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What is the optimal time for laparoscopic cholecystectomy in gallbladder empyema?

Yong Jin Kwon · Byung Kyu Ahn · Hwon Kyum Park · Kwang Soo Lee · Kyeong Geun Lee

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Abstract
Purpose With the accumulating experience in laparoscopic surgery, early laparoscopic cholecystectomy (LC) is increasingly offered for acute cholecystitis. However, early LC without percutaneous transhepatic gallbladder drainage (PTGBD) for gallbladder empyema is still believed to be unsafe. The purpose of this study was to determine the optimal time for LC in gallbladder empyema.
Methods A retrospective analysis was carried out of patients who underwent LC without PTGBD for gallbladder empyema between August 2007 and December 2010. All cases were confirmed by biopsy. The patients were divided into two groups on the basis of a cutoff of 72 h.
Results LC for gallbladder empyema was performed without PTGBD in 61 patients during the study period. The overall conversion rate was 6.6 %. Based on the 72 h cutoff, there were 33 patients in the early group and 28 in the delayed group. There were no significant differences between early and late patients with respect to operation duration (75.5 vs. 71.4 min, $p = 0.537$), postoperative hospital stay (4.2 vs. 3.3 days, $p = 0.109$), conversion rate (12.1 vs. 0 %, $p = 0.118$), and complication rate (12.1 vs. 3.6 %, $p = 0.363$). However, the early group had a significantly shorter total hospital stay (5.3 vs. 8.7 days, $p = 0.001$).
Conclusions Early LC without PTGBD is safe and feasible for gallbladder empyema and is associated with a low conversion rate. Delayed LC for gallbladder empyema has no advantages and results in longer total hospital stays. LC should be performed as soon as possible within 72 h after admission to decrease length of hospital stay.

Keywords Laparoscopic cholecystectomy · Gallbladder empyema · Conversion · Complications · Timing

Although acute cholecystitis was initially considered a contraindication for laparoscopic cholecystectomy, this procedure is now accepted as safe due to mastery of the required skills by surgeons and improvements in laparoscopic instrumentation [1–4]. Early laparoscopic cholecystectomy is now accepted to be safe enough for routine use [5–13]. However, the appropriate timing for its use in the treatment of gallbladder empyema remains controversial, and early LC without percutaneous transhepatic gallbladder drainage (PTGBD) is still believed to be unsafe. We therefore set out to answer the following question: "Is laparoscopic cholecystectomy without PTGBD for gallbladder empyema safe?" and "What is the optimal time to perform this procedure?"

Patients and methods

We performed a retrospective analysis of patients who underwent LC without PTGBD for gallbladder empyema in Hanyang University Hospital between August 2007 and December 2010. All cases were confirmed by biopsy. Three patients who underwent preoperative PTGBD were excluded as were five patients who underwent preoperative

Y. J. Kwon (✉) · B. K. Ahn · H. K. Park · K. S. Lee · K. G. Lee
Department of Surgery, College of Medicine, Hanyang University, 17 Haengdang-dong, Seongdong-gu, Seoul 133-792, Korea
e-mail: skull21c@kornet.net

K. G. Lee
e-mail: hepafel@hanyang.ac.kr

ERCP due to coexisting CBD stones. LC for gallbladder empyema without PTGBD was thus performed in 61 patients during the study period. The patients were divided two groups based on a cutoff of 72 h. There were 33 patients in the early group and 28 in the delayed group.

All 61 LC procedures were performed by an experienced hepatobiliary surgeon using the four-port method.

SPSS® 17.0 (Chicago, IL) was used for statistical analysis. χ^2 and Fisher's exact tests were employed for categorical variables, and Student's t test for continuous variables. Values of $P < 0.05$ were considered statistically significant.

Results

LC for gallbladder empyema was performed without PTGBD in 61 patients during the study period. The mean age of the 61 patients was 61.1 years ± 15.6 (range 26–83). M/F ratio was 1.4. Mean operation time was 73.6 min ± 25.1 (range 30–150), mean postoperative hospital stay was 3.8 days ± 2.2, and mean total hospital stay was 6.9 days ±3.8. There were no mortalities. The overall conversion rate was 6.6 %, and the overall complication rate was 8.2 %. There were no major complications, and all of the complications that occurred were wound seromas.

All four conversions were to open surgery. The reasons were omental bleeding ($n = 2$), cystic arterial bleeding ($n = 1$), and inability to get traction due to severe necrosis of the entire gallbladder ($n = 1$). Difficulty in dissecting at Calot's triangle was not one of the reasons for conversion. There were no significant differences between early and late patients in operation time (75.5 vs. 71.4 min, $p = 0.537$), postoperative hospital stay (4.2 vs. 3.3 days, $p = 0.109$), conversion rate (12.1 vs. 0 %, $p = 0.118$) and complication rate (12.1 vs. 1 %, $p = 0.363$). There were also no significant differences in laboratory findings. However, the early group had a significantly shorter total hospital stay (5.3 vs. 8.7 days, $p = 0.001$) (Table 1).

Comparing the 57 laparoscopic cholecystectomies and the four conversion cholecystectomies, there were no significant differences in demographic characteristics and laboratory findings. The conversion group had a longer average postoperative hospital stay (8.5 vs. 3.4 days, $p = 0.079$) and total hospital stay (9.0 vs. 6.7 days, $p = 0.253$), but these differences were not statistically significant. However the conversion group had a significantly longer operation time (118.8 vs. 70.4 min, $p = 0.000$) (Table 2).

Surgical technique

The standard four-port method and angled (30°) laparoscope were used. Access to the peritoneal cavity and creation of the pneumoperitoneum were achieved by the open technique. After gallbladder decompression, blunt dissection was performed with a metal suction-irrigation tip. The operation was a hepatocystic dissection with the entire hepatocystic triangle dissected, exposing the cystic duct and artery, the infundibulum of the gallbladder, and the junction of the gallbladder and cystic duct before division of the cystic duct and artery. This technique provided views critical view of safety in almost all the patients (Fig. 1).

Since inflammation is basically a hyperemic state, bleeding always occurred. Bleeding from the cystic artery and large omental vessels needed to be controlled, but

Table 1 Comparison of early and delayed laparoscopic cholecystectomy

	Timing of LC		Total ($n = 61$)	p
	LC within 72 h ($n = 33$)	LC after 72 h ($n = 28$)		
Age (year)	59.0 (±16.4)	63.6 (±15.0)	61.1 (±15.6)	0.266
Sex (M/F ratio)	2.3	0.9	1.4	0.066
BMI	24.4 (±3.1)	24.1 (±3.2)	24.3 (±3.1)	0.722
OP time (mim)	75.5 (±29.3)	71.4 (±19.9)	73.6 (±25.1)	0.537
Postop stay (days)	4.2 (±2.5)	3.3 (±1.6)	3.8 (±2.2)	0.109
Hospital stay (days)	5.3 (±2.4)	8.7 (±4.3)	6.9 (±3.8)	0.001
WBC (mm^{-3})	13,281.8 (±5,252.2)	13,242.9 (±4,866.3)	13,263.9 (±4,995.3)	0.976
Total bilirubin (mg/dl)	1.3 (±0.8)	1.5 (±1.2)	1.4 (±1.0)	0.398
ALP (U/L)	110.4 (±73.1)	100.2 (±80.5)	105.7 (±75.4)	0.609
AST (U/L)	46.4 (±78.9)	38.7 (±39.3)	42.9 (±63.0)	0.642
ALT (U/L)	53.5 (±67.4)	35.2 (±35.7)	45.1 (±55.1)	0.182
Conversion, n (%)	4 (12.1 %)	0	4 (6.6 %)	0.118
Complication, n (%)	4 (12.1 %)	1 (3.6 %)	5 (8.2 %)	0.363

Table 2 Comparison of conversion cholecystectomy and laparoscopic cholecystectomy

	Conversion		Total ($n = 61$)	p
	Yes ($n = 4$)	No ($n = 57$)		
Age (year)	50.8 (±23.2)	61.8 (±15.2)	61.1 (±15.6)	0.176
Sex (M/F ratio)	All male	1.3	1.4	0.137
BMI	25.0 (±0.7)	24.2 (±3.2)	24.3 (±3.1)	0.183
OP time (min)	118.8 (±21.7)	70.4 (±22.5)	73.6 (±25.1)	<0.001
Postop stay (days)	8.5 (±3.9)	3.4 (±1.6)	3.8 (±2.2)	0.079
Hospital stay (days)	9.0 (±4.3)	6.7 (±3.8)	6.9 (±3.8)	0.253
WBC (mm^{-3})	14,600 (±6,187.6)	13,170.2 (±4,999.4)	13,263.9 (±4,995.3)	0.587
Total bilirubin (mg/dl)	1.1 (±0.8)	1.4 (±1)	1.4 (±1)	0.568
ALP (U/L)	133.0 (±81.6)	103.8 (±76.1)	105.7 (±75.4)	0.463
AST (U/L)	22.5 (±17.2)	44.3 (±65.4)	42.9 (±63)	0.511
ALT (U/L)	58.5 (±83.8)	44.2 (±54)	45.1 (±55.1)	0.622
LC within 72 h, *n* (%)	4 (100 %)	29 (50.9 %)	33 (54.1 %)	0.118
Complication, *n* (%)	2 (50 %)	3 (5.3 %)	5 (8.2 %)	0.031

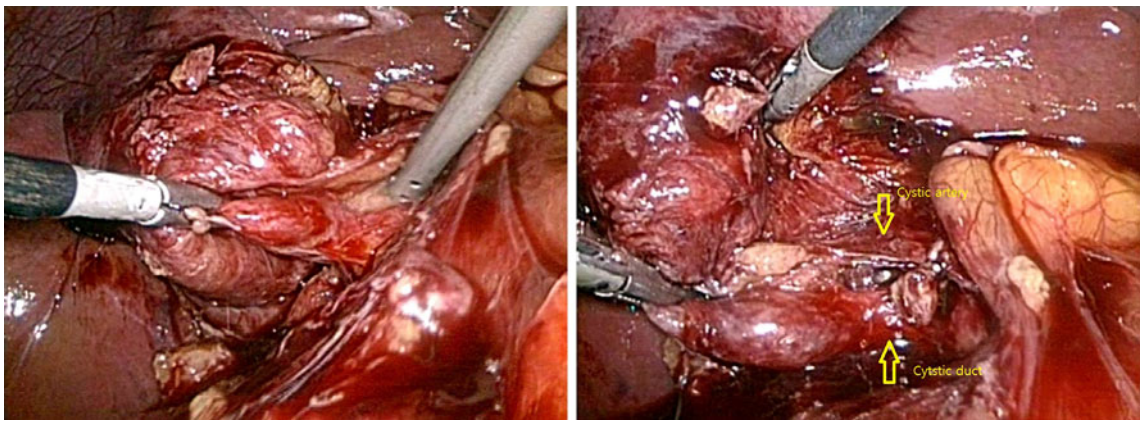

Fig. 1 Blunt dissection (*left*) and critical view of safety (*right*)

bleeding from the soft tissue around Calot's triangle gradually stopped by itself during the operation. At the end of the operation, there was a small amount of bleeding on the GB bed, but most of the bleeding stopped spontaneously. We therefore did not control bleeding during the operation. Intra-operative bleeding control is unnecessary except when there is bleeding from the cystic artery or large omental vessels.

Discussion

Gallbladder empyema is defined as inflamed gallbladder containing pus. It remains a serious condition that can lead to death secondary to sepsis. In the past, mortality as high as 25 % was reported [14]. Cholecystectomy is the treatment of choice, but the optimal surgical treatment and timing remain controversial. Recently LC has become the preferred option even in the most difficult situations associated with complicated gallbladders. An international consensus was published as the Tokyo Guidelines in 2007. These guidelines describe the timing and optimal surgical treatment of acute cholecystitis in a question-and-answer format. At the Tokyo meeting, early and laparoscopic cholecystectomy was preferred to late and open cholecystectomy [15]. Table 3 presents the outcomes of several studies. The results show that performing surgery early was superior in terms of length of total hospital stay, and there were no significant differences in conversion rate and complication rate between the early and late groups ($P < 0.05$). Recent studies have yielded lower conversion rates than early studies, probably due to improvements in laparoscopic instrumentation and surgical skill.

High conversion rates (12.5 % [16], 15.38 % [17], 42 % [18]) have been reported for gallbladder empyema patients compared to those with other gallbladder diseases. Causes of conversion were difficulty in dissecting at Calot's triangle, difficulty in exposing the gallbladder due to adhesions, bleeding, cystic duct impacting by stones, and so on. One of the most frequent causes of conversion was

Table 3 Comparison of early and delayed laparoscopic cholecystectomy

Authors	Number of patients	Conversion rate			Complication rate			Hospital stay	
		Early (%)	Late (%)	Total (%)	Early (%)	Late (%)	Total (%)	Early	Late
Lo et al. [11]	86	11	23	16.3	13	29	21	*6*	*11*
Lai et al. [19]	91	21	24	22	9	8	8.8	*7.6*	*11.6*
Johanson et al. [12]	143	31	29	30	18	10	14	*5*	*8*
Al-Mulhim [20]	196	2.4	7	5.1	0	6	3.6	*5.1*	*12.2*
Han et al. [23]	67	0	6.5	4.5	19	4.3	9	10.8	14.7

Italic values are statistically significant ($P < 0.05$)

difficulty in clearing the anatomical structures in Calot's triangle because of the inflammation [11, 18–22]. In our study, four patients were converted to open surgery. The reasons for conversion were omental bleeding, cystic artery bleeding and inability to obtain traction due to severe necrosis of the entire gallbladder. In the two cases caused by omental bleeding. The loci of bleeding were attached to the gallbladders on the blind side and so could not be located. The other case was caused by cystic arterial bleeding: because the cystic artery was friable as a result of the inflammation, there was a danger that it would be cut by the suction-irrigation tip. To avoid this, we had to dissect it carefully. The last case was caused by severe necrosis, which prevented us from gaining traction. In contrast to other studies, difficulty in dissecting at Calot's triangle was not a cause of conversion.

Some authors have suggested that delaying LC after PTGBD reduces conversion rates in complicated acute cholecystitis because the PTGBD may permit the severe inflammation to gradually subside [23–26]. However we believe that delaying LC can lead to soft tissue fibrosis around Calot's triangle, which makes it difficult to dissect there. On the other hand we were able to perform this dissection without difficulty using a metal suction–irrigation tip because the tissue was edematous and friable. Since use of this tip did not interfere with the surgical plane, we were able to obtain the critical view of safety in almost all cases.

Conclusions

There is no advantage in delaying LC for gallbladder empyema in patients suitable for surgery. Early LC without PTGBD is safe and feasible for gallbladder empyema and is associated with a low conversion rate. Delaying LC for gallbladder leads to longer total hospital stays. LC should be performed as soon as possible within the first 72 h after admission.

Disclosures The authors in this case are not related with potential investigator conflicts of interest.

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