deaths nor any need for reoperation.

No significant difference was found in postoperative analgesic requirements, regardless of whether patients requiring conversion to open surgery were included (Table 5). After successful laparoscopic cholecystectomy, the postoperative hospital stay was significantly longer in the early group than in the delayed group (4.6 ± 3.2 *vs.* 2.5 ± 1.4 days; $p < 0.005$). However, when all patients were included, the difference in postoperative stay did not reach statistical significance ($p = 0.08$). The average hospital stay for initial medical treatment in the delayed group was 11.1 ± 10.1 days. For patients not requiring conversion to open surgery, the total hospital stay was 6.4 ± 3.7 days for the early group and 12.4 ± 8.4 days for the delayed group ($p < 0.001$). Total hospital stay was 6.7 ± 4.1 and 15.1 ± 11.1 days for the early and delayed groups, respectively, when all patients were included ($p < 0.001$).

DISCUSSION

Until recently, acute cholecystitis was considered a contraindication to laparoscopic cholecystectomy.[11] With improvement in instruments and technique, the number of reports on laparoscopic cholecystectomy for acute cholecystitis has increased, with conversion rates ranging from 6.5% to 35%.[4–7,12–15] However, in some series, the diagnosis of acute cholecystitis was made according to either the operative or pathologic findings without consideration of the clinical condition.[6,7,11,12] Results from these series might not be applicable to patients who have clinical evidence of acute cholecystitis. For evaluation of the role and timing of laparoscopic cholecystectomy in the management of this clinical problem, only patients with clinical, laboratory, and ultrasonographic evidence of acute cholecystitis should be included.

The safety of the laparoscopic approach for acute cholecystitis is a major concern. A higher incidence of complications, including a bile duct transection rate of 1.5%, has been reported.[4] The results of the current series confirms

Table 5. POSTOPERATIVE ANALGESIC REQUIREMENT AND HOSPITAL STAY

	All patients		Successful LC	
	Early (n = 27)	Delayed (n = 25)	Early (n = 25)	Delayed (n = 20)
Doses of analgesics	1.2 ± 2.4	2.5 ± 3.4*	0.72 ± 1.1	1.0 ± 1.1*
Postoperative stay (days)	5.1 ± 3.7	4.0 ± 3.4†	4.6 ± 3.2	2.5 ± 1.4‡
Total hospital stay (days)	6.7 ± 4.1	15.1 ± 11.1§	6.4 ± 3.7	12.4 ± 8.4§

LC = laparoscopic cholecystectomy
* $p > 0.1$.
† $p = 0.08$.
‡ $p < 0.005$.
§ $p < 0.001$.

the view that when performed by surgeons experienced in the technique, both early and delayed laparoscopic cholecystectomy for treatment of acute cholecystitis are safe and effective. The complication rates are comparable to open cholecystectomy.[15] None of our patients sustained bile duct injury or developed other major complications, whereas minor complications occurred in 21% of these patients. The overall conversion rate of 13.5% is almost three times that reported for chronic cholecystitis[1] and is consistent with the finding that acute cholecystitis is a risk factor for conversion to open surgery.[16] We agree that conversion to open procedure after adequate trial by an experienced laparoscopic surgeon should not be regarded as a complication or an operative failure. With patience, experience, careful dissection, and identification of vital structures, the surgeon can safely complete a cholecystectomy in the majority of cases. When the operation is performed successfully, patients enjoy a less painful postoperative course with low analgesic requirement and short hospital stay. The total hospital stay after laparoscopic cholecystectomy for acute cholecystitis (6.4 days for early and 12.1 days for delayed) compares favorably with length of hospital stay associated with open surgery (9.1–12.3 days for early and 15.5–21.4 days for delayed), as reported in the literature.[17–19]

Whether early or delayed laparoscopic cholecystectomy presents more technical difficulties remains controversial. Adoption of an initial conservative approach does not improve the success rate. In fact, the 20% conversion rate for delayed surgery was higher than that for early surgery (7.4%), although the difference was not significant. The most common reason for conversion was the existence of severe adhesions. In the early phase of acute inflammation, adhesions are easily separated, and there is usually an edematous plane around the gallbladder that facilitates dissection. After a period of conservative treatment, the inflammation and edema are replaced by fibrotic adhesions between the gallbladder and surrounding structures, which occasionally render laparoscopic dissection extremely difficult. Furthermore, there is a higher risk of cholecystoenteric fistula developing.[19] Conversely, performing laparoscopic cholecystectomy during the acute phase requires more frequent special modifications in operative technique and thus a longer operative time. In the majority of cases, decompression of a tensely distended gallbladder by needle aspiration is necessary. To avoid septic complications, the surgeon must take extra precautions, including the use of endoscopic pouches and closed suction drains because of the high incidence of turbid bile or even pus in the gallbladder with the potential risk of infection.

After laparoscopic cholecystectomy, the analgesic requirements for early and delayed surgery are comparable. Patients undergoing successful early surgery have a longer postoperative hospital stay than do those who have undergone delayed surgery. This can be explained by the presence of acute intra-abdominal inflammation before surgery in the early group, with resulting delay in postoperative recovery. Such a difference in postoperative hospital stay between patients who have undergone early *versus* delayed surgery went unnoticed in the prelaparoscopic era,[18] because the slower recovery after open surgery determines the duration of postoperative hospital stay. Despite a longer postoperative stay, the major advantage of early laparoscopic cholecystectomy is the reduction of the total hospital stay, being 8.4 days, or 56%, shorter than that of delayed laparoscopic surgery. One of the main advantages of laparoscopic cholecystectomy is the potential for patients to return to work early, but the recuperation periods after early and delayed surgery were not compared in the current study because of its retrospective nature.

In conclusion, both early and delayed laparoscopic cholecystectomies performed by experienced surgeons are safe and effective for the treatment of acute cholecystitis. Early surgery is technically demanding and time consuming and involves a longer postoperative hospital stay. However, its economic advantage is a markedly reduced total hospital stay.

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