Implementation of a Critical Pathway for Patients with Acute Cholecystitis

Sa-Hong Min, M.D., Ho-Seong Han, M.D., Ph.D., Jai Young Cho, M.D., Ph.D.,
Yoo-Seok Yoon, M.D., Ph.D., Dae Wook Hwang, M.D., Kyuwahn Jung, M.D.,
Young Ki Kim, M.D., Hong Kyung Shin, M.D., Woohyung Lee, M.D.

*Department of Surgery, Seoul National University Bundang Hospital, Seoul National University
College of Medicine, Seongnam, Korea*

Purpose: Since introduction of the laparoscopic procedure for cholecystectomy, it has become the treatment of choice for symptomatic gallbladder diseases. Previous studies have demonstrated that implementation of critical pathway (CP) in laparoscopic cholecystectomy (LC) is effective in reducing cost in terms of length of stay (LOS) and revisit rates. However, few studies have proven the effectiveness of critical pathway specifically in patients with acute cholecystitis (AC).

Methods: CP was introduced for LC for chronic cholecystitis (CC) in April 2008. Then, indication for CP was extended to AC in May 2010. We compared outcomes of LC for patients with AC between two eras, including Pre-CP (Jan 2007 to Mar 2008) and Post-CP (May 2010 to Jun 2011). Among 78 patients with AC, 70 patients (90%) were enrolled for the critical pathway. Among them, 55 patients (79%) were discharged with full application of CP; however, it was suspended in 15

patients (21%).

Results: No differences in demographics and clinical characteristics were observed between Pre-CP (n=97) and Post-CP (n=70) patients. The mean LOS before surgery was shorter in the Post-CP group (2.6 vs. 4.0 days, $p=.012$). In addition, the mean total LOS was shorter in the Post-CP group (5.5 vs. 8.7 days, $p<.001$). However no differences in postoperative complications were observed between the two groups (10 vs. 5 cases, $p=.483$).

Conclusion: Implementation of CP in AC resulted in a decrease in the LOS in total and before surgery, without increasing morbidity. Therefore, critical pathway can be safely implemented for selected patients with AC.

Key words: Critical pathway, Acute cholecystitis, Laparoscopic cholecystectomy, Length of stay

INTRODUCTION

Critical pathways (CP) are designed tools to protocolize procedures or patient care for diseases. It was first developed in the 1980s in New England Medical Center for nurses to organize and improve the quality of medical care.¹ Then, CP evolved to a multidisciplinary instrument for standardized diseases, for all medical personnel.² Numerous studies have demonstrated that a well-designed critical pathway is an effective means of sustaining quality while controlling costs.²⁻⁵

Since laparoscopic procedure for cholecystectomy has been introduced, it has become the treatment of choice for symptomatic gallbladder stone.⁶ The positive effects of implementing critical pathways has been assessed in laparoscopic cholecystectomy (LC) for chronic cholecystitis (CC).⁵ However, only a

few studies are present on the usefulness on critical pathway in acute cholecystitis (AC) are present,⁴ because implementation of CP to AC is regarded as difficult due to wide variation of clinical manifestation. In this study, we evaluated on the length of hospital stay and the length of stay before surgery after implementation of critical pathway in patients with acute cholecystitis.

MATERIALS AND METHODS

In April 2008, our institution developed a critical pathway to standardize hospital course of LC, to improve quality of healthcare, to increase patients' satisfaction and to reduce length of stay. From January 2007 to March 2008 (before implementation of CP), 97 patients underwent LC for AC. And, 78 patients underwent LC for AC from May 2010 to June 2011(after CP implementation). Out of these 78 patients with AC, 8 patients were excluded. The reasons for exclusion were due to, newly developed AC during admission for other diseases (n=5), combined operation for concomitant colon cancer (n=1), valvular heart disease requiring warfarin stabilization after surgery (n=1), and severe inflammation in need of emergent

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* Corresponding author : Ho-Seong Han

Department of Surgery, Seoul National University Bundang Hospital, 300, Gumi-dong, Bundang-gu, Seongnam 463-707, Korea

Tel : +82-31-787-7091, Fax : +82-31-787-4078

E-mail : hanhs@snuh.org

Table 1. Demographics and characteristic between two groups

	Pre CP (n=97)	Post CP (n=70)	<i>p</i>
Age (yr, mean)	59.8±17	57.9±14	0.452
Sex (M : F)	65 : 32	46 : 24	0.862
BMI (kg/m ²)	24.6	24.6	0.980
Co-morbidity (patient, %)	58 (60)	43 (61)	0.832
Cerebrovascular	5	3	
Cardiovascular	42	32	
Chronic liver disease	1	2	
Respiratory	9	5	
PTGBD (patient, %)	23 (23.7)	18 (26)	0.768
Operation time (min, mean)	64.3	61.6	0.596
LOS after operation (day, mean)	4.7	3	<0.001
Total LOS (day, mean)	8.7	5.5	<0.001
LOS before surgery (day, mean)	4.0	2.6	0.012
Revisits to OPC (patient, %)	1	4	0.081
Open conversions (patient)	0	0	
Overall complications (case)	10	5	0.483

CP = critical pathway; BMI = body mass index; LOS = length of stay; OPC = out patient clinic.

operation (n=1). Therefore, CP was applied in 70 (90%) out of 78 patients. Among those 70 patients, CP was suspended in 14 patients (20%) due to the following reasons; severe inflammation (n=9), ileus (n=1), discharge refusal (n=1), small bowel perforation (n=1), voiding difficulty (n=1) and cholangitis (n=1).

The critical pathway is made up of a set of orders and directions for medical personnel including nurses and doctors. Pre-operative tests were usually done in the ER. After implementation of CP after admission from the ER, patients receive IV fluids, antibiotics and bowel preparation for surgery. On the day of surgery, IV antibiotics are administered right before the surgery and additional IV fluids are given after the operation. On the first day after operation, patients can drink water continued by soft solids, and also oral analgesics if the patients requires. On the second day, laboratory tests are done to check general status, and all IV medications including fluids and antibiotics are discarded. Patients can stay one more day if they have personal errands or if labs show abnormal results.

In this study, we compared postoperative LOS, LOS before surgery, complication rates, and re-admission rates between before and after implementation of CP during more than 1 year of follow-up period. Re-admission rates were measured by hospital visits up to present day, regarding cholecystectomy other than regular follow-up. Data were collected from chart review of electronic medical records.

Chi-square tests and independent samples t-tests were used

for statistical analysis. A *p* value of 0.05 or less was considered significant. All statistical analysis was done with SPSS version 18.0.

RESULTS

Table 1 shows patients' demographics, operation time and in-hospital events. There were no differences in terms of age, sex, Body Mass Index (BMI), and operation time between the two groups. Comorbidities were also similar between the two groups which consisted of cerebrovascular accidents, cardiovascular disease, chronic liver disease, and respiratory disease. No patients underwent open conversions in both groups. There were 23 cases of complicated AC in pre-CP group and 18 cases in post-CP group which needed percutaneous drainage (PTGBD) before surgery. There was no significant difference in the number of PTGBD insertions between the two groups. The LOS was significantly shorter in Post-CP group compared to Pre-CP group, in both total and postoperative (5.5 vs. 8.7, *p*<.001; 3.0 vs. 4.7, *p*<.001 respectively). Also, the LOS before surgery was significantly shorter after CP implementation (2.6 vs. 4, *p*=.012). All patients in Post-CP group were discharged at postoperative day 2 or day 3.

Regarding the number of revisits to outpatient clinic for complications, there was one patient from before implementation of CP and 4 patients after implementation of CP, which was not significant (*p*=.081).

Table 2. Types of complications in both groups

	Pre CP (n=97)	Post CP (n=70)	<i>p</i>
Fluid collection	4	0	0.086
Bile leakage	2	0	0.229
Infection	1	2	0.384
Residual stone	1	0	0.397
Ileus	1	1	0.817
Voiding difficulty	1	2	0.384

Table 2 shows types of postoperative complications in both groups and shows no significant differences. Before CP implementation, there were 4 cases of postoperative fluid collections, 2 cases of bile leakage, and one of each case of infection, residual stone, ileus, and voiding difficulty. After implementation of CP, there were 2 cases of infection, 1 case of ileus and 2 cases of voiding difficulty. Two patients who had bile leakage did not undergo percutaneous drainage due to its minor nature. Postoperative ERCP was done to patient with residual common bile duct stone. Indwelling urinary catheters were done to patients with voiding difficulty. Nasogastric tube was inserted to patients with ileus. Although cases of complications differ in the two groups, there were no significant differences overall ($p=.483$).

DISCUSSION

Increasing medical costs have pressured health care organizations to come up with strategies for efficient way of utilizing medical resources without compromising quality of care.⁷ Critical pathway implementation has several advantages. First, quality of medical care can be improved.³ Second, obtaining informed consent becomes easier.³ Third, works for medical staff and related professionals become standardized and simpler.³ Fourth, hospitalization period decreases which not only lowers the medical cost but increases hospital income by improving bed rotations.³

The effects of critical pathway in LC have been proven in previous studies.³ Now, out-patient LC is increasing in the United States due to expensive admission costs.^{6,8} However, some studies showed difficulty of LC on initial admission in patients with complicated gallstone diseases due to their severity of the disease.⁴ Some institutions demonstrated that only 40% of patients with AC underwent cholecystectomy on initial admission,^{9,10} despite the advantages of early cholecystectomy.¹¹

In our institution, all patients who come through the ER with AC are admitted for surgery, with or without a percutaneous

drainage.

There were several conditions that critical pathway cannot be applied. These conditions are patients with cardiac stent placements or myocardial infarction within 3 months, active use of anticoagulants, pregnancy, choledocholithiasis, emergency surgery, simultaneous treatment for acute cholecystitis and other major surgical procedures.^{2,4,5} Among 8 patients of exclusion in our study, 5 patients were initially admitted for other diseases and acute cholecystitis occurred coincidentally. All 5 patients were transferred back to the previous department immediately after surgery. Remaining 3 patients consisted of a patient with concomitant colon cancer, a patient being treated with warfarin, and a patient with unstable vital signs. All the patients in our study were diagnosed with AC before operation. Many studies have included intraoperative finding of AC as an exclusion criteria.^{2,5} Our study shows that patients with AC are capable of following the same pathway as non-acute patients.

Although it was in a chronic cholecystitis setting, report from Japan also showed decreased length of stay after pathway implementation.¹² Critical pathways are capable of reducing length of stays in not only surgical diseases but also medical diseases such as pneumonia and coronary artery bypass graft surgery.⁷ This reduction of length of stay reduces the time of waiting for patients awaiting surgery, as well as increasing hospital income. In our study, time from admission to surgery decreased from 4 days before CP to 2.6 days after CP implementation ($p=.012$). Sheffield and colleagues also reported significant decrease in time from admission to surgery after CP implementation (4.1 days to 2.1 days, $p<.001$).⁴ In another study by Casillas et al., shorter time to cholecystectomy reduced length of stay with no major or minor complications,⁹ which were also shown in this study.

LC has several possible postoperative complications, some major and some minor.¹³ Early discharge won't be acceptable if there were significant increase in complication rates. There were no major postoperative complications in our study, and there were no significant differences in overall immediate com-

plications after surgery between the two groups.

Patients' re-admissions or re-visits to the clinic, related to the surgery, are mainly because of delayed postoperative complications. Immediate complications can influence the length of stay, when delayed complications can cause re-admissions or re-visits. In our study there were no re-admissions but only a few re-visits. There were 5 patients who came to the out-patient clinic after discharge. The reasons for the returns were minor problems. One patient suffered from mild dyspepsia and received prescription for oral medication. Four patients had umbilical wound dehiscence which was clean enough to be sutured right away at the clinic. All the patients were easily controlled in the clinic. There were no major complications which led to an admission. This was similar to those of other studies on out-patient cholecystectomies.⁵ It is possible to say that early discharges after CP implementation did not increase delayed postoperative complications.

In conclusion, the ultimate goal of implementing a critical pathway begins with shortening the length of stay with lesser complications which then might lead to an out-patient basis practice. Further study and development of medication and surgery is needed to achieve the goal. For now, our study demonstrated that implementation of critical pathway has improved the efficiency of hospital care without compromising risks in selected patients with acute cholecystitis.

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