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대한영상의학회지

The Efficacy of Preoperative Percutaneous Cholecystostomy for Acute Cholecystitis with Gallbladder Perforation

담낭천공을 동반한 급성담낭염 환자에서 수술 전 경피적담낭배액술의 효용성에 관한 연구

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Purpose: Treatment of acute cholecystitis with gallbladder perforation remains controversial. We aimed to determine the feasibility of percutaneous cholecystostomy (PC) in these patients.
Materials and Methods: We retrospectively reviewed patients who had acute cholecystitis with gallbladder perforation at a single institution. Group 1 (n = 27; M:F = 18:9; mean age, 69.9 years) consisted of patients who received PC followed by cholecystectomy, and group 2 (n = 16; M:F = 8:8; mean age 57.1 years) consisted of patients who were treated with cholecystectomy only. Preoperative details, including sex, age, underlying medical history, signs of systemic inflammatory response syndrome (SIRS), laboratory findings, body mass index, presence of gallstone, and type of perforation; treatment-related variables, including laparoscopic or open cholecystectomy, conversion to laparotomy, blood loss, surgical time and anesthesia time; and outcome, including postoperative complications and hospital stay were analyzed.
Results: There was no significant difference in preoperative details, treatment-related variables, postoperative complications, and postoperative hospital stay. However, preoperative hospital stay (median, 14 days vs. 8 days; $p < 0.05$) and total hospital stay (median, 22 days vs. 14.5 days; $p < 0.05$) were significantly longer in group 1 than in group 2.
Conclusion: The preferred treatment of acute cholecystitis with gallbladder perforation might be cholecystectomy without preoperative PC; however, preoperative PC can be a safe, optional treatment in elderly patients with signs of SIRS.

Index terms
Cholecystostomy
Cholecystitis, Acute
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INTRODUCTION

Gallbladder perforation is a complication of acute cholecystitis, occurring in 2–42% of patients with acute cholecystitis (1, 2). Since Niemeier (3) classified gallbladder perforation into three types, modified Niemeier classification of gallbladder perforation (4) has been used: type I, acute perforation into the free peritoneal cavity; type II, subacute perforation of the gallbladder surrounded by an abscess; and type III, chronic perforation with fistula formation between the gallbladder and other abdominal viscera.

Since this original classification was published, other classification systems with more complicated subtypes have been suggested, and diagnostic tools and therapeutic options have emerged (2). There are several treatment options for acute cholecystitis with gallbladder perforation, such as simple drainage, endoscopic treatment, and surgical cholecystectomy. However, no consensus has been reached regarding the standard treatment for acute cholecystitis with gallbladder perforation (2, 5).

Laparoscopic cholecystectomy is regarded as one of the stan-

dard treatments in patients with acute cholecystitis, and early laparoscopic cholecystectomy within 48 to 96 hours after symptom onset is recommended (6-10), although percutaneous cholecystostomy (PC) is chosen for initial treatment in high-risk patients and when emergent surgery is not possible due to manpower constraints (7, 9, 11). However, the efficacy of PC before cholecystectomy in acute cholecystitis remains controversial; some surgeons advocate preoperative PC in critically ill or elderly patients, while others suggest that it has poor outcomes, with a longer hospital stay and a higher rate of conversion to open surgery (7-10).

Furthermore, treatment options for acute cholecystitis combined with gallbladder perforation in various situations remain controversial and have not yet been standardized.

Therefore, the purpose of this study was to evaluate outcomes in patients with acute cholecystitis combined with gallbladder perforation who were treated only with cholecystectomy and those who were treated with preoperative PC followed by cholecystectomy.

MATERIALS AND METHODS

Patients and Study Groups

For this study, approval from the Institutional Review Board of our institution was obtained (DAUHIRB-16-177). Medical records were retrospectively reviewed, so the requirement for obtaining informed consent was waived.

Among the 2202 patients who underwent cholecystectomy from 2010 to 2014 at our institution, 600 patients had been operated for acute cholecystitis. In the other 1602 patients, cholecystectomy was conducted for various reasons such as gallbladder cancer, chronic cholecystitis, and gallbladder polyp(s), or additional cholecystectomy was performed in cases of gastric cancer surgery and hepatic malignancy surgery. Among the former 600 patients, 43 patients underwent operation due to acute cholecystitis combined with gallbladder perforation. Among them, group 1 (n = 27) included patients who had been treated with preoperative PC followed by surgical treatment. Group 2 (n = 16) included patients who had been treated with cholecystectomy only. There were 18 male and 9 female patients in group 1, with a mean age of 69.9 years (range, 51−83 years), and 8 male and 8 female patients in group 2, with a mean age of 57.1 years (range, 20−81 years).

Acute cholecystitis with gallbladder perforation was diagnosed based on the patients' symptoms, physical examination, laboratory findings, and imaging studies, including computed tomography and/or ultrasonography (US). Imaging findings for making the diagnosis were defects in the wall of the gallbladder and/or pericholecystic abscess formation, in addition to the findings of acute cholecystitis-distension of the gallbladder, thickening of the gallbladder wall, and pericholecystic hyperemia. The presence of cholelithiasis and modified Niemeier's type of gallbladder perforation were evaluated on imaging studies.

Treatment

When the patient was older than 50 years of age and systemic inflammatory response syndrome (SIRS) was suspected (n = 15) or emergent surgery was not possible due to manpower constraints such as shortage of surgeons, anesthetists or equipment (n = 12), PC was conducted before surgical treatment. If the patient was younger than 50 years of age (n = 7) or the patient was older than 50 years of age but did not have SIRS and emergent operation was possible (n = 9), cholecystectomy was conducted without preoperative PC (Table 1, Fig. 1).

SIRS was defined when more than two of the following were noted: body temperature > 38°C or < 36°C, heart rate > 90 beats/min, respiratory rate > 20/min or $PaCO_2$ < 32 mm Hg, and white blood cell (WBC) count > 12000/mm^3 or < 4000/mm^3 or > 10% immature bands (12).

For PC, a transhepatic or transperitoneal approach was chosen, and an 8-French catheter was inserted into the gallbladder under US and fluoroscopy guidance. The patients were conservatively treated in the hospital, and surgical treatment was performed when clinical improvement, including the disappearance of signs of SIRS, was achieved.

Open or laparoscopic cholecystectomy was conducted based on the patient's status, such as adhesion due to previous abdominal surgery. For laparoscopic cholecystectomy, three or four ports were inserted in the umbilical, epigastric, and subcostal areas. When severe adhesion or severe inflammation was observed intraoperatively in patients in whom laparoscopic surgery was planned, the surgical procedure was converted from laparoscopic surgery to laparotomy.

Postoperative Complications and Hospital Stay

For evaluation of treatment-related complications, complications were categorized as surgical site infection, biliary complications, pulmonary complications, postoperative bleeding, ileus, wound dehiscence, complications requiring re-operation, PC-related complications, etc.

Hospital stay was subcategorized as preoperative hospital stay, postoperative hospital stay, and total hospital stay.

To assess the effect of signs of SIRS on these treatment outcome variables, the presence of SIRS in the two groups, as well as complications and hospital stay were analyzed.

Statistical Analysis

We analyzed the following variables between the two groups: preoperative details, including sex, age, underlying medical history, signs of SIRS, initial laboratory findings, body mass index (BMI), presence of gallstone, and type of perforation; treatment-related variables, such as laparoscopic or open cholecystectomy, conversion to laparotomy, blood loss, surgical time and anesthe-

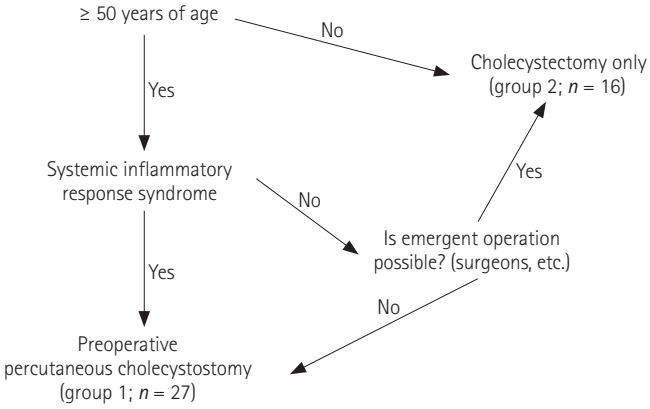

Fig. 1. Algorithm for treatment decision in the patients having acute cholecystitis with gallbladder perforation in this study.

Table 1. Demographics and Initial Status of the Patients in the Two Groups

Group 1								Group 2							
Patient	Sex	Age	BT (°C)	HR (/min)	RR (/min)	WBC (/mm³)	SIRS	Patient	Sex	Age	BT (°C)	HR (/min)	RR (/min)	WBC (/mm³)	SIRS
1	M	68	38.2	97	20	10180	O	1	F	48	36.0	82	21	16470	O
2	F	70	36.5	78	20	11090	X	2	M	44	37.9	115	20	13740	O
3	M	63	36.6	92	20	13160	O	3	F	71	39.2	89	20	4590	X
4	M	71	38.2	109	20	20870	O	4	F	64	36.5	94	20	7060	X
5	M	58	36.7	103	20	6120	X	5	F	71	37.4	71	20	21010	X
6	M	76	38.5	95	20	20570	O	6	M	33	39.4	119	20	11120	O
7	M	71	38.0	98	20	9970	X	7	F	33	37.0	91	20	12610	O
8	M	79	38.0	140	20	21970	O	8	M	59	36.0	76	19	10350	X
9	M	58	36.4	74	20	12900	X	9	F	63	36.0	74	22	9930	X
10	F	70	37.0	88	22	22450	O	10	M	86	37.6	80	20	13180	X
11	M	72	36.6	100	22	15710	O	11	M	87	36.8	72	20	11110	X
12	M	78	38.0	97	20	9760	X	12	F	45	36.6	82	20	8200	X
13	F	81	38.2	92	20	20830	O	13	M	81	36.9	68	20	18730	X
14	M	69	36.4	92	20	9320	X	14	M	20	36.4	70	20	12190	X
15	F	56	37.0	102	20	15100	O	15	M	74	36.9	76	20	18430	X
16	F	67	36.6	85	20	19210	X	16	F	35	37.3	115	20	12210	O
17	M	59	36.7	98	20	10160	X								
18	F	83	36.5	97	20	11010	X								
19	F	71	37.3	112	20	12860	O								
20	M	69	36.8	118	26	7830	O								
21	M	71	37.2	87	20	14920	X								
22	M	68	39.2	106	20	13800	O								
23	M	77	37.4	102	20	11350	X								
24	M	51	36.6	92	20	30820	O								
25	F	78	37.7	107	24	23100	O								
26	M	80	38.5	88	20	16960	O								
27	F	74	36.4	68	20	14520	X								

BT: body temperature, HR: heart rate, RR: respiratory rate, SIRS: systemic infiammatory responsary syndrome, WBC: white blood cell

sia time; and outcome, including postoperative complications and hospital stay.

Variables in the two groups were analyzed using a statistical analysis program package (SPSS version 22.0; IBM Corp., Armonk, NY, USA). For analyzing categorical variables, the adjusted chi-squared test was used, and the results are presented as "number of patients (%)." In case of continuous variables, we used the Mann-Whitney U test due to the small number of patients in the study, and the results are expressed as "median (25–75th percentile)." A *p*-value of less than 0.05 was considered statistically significant.

RESULTS

Overview of Patients

No significant differences were found between the two groups

Table 2. Clinical Characteristics of the Patients in the Two Groups

Variables	Group 1 (*n* = 27)	Group 2 (*n* = 16)	*p*-Value
Sex (%)			0.449
Male	18 (66.7)	8 (50.0)	
Female	9 (33.3)	8 (50.0)	
Age (years)	71 (67–77)	61 (37.3–73.3)	0.070
Underlying disease (%)			
Diabetes	14 (51.9)	8 (50.0)	0.957
Hypertension	14 (51.9)	8 (50.0)	1.000
Heart disease	6 (22.2)	2 (12.5)	0.699
Lung disease	11 (40.7)	2 (12.5)	0.108
Ranal disease	4 (14.8)	3 (18.8)	1.000
Hepatic disease	21 (77.8)	12 (75.0)	1.000
Dementia or cerevral vascular accident	5 (18.5)	1 (6.2)	0.505
Pervious abdominal surgery	5 (18.5)	4 (25.0)	0.907
Malignancy	2 (7.4)	2 (12.5)	0.990
Others	5 (18.5)	1 (6.2)	0.505
Body temperature (°C)	37.2 (36.6–38)	36.9 (36.5–37.7)	0.385
Fever (body temperature > 37.2°C) (%)	13 (48.1)	6 (37.5)	0.717
Lab findings on admission			
WBC (/mm^3)	14520 (9970–20870)	12685 (10097.5–14912.5)	0.218
Leukocytosis (WBC > 10000/mm^3) (%)	22 (81.5)	12 (75.0)	0.907
AST (IU/L)	43 (31–123)	31 (17.8–113.3)	0.080
AST > 40 IU/L (%)	13 (48.1)	3 (18.8)	0.109
ALT (IU/L)	39 (26–67)	23.5 (12–126)	0.148
ALT > 40 IU/L (%)	12 (44.4)	5 (31.2)	0.594
Total bilirubin (mg/dL)	1.2 (0.9–3.6)	0.9 (0.6–1.8)	0.027
Total bilirubin > 2.0 mg/dL (%)	7 (25.9)	2 (12.5)	0.510
CRP (mg/dL)	22.4 (8.3–33.4)	16.7 (10.7–19.3)	0.117
CRP > 0.5 mg/dL (%)	25 (92.6)	13 (100.0)	0.816
BMI (%)	22.3 (20.3–25.2)	25.1 (22.7–27.2)	0.163
> 25	9 (33.3)	7 (43.8)	0.721
< 18	3 (11.1)	0 (0.0)	0.445
Types of gallbladder perforation* (%)			0.429
Type I	8 (29.6)	3 (18.8)	
Type II	19 (70.4)	13 (81.3)	
Type III	0 (0.0)	0 (0.0)	
Persence of gallstone on imaging (%)	21 (77.8)	15 (93.8)	0.345

*Modified Niermeir classification of gallbladder perforation.

ALT = serum alanine aminotransaminase, AST = serum aspartate aminotransferase, BMI = body mass index, CRP = C-reactive protein, WBC = white blood cell

in terms of sex, age, underlying medical history, such as diabetes and hypertension, body temperature on admission, initial laboratory findings, including WBC count, serum aspartate aminotransferase, serum alanine aminotransaminase, and C-reactive protein, and BMI. There was no type III gallbladder perforation in either group, and there were no differences in the types of gallbladder perforation and the presence of cholelithiasis between the two groups (Table 2).

Treatment

In group 1, PC was performed through a transhepatic approach in 8 patients and through a transperitoneal approach in 19 patients. Cholecystectomy was conducted 1–38 days (mean, 14.0 days) after PC in group 1, when signs of SIRS had disappeared and there was no evidence of other symptoms or signs of inflammation associated with PC. Among the 27 patients, 16 patients were treated by laparoscopic cholecystectomy; one patient with use of 4 ports, and 15 patients with use of 3 ports. Open cholecystectomy was conducted in the other 11 patients, and in 4 patients of these 11 patients, surgical treatment was converted from laparoscopic surgery to laparotomy intraoperatively due to severe adhesion in two patients and severe inflammation in the other two patients.

In group 2, laparoscopic cholecystectomy was performed in 8 patients; one patient with use of 4 ports and 7 patients with use of 3 ports. Open cholecystectomy was conducted in the other 8 patients. Open conversion was conducted in 5 patients because of severe adhesion in two patients and severe inflammation in 3 patients.

The frequency of laparoscopic and open cholecystectomy was not different between the two groups, and the frequency of open conversion was also not significantly different between the two groups. Blood loss during surgery, surgical procedure time, and anesthesia time were also compared, and no significant difference was found between the two groups (Table 3).

Complications and Hospital Stay

In group 1, one patient developed incision site infection, and two patients developed space or organ infection. In group 2, one patient developed incision site infection and two patients developed space or organ infection. There were two patients with pleural effusion in group 1 and one patient with pulmonary edema in group 2. In both groups, one patient experienced postoperative bleeding, and the patient in group 1 required re-operation

Table 3. Treatment-Related Variables in the Two Groups

Variables	Group 1 (*n* = 27)	Group 2 (*n* = 16)	*p*-Value
Laparoscopic cholecystecomy (%)	16 (59.3)	8 (50.0)	0.785
Open cholecystectomy (%)	11 (40.7)	8 (50.0)	0.785
Open conversion (%)	4 (14.8)	5 (31.2)	0.372
Blood loss (mL)	500 (400–500)	400 (50–600)	0.512
Surgical procedure time (min)	120 (75–145)	147.5 (98.8–166.3)	0.428
Anesthesia time (min)	155 (115–180)	175 (142.5–200)	0.268

Table 4. Complications and Hospital Stay in the Two Groups

Variables	Group 1 (*n* = 27)	Group 2 (*n* = 16)	*p*-Value
Post-operative complications (%)			
Surgical site infection	3 (11.1)	3 (18.8)	0.808
Biliary complications	0	0	-
Lung complications	2. (7.4)	1 (6.2)	1.000
Postoperative bleeding	1 (3.7)	1 (6.2)	1.000
Postoperative ileus	0	0	-
Would dehiscence	2 (7.4)	0 (0.0)	0.714
Complications requiring re-operation	2 (7.4)	0 (0.0)	0.714
Others	2 (7.4)	0 (0.0)	0.714
Hospital stay (days)			
Preoperative hospital stay	14 (7–26)	8 (1–12.3)	0.001
Postoperative hospital stay	8 (6–14)	7.5 (6–12.8)	0.705
Total hospital stay	22 (18–36)	14.5 (10–23.5)	0.001

to control bleeding. Wound dehiscence occurred in two patients from group 1, and one of them required re-operation. None of the patients in group 2 required re-operation. Biliary complications, such as biliary infection or bile duct injury and postoperative ileus did not develop in patients from the two groups. PC-related complications were not found in group 1. Other complications occurred in two patients from group 1, acute pancreatitis and central venous catheter-related infection in one patient, and myocardial infarction in one patient. Overall, there were two treatment-related complications requiring re-operation in group

Table 5. Relationship between Presence of SIRS & Treatment Outcome Variables

Complications & Hospital Stay	SIRS O	SIRS X	*p*-Value
Group 1 & group 2 (with SIRS, *n* = 20; without SIRS, *n* = 23)			
Postoperative complications (%)			
Surgical site infection	3 (15.0)	3 (13.0)	1.000
Biliary complications	0	0	-
Lung complications	2 (10.0)	1 (4.3)	0.590
Postoperative bleeding	1 (5.0)	1 (4.3)	1.000
Postoperative ileus	0	0	-
Would dehiscence	0 (0.0)	2 (8.7)	0.491
Complications requiring re-operation	1 (5.0)	1 (4.3)	1.000
Others	1 (5.0)	1 (4.3)	1.000
Hospital stay (days)			
Preoperative hospital stay	10 (6.3–23.5)	7 (5–13)	0.157
Postoperative hospital stay	5 (3–7)	7 (4–13)	0.255
Total hospital stay	16 (12–34.3)	14 (10–22)	0.387
Group 1 (with SIRS, *n* = 15; without SIRS, *n* = 12)			
Postoperative complications (%)			
Surgical site infection	3 (20.0)	0 (0.0)	0.231
Biliary complications	0	0	-
Lung complications	2 (13.3)	0 (0.0)	0.487
Postoperative bleeding	1 (6.7)	0 (0.0)	
Postoperative ileus	0	0	-
Would dehiscence	0 (0.0)	2 (16.7)	0.188
Complications requiring re-operation	1 (6.7)	1 (8.3)	1.000
Others	1 (6.7)	1 (8.3)	1.000
Hospital stay (days)			
Preoperative hospital stay	13 (7–29)	12.5 (6.8–18)	0.627
Postoperative hospital stay	5 (3–9)	7.5 (3.3–13.8)	0.556
Total hospital stay	20 (15–36)	19 (12.3–32.8)	0.807
Group 2 (with SIRS, *n* = 5; without SIRS, *n* = 11)			
Postoperative complications (%)			
Surgical site infection	0 (0.0)	3 (27.3)	0.509
Biliary complications	0	0	-
Lung complications	0 (0.0)	1 (9.1)	1.000
Postoperative bleeding	0 (0.0)	1 (9.1)	1.000
Postoperative ileus	0	0	-
Would dehiscence	0	0	-
Complications requiring re-operation	0	0	-
Others	0	0	-
Hospital stay (days)			
Preoperative hospital stay	9 (1.5–11.5)	6 (1–7)	0.529
Postoperative hospital stay	4 (2.5–6)	6 (4–10)	0.152
Total hospital stay	12 (5–17)	10 (7–20)	0.690

SIRS = systemic inflammatory response syndrome

1, and no treatment-related complications requiring re-operation in group 2. None of these complications were significantly different between the two groups (Table 4).

Postoperative hospital stay was not significantly different between the two groups; however, preoperative hospital stay (median, 14 days vs. 8 days; $p < 0.05$), and total hospital stay (median, 22 days vs. 14.5 days; $p < 0.05$) were significantly longer in group 1 than in group 2 (Table 4).

The presence of SIRS on admission did not have an effect on treatment-related complications and hospital stay in either group. Although preoperative hospital stay and total hospital stay were longer in patients with SIRS, the differences were not statistically significant (Table 5).

DISCUSSION

Since laparoscopic cholecystectomy was introduced in the late 1980s, it has been considered a standard management option in patients with acute cholecystitis. However, controversy remains in the treatment of acute cholecystitis, with respect to the optimal time for cholecystectomy and the efficacy of PC.

Many authors recommend early laparoscopic cholecystectomy within 72 hours after symptom onset (6-10). However, we often encounter situations when early surgical treatment of acute cholecystitis is not possible due to patients' advanced age, severe co-morbidities, and manpower constraints, such as a shortage of surgeons or equipment. In these cases, conservative management, including PC, can be an alternative (7, 9, 11).

The Society of American Gastrointestinal and Endoscopic Surgeons and the Society for Surgery of the Alimentary Tract recommend early laparoscopic cholecystectomy, and they also suggest PC as an alternative in critically ill patients (13, 14). Although PC is a valuable alternative to surgical treatment in high-risk patients, many authors have suggested that subsequent elective cholecystectomy in patients with acute calculous cholecystitis should be routinely considered to avoid recurrence (11, 15, 16). Sugiyama et al. (16) additionally showed that PC may be a definitive treatment option for acute acalculous cholecystitis without recurrence.

However, controversy remains regarding the efficacy of preoperative PC. Some authors have advocated preoperative PC in high-risk patients in whom early laparoscopic cholecystectomy is not appropriate (10, 17, 18). Other authors have expressed doubts regarding the efficacy of preoperative PC due to the high rate of conversion to laparotomy, longer hospital stay, and more postoperative complications (7-9, 19).

Gallbladder perforation is a life-threatening complication of acute cholecystitis, and its prevalence in the previous literature varies from 2% to 42% (1, 2). When the cystic duct is occluded, often due to gallstone, intraluminal pressure in the gallbladder increases, and venous and lymphatic drainage is interrupted. As a result, perforation occurs owing to vascular compromise (1, 20). Elderly patients, usually over 60 years of age, are considered susceptible to gallbladder perforation, and other known predisposing factors are infections, malignancy, trauma, drugs, and systemic diseases such as diabetes mellitus (1, 16).

Because of this predisposition for gallbladder perforation in high-risk patients and the relative rarity of its occurrence, there is no consensus regarding its treatment. Although cholecystectomy, drainage of abscess, and additional surgical repair of the fistula in type III perforation are thought to be sufficient treatments, preoperative conservative treatment, including abscess drainage, remains controversial, especially in high-risk patients (1, 2, 5). Date et al. (2) reported that, while treatment of type I perforation is quite simple with urgent surgical treatment or cholecystostomy, treatment of type II perforation is more complicated because of the characteristics of chronicity and occurrence in older patients with co-morbidities. They showed that radiology-guided drainage was useful in patients with type II gallbladder perforation who are not suitable for surgical treatment.

In this study, there were no cases of type III perforation, and the proportion of type I and type II perforations in the two groups was not significantly different. The type of perforation had no impact on the treatment outcome, but further study on management options for each type of perforation is necessary.

Although the initial treatment option was chosen according to the different criteria in the two groups as shown in Fig. 1 and we supposed that preoperative PC tends to be applied in more critically ill patients, there was no difference in preoperative details between the two groups. This may be due to the fact that group 1 included older patients without any signs of SIRS in whom preoperative PC was conducted due to manpower constraints, and group 2 included younger patients with signs of

SIRS.

As observed in previous reports on the treatment of acute cholecystitis, our study also showed that preoperative PC increased the total hospital stay. We initially believed that this prolongation was due to the severity of the disease in group 1; however, statistical analysis revealed that the presence of SIRS did not affect the hospital stay in either group.

A possible cause of the long preoperative hospital stay in group 1 was the time required not only for the clinical improvement of patients, but also for the resolution of inflammatory reactions related to PC. The long time interval between PC and cholecystectomy prolonged the preoperative hospital stay, and this resulted in an increase in the total hospital stay in group 1.

Kim et al. (21) suggested that delayed cholecystectomy may allow the inflammation to subside, which is crucial for successful laparoscopic cholecystectomy. Han et al. (22) suggested that the timing of cholecystectomy after PC should be determined based on the patients' condition, hospital facilities, and surgical experience.

In this study, although preoperative PC prolonged the preoperative hospital stay and the total hospital stay, postoperative hospital stay was not significantly different between the two groups. This means that preoperative PC may not have a significant effect on patients' recovery compared to cholecystectomy without PC, and it may reduce perioperative morbidity in elderly and high-risk patients. Therefore, a long hospital stay in patients who underwent PC does not imply that preoperative PC is ineffective, and preoperative PC can be recommended in elderly and high-risk patients.

We recognize several limitations in this study. First, as it was a retrospective study, precise clinical descriptors in each patient may have been omitted. Moreover, treatment options might have been chosen according to the subjective decision made by the physicians or surgeons. Second, the number of enrolled patients was small, and, consequentially, the results may not reflect the general outcome. Third, the patient groups were divided according to medical records and were retrospectively reviewed. However, in clinical settings, we often recognize that preoperative PC is effective in elderly patients more than 70 years of age with signs of SIRS, who have acute cholecystitis. Further study is necessary in various patient groups. In addition, we suggest that further studies are necessary to assess the severity of the patient's condition based on imaging findings which may indicate the need for preoperative PC.

In conclusion, preoperative PC for the management of acute cholecystitis with gallbladder perforation seems to have no significant effect on the rate of conversion to open cholecystectomy and treatment-related complications, even though it prolongs the hospital stay. However, in relatively high-risk patients, such as elderly patients with signs of SIRS, preoperative PC can be an alternative treatment. Although the preferred initial treatment might be cholecystectomy instead of PC, further discussions on PC are necessary in various patient groups.

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담낭천공을 동반한 급성담낭염 환자에서 수술 전 경피적담낭배액술의 효용성에 관한 연구

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목적: 담낭천공을 동반한 급성담낭염의 치료는 아직 정립되지 않은 상태로, 본 연구에서 이러한 환자들에서 수술 전 경피적담낭배액술이 가지는 효용성에 관해 알아보고자 한다.

대상과 방법: 한 기관에서 시행한 후향적 연구로, 수술전 경피적담낭배액술을 시행한 환자군 1 (n = 27; M:F=18:9; mean age, 69.9 years)과 수술만 시행한 환자군 2 (n = 16; M:F = 8:8; mean age 57.1 years)에 대하여 성별, 나이, 기저질환, 전신성염증반응증후군의 징후, 검사실 소견, 체질량 지수, 담석의 유무, 천공 유형과 같은 수술 전 항목과, 수술 방법 (복강경 또는 개복), 개복술로의 전환, 수술 중 실혈량, 수술 및 마취 시간과 같은 치료 관련 항목, 그리고 수술 후 합병증과 입원기간을 포함한 결과 항목을 비교하였다.

결과: 수술 전 항목과 치료 관련 항목, 그리고 결과 항목 중 수술 후 합병증과 수술 후 입원기간은 두 군 간에 유의한 차이가 없었다. 그러나 수술 전 입원기간(median, 14 days vs. 8 days; $p < 0.05$), 총 입원기간 (median, 22 days vs. 14.5 days; $p < 0.05$)은 환자군 1에서 환자군 2에 비해 유의하게 길었다.

결론: 담낭천공을 동반한 급성담낭염 환자에서 수술 전 경피적담낭배액술 없이 수술을 바로 시행하는 것이 선호되는 치료라 할 수 있으나, 전신성염증반응증후군의 징후가 있는 고령의 환자에서 경피적담낭배액술은 안전한 치료 중의 하나로 선택적으로 시행해 볼 수 있겠다.

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