Acute Care Surgery Model for Emergency Cholecystectomy

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Purpose: Acute care surgery (ACS) models have evolved worldwide over the last decade. However, South Korea has an established trauma system and does not consider the ACS model. This study compares the management and outcome of emergency cholecystectomy in the ACS model to those of traditional on-call attending surgeon model for emergency surgery.

Methods: Retrospectively collected data for patients who underwent emergency cholecystectomy from May 2013 to January 2015 was analyzed to compare data from a traditional on-call system (OCS) and ACS.

Results: One hundred and twenty-four patients were enrolled in the study (62 patients ACS vs. 62 patients OCS). Hospital stay (days) (ACS=4.29±2.49 vs. OCS=4.82±4.48, p=0.46) and stay in emergency room (minutes) (ACS=213.10±113.99 vs. OCS=241.10±150.73, p=0.20) did not differ significantly between groups. Operation time (minutes) was significantly shorter in the ACS than OCS group (389.97±215.21 vs. 566.35±290.14, p < 0.001). Other clinical variables (sex, open-conversion rate, whether the operation was performed at night/holiday, intensive care unit admission rate) did not differ between groups. There was no mortality and readmission.

Conclusion: The implementation of the ACS led to shorter operation time and no increase of postoperative mortality and complication. (J Acute Care Surg 2016;6:57-61)

Key Words: General surgery, Time, Cholecystectomy, Gall bladder, Wounds and injuries

Introduction

Acute care surgery (ACS) model has evolved worldwide over the last decade. ACS is considered as a specific surgical service dedicated to the urgent assessment and treatment of patients with general surgical emergency including trauma [1,2]. Western countries have experienced fall of trauma surgery caused by development of imaging study, improved drug control, evolution of vascular intervention, and injury prevention [1,2].

ACS model has been suggested to overcome reduced operative management of blunt torso injury, increased financial burden, and challenge in maintaining surgical skill [1,2]. Now, ACS has become a standard model through a paradigm shift in western countries [1,2]. The trauma system of Korea is now being established under the leadership of the public health authority; however, the ACS model has not been adopted. Acute cholecystitis is one of the most common surgical problems in need of emergency surgery [3]. The prognosis of
acute cholecystitis varies widely from uneventful cure after cholecystectomy to lethal complication like biliary sepsis [4,5]. Early cholecystectomy can reduce the complication rate and hospital stay of acute cholecystitis patients [4,5].

Even though ACS model was successfully implemented in many hospitals worldwide, relatively few studies have focused on the effect of ACS for the non-trauma surgical emergency [3,6,7]. The previous studies showed that ACS model improved work flow in emergency department, decreased surgical evaluation time and hospital length of stay, as compared to traditional on-call system (OCS) [3,8-10]. The aim of this study was to elucidate the impact of the ACS model to emergency cholecystectomy by comparing the management and outcome of emergency cholecystectomy in ACS model to those of traditional on-call attending surgeon model for emergency surgery.

Methods

A retrospective analysis of patients who underwent emergency cholecystectomy in the hospital was performed to compare data from traditional OCS and ACS from May 2013 to January 2015. Each protocol was reviewed and approved by the institutional review board of Myongji Hospital. In this period, ACS model was partially implemented in the hospital. The ACS model and OCS model were applied alternatively for the study period for the emergency surgery.

Exclusion criteria of the study were the following: patients with 1) preoperative/postoperative endoscopic retrograde cholangiopancreatography (ERCP); 2) accompanied choledocholithiasis, cholangitis; 3) accompanied procedure including choledocholithotomy, choledochostomy or other combined surgical procedure; 4) sepsis needed to resuscitation; 5) intra-abdominal adhesion due to previous operation or medical condition; 6) severe combined pancreatitis; 7) other medical conditions that needed further diagnosis or additional treatment including pneumonia, heart failure; 8) single incision laparoscopic cholecystectomy; and 9) immediate transfer to other hospital after cholecystectomy (Fig. 1).

The emergency cholecystectomy was performed by 2 attending surgeons dedicated to emergency surgery including trauma in...
ACS group and by 3 other conventional on-call surgeons in OCS group. A retrospective analysis was performed for the basic patient characteristics and clinical factors including sex, age, operation method, open conversion, whether the surgery was performed on holiday (weekend and other national holiday), whether the surgery was performed at night (6 PM ~ 7 AM), intensive care unit (ICU) admission, emergency room (ER) stay, time to operation, operation time, and hospital stay.

All continuous data were presented as mean±standard deviation, unless otherwise noted. χ² test was used for nominal and categorical variables and the t-test was used for continuous variables. A p-value <0.05 (two tailed) was considered statistically significant. All statistical analyses were performed with IBM SPSS Statistics ver. 19.0 for Windows (IBM Co., Armonk, NY, USA).

Results

A total 239 emergency cholecystectomies were performed in this period. Finally, 124 patients were enrolled after 115 exclusions according to the exclusion criteria of the study (Fig. 1). There was no mortality and readmission. ACS group was younger than OCS group (57.66±15.97 vs. 48.56±14.73, p<0.01; Table 1). Hospital stay (d) and stay in ER (min) was not significantly different between OCS and ACS group (4.29±2.49 vs. 4.82±4.48, p=0.46; 213.10±113.99 vs. 241.10±150.73, p=0.20; Table 1). Time to operation (min) was significantly shorter in ACS than OCS group (389.97±215.21 vs. 566.35±290.14, p<0.001; Table 1). Laparoscopic-cholecystectomy rate of ACS group was higher than that of OCS group, with no statistical significance (3.2% vs. 11.3%, p=0.05; Table 1). Other clinical variables (sex, open-conversion rate, whether the operation was performed at night/holiday, and ICU admission rate) did not show differences between the two groups (Table 1). Post-operative complication occurred as follows: 1 patient of OCS group had pneumonia after the operation; 1 patient had wound seroma of umbilical port site in each group individually.

Discussion

The purpose of this study was to determine the impact of ACS model to emergency cholecystectomy. There has been no such study for impact of ACS in Korea. We evaluated the clinical impact of ACS in emergency surgery especially in cholecystectomy because cholecystectomy is one of the most common emergency surgical procedures. Appendectomy is also a common emergency procedure, but since it is technically easier compared to cholecystectomy it is often performed by in-house residents. This can cause bias when comparing outcomes such as time to operation between groups.

The five studies were performed to determine the impact

| Table 1. Demographics, work flow and outcomes between groups (n=124) |
|---------------------------------------------------------------|
|                                                               |
| Acute care surgery group (n=62)                               |
| On-call system group (n=62)                                   |
| p-value                                                      |
| Sex (male/female)                                            |
| 30/32                                                        |
| 33/29                                                        |
| 0.72                                                         |
| Age (y)                                                      |
| 57.66±15.97                                                  |
| 48.56±14.73                                                  |
| <0.001                                                       |
| Open cholecystectomy                                         |
| 2 (3.2)                                                      |
| 7 (1.3)                                                      |
| 0.05                                                         |
| Open conversion                                              |
| 0                                                            |
| 1 (1.6)                                                      |
| 1.00                                                         |
| Holiday surgery                                              |
| 18 (29.0)                                                    |
| 19 (30.6)                                                    |
| 1.00                                                         |
| Night surgery                                                |
| 33 (53.2)                                                    |
| 32 (51.6)                                                    |
| 1.00                                                         |
| Holiday or night surgery                                     |
| 24 (38.7)                                                    |
| 20 (32.3)                                                    |
| 0.57                                                         |
| Intensive care unit admission                                |
| 8 (12.9)                                                     |
| 1 (1.6)                                                      |
| 0.34                                                         |
| Emergency room stay (min)                                    |
| 213.10±113.99                                                |
| 241.10±150.73                                                |
| 0.20                                                         |
| Time to operation (min)                                      |
| 389.97±215.21                                                |
| 566.35±290.14                                                |
| <0.001                                                       |
| Operation time (min)                                         |
| 73.79±31.44                                                  |
| 63.39±36.46                                                  |
| 0.09                                                         |
| Hospital stay (d)                                            |
| 4.29±2.49                                                    |
| 4.82±4.48                                                    |
| 0.46                                                         |

Values are presented as number only, mean±standard deviation, or number (%).
Table 2. The impact of ACS model compared to traditional OCS model in previous studies

| Author                | Time to operation | Open conversion | Hospital stay | Mortality or morbidity | Cost |
|-----------------------|-------------------|-----------------|---------------|------------------------|------|
| Lehane et al. [9]     | Shorter           | NS              | Less          | Less                   | -    |
| Britt et al. [8]      | Shorter           | NS              | NS            | NS                     | Less |
| Lau and Difronzo [3]  | Shorter           | NS              | Less          | NS                     | -    |
| Lim et al. [7]        | Shorter           | NS              | NS            | NS                     | -    |
| Michailidou et al. [11]| Shorter          | Less            | Less          | Less                   | Less |
| The current study     | Shorter           | NS              | NS            | NS                     | -    |

ACS: acute care surgery, OCS: on-call system, NS: non-significant.

The current study has mainly two limitations. The first is from the retrospective study design. The second concerns the surgeon factor. The result can vary widely between hospitals based on skill and policy of the attending surgeon. While our results showed faster time to operation of ACS group than OCS group, the difference was not sufficient to change clinical outcome. The OCS surgeons of our hospital did not have their own protocol for acute cholecystitis, but they have a policy by which they do not delay the operation without a specific reason.

In conclusion, implementation of the ACS showed the shorter time to operation and no increase of postoperative mortality and complication. The true effect of ACS should be evaluated in terms of clinical, educational, and financial aspects. The United States has recognized the need to implement ACS because of the limitation of trauma system through many trials and error [12]. Korea is now establishing the trauma system and can take a lesson from the good role model, which has developed the trauma system. We believe that the public health authority of Korea should consider the implementation of ACS model.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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