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Propensity score-matching analysis of the efficacy of late cholecystectomy for acute cholecystitis

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ABSTRACT

Background: Urgent cholecystectomy within 72 h from symptom onset is recommended. We assessed the feasibility of performing late cholecystectomy (4–7 days from symptom onset) for acute cholecystitis.
Methods: One hundred sixty-four patients with grades 1 and 2 cholecystitis, who underwent urgent cholecystectomy within 7 days from symptom onset between June 2011 and June 2015 were enrolled. One hundred thirteen patients underwent operation within 72 h from symptom onset (early operation group), and 51 underwent operation between 4 and 7 days (late operation group). Surgical outcomes and postoperative complications were analyzed using propensity score-matching analysis.
Results: The rate of conversion, intraoperative bleeding, and complications were comparable between the groups. After a one-to-two propensity score-matched analysis was performed, outcomes of the late operation group were not inferior to those of the early operation group.
Conclusion: Late cholecystectomy was acceptable for treating grades 1 and 2 acute cholecystitis.

1. Introduction

Acute cholecystitis is one of the most common diseases among acute abdomen disorders. Tokyo guidelines for managing acute cholangitis and acute cholecystitis (Tokyo guidelines 2007: TG07) have been established, and early cholecystectomy (within 7 days from symptom onset) is recommended for acute cholecystitis.[1] Several randomized studies and meta-analyses have demonstrated the advantages of laparoscopic cholecystectomy (LC) compared to open procedures, which include less blood loss, a shorter hospital stay, and early recovery.[2–6] Thus, performing LC more and open cholecystectomy less may enable patients to experience these aforementioned advantages. Additionally, the appropriate timing of surgical intervention for acute cholecystitis has been evaluated. Several studies have reported that the advantages of early cholecystectomy are a shorter postoperative hospital stay, lower medical cost, and fewer surgical complications.[7–15]

Although the Tokyo guideline 2013 (TG13) has recommended performing cholecystectomy within 72 h from symptom onset, we have performed late cholecystectomy (72 h–7 days from symptom onset) due to failed conservative treatment and delayed treatment at other clinics. Thus, the optimal time for performing cholecystectomy for grade (G) 1 and G2 cholecystitis remains unclear. Only a few studies have compared cholecystectomy performed within 72 h from symptom to cholecystectomy performed 4–7 days from symptom onset.[16–20] Therefore, the present study aimed to evaluate the feasibility of performing late cholecystectomy in patients with G1 and G2 acute cholecystitis using propensity score-matched analysis.

2. Materials and methods

2.1. Patients

A retrospective study spanning a 5-year period from June 2011 to June 2015 was performed, and 192 patients who underwent

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cholecystectomy for acute cholecystitis at the Department of Surgery, Onomichi General Hospital were identified. The diagnosis of acute cholecystitis and classification of the severity grades were confirmed according to the TG13 criteria.[21] Sixty-five (33.9%), 99 (51.6%), and 28 (14.6%) patients had G1 (mild), G2 (moderate), and G3 (severe) cholecystitis, respectively. Patients with G3 cholecystitis were excluded from our study. We compared the clinical features and perioperative outcomes between patients with G1 and G2 cholecystitis who underwent cholecystectomy within 72 h (early cholecystectomy) and 72 h to 7 days (late cholecystectomy) from symptom onset.

The measured variables were sex, age, body mass index (BMI), and comorbidities (e.g., diabetes mellitus, hypertension, cardiovascular disease, pulmonary disease, and renal failure). The Murphy sign on admission was documented by a physician during a physical examination. Computed tomography (CT) images were evaluated by at least one physician and one radiologist. Laboratory data were collected preoperatively. The study was approved by the local review board, and written informed consent was obtained from all patients before treatment.

2.2. Morbidity and complications

Our definition of complications was determined according to the method described by Clavien et al.[22] In our study, postoperative complications were defined as those that were grade IIIa or greater.

2.3. Statistical analysis

Values for continuous variables are presented as a median and range. Nominal variables are expressed as a number (%). Nonparametric quantitative data were analyzed using the Mann-Whitney *U* test. The chi-square test was performed to analyze nominal variables. P-values <0.05 were considered significant. Statistical analyses were performed using SPSS software (version 22; IBM Corp., Armonk, NY, USA).

Propensity score-matching analysis was performed using logistic regression analysis to create a propensity score for the early cholecystectomy and late cholecystectomy groups with a logistic regression model. The following variables were entered into the propensity model: sex, BMI, age, CT findings, comorbidities, white blood cell count (WBC), C-reactive protein (CRP) level, and albumin level. One-to-two matching without replacement was performed with a 0.1 caliper width, and the resulting score-matched pairs were used in subsequent analyses.

3. Results

3.1. Patients' demographics

During the study period, 164 (85.4%) patients with G1 and G2 acute cholecystitis underwent emergency cholecystectomy; LC was performed in 152 (92.7%) patients, and open cholecystectomy was performed in 12 (7.3%). Conversion to open cholecystectomy was performed in 8 (5.3%) patients. The clinicopathological data are shown in Table 1.

3.2. Comparison of patients' characteristics and surgical outcomes between the early and late operation groups

One hundred thirteen patients were included in the early operation group (EO group), and 51 were included in the late operation group (LO group). There were no significant differences in sex, age, morbidities, symptoms, and the CT findings of

Table 1
Comparison of the patient characteristics between early and late cholecystectomy groups.

Variable	All patients (N = 164)	Early operation group (N = 113)	Late operation group (N = 51)	*P* value
Mean age (range)	75 (9–99)	75 (9–99)	75 (26–94)	0.964
Sex (%)				0.639
Male	101 (61.6)	67 (59.3)	34 (66.7)	
Female	63 (38.4)	46 (40.7)	17 (33.3)	
BMI, kg/cm^2 (range)	23.5 (15.7–35.8)	23.0 (15.7–35.8)	20.8 (17.7–35.4)	0.201
Comorbidity (%)				
Diabetes mellitus	39 (24.0)	28 (24.8)	11 (21.6)	0.655
Hypertension	71 (43.3)	52 (46.0)	19 (37.3)	0.294
Cardiovascular disease	18 (11.0)	12 (10.6)	6 (11.8)	0.910
Pulmonary disease	17 (10.4)	12 (10.6)	5 (9.8)	0.874
Renal failure	9 (5.5)	6 (5.3)	3 (5.9)	0.882
Glasgow coma scale score (range)	15 (8–15)	15 (8–15)	15 (10–15)	0.554
Body temperature, °C (range)	36.9 (35.0–39.9)	36.9 (35.0–39.9)	36.9 (35.8–39.6)	0.810
Concurrent acute cholangitis (%)	72 (43.9)	40 (35.4)	32 (62.7)	**0.001**
Preoperative biliary drainage (%)	70 (97.2)	39 (97.5)	31 (96.4)	**0.002**
Murphy' sign (%)	104 (63.4)	73 (64.6)	31 (60.8)	0.638
CT findings (%)				
Gallbladder wall thickness	141 (86.0)	100 (88.5)	41 (80.4)	0.167
Gallbladder stone	122 (74.4)	83 (73.5)	39 (76.5)	0.682
Effusion	114 (69.5)	74 (65.5)	40 (78.4)	0.096
Liver abscess	8 (4.9)	3 (2.7)	5 (9.8)	0.308
Ascites	17 (10.4)	12 (10.6)	5 (9.8)	0.874
Laboratory values (range)				
WBC (/μL)	12 800 (3602–30 700)	13 300 (3602–30 700)	10 900 (5654–28 200)	0.051
CRP (mg/μL)	5.1 (0.02–32.3)	4.3 (0.02–30.6)	8.4 (0.08–32.3)	**0.031**
Hb (g/dL)	13.7 (9.5–17.7)	13.9 (9.5–17.7)	13.1 (10.8–17.5)	0.170
Plt ($\times 10^4$/μL)	21.4 (1.5–48.1)	22.7 (4.4–48.1)	20.7 (1.5–45)	0.270
Bilirubin (mg/dL)	1.23 (0.2–9.4)	1.2 (0.3–8.2)	1.3 (0.2–9.4)	0.563
LDH (IU/L)	224 (27–802)	225 (27–802)	225 (64–754)	0.551
Alb (g/dL)	3.7 (2.4–6.2)	3.8 (2.4–6.2)	3.3 (2.4–4.2)	**0.001**
BUN (mg/dL)	16.0 (4.6–65.2)	15.5 (5.7–40.4)	16.4 (4.6–65.2)	0.643
Cr (mg/dL)	0.78 (0.35–8.1)	0.8 (0.35–8.1)	0.78 (0.4–4.3)	0.945

Variables in bold are statistically significant (P < 0.05). Abbreviations: Alb, albumin; BMI, body mass index; BUN, blood urea nitrogen; Cr, creatinine; CRP, C-reactive protein; CT, computed tomography; Hb, hemoglobin; LDH, lactate dehydrogenase; Plt, platelet count; WBC, white blood cell count.