Asian Journal of Surgery (2016) xx, 1–8

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.e-asianjournalsurgery.com

ORIGINAL ARTICLE

Risk assessment scales and predictors for simple versus severe cholecystitis in performing laparoscopic cholecystectomy

Kee-Hwan Kim [a], Say-June Kim [b], Sang Chul Lee [b], Sang Kuon Lee [b,*]

[a] *Department of Surgery, Uijeongbu St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Uijeongbu, Republic of Korea*
[b] *Department of Surgery, Daejeon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Daejeon, Republic of Korea*

Received 20 October 2015; received in revised form 3 December 2015; accepted 21 December 2015

KEYWORDS
cholecystitis;
complication;
CT scan;
predictive model;
prognosis

Summary *Background:* Because acute cholecystitis has a different prognosis according to the degree of inflammation, early detection and prompt operation of severe cholecystitis are critical to the success of treatment. However, computed tomography (CT) has a low discriminative value for differentiating between simple and severe cholecystitis. Therefore, to enhance the diagnostic accuracy of CT scan, the imaging studies should be supplemented by preoperative clinical variables.
Methods: Patients undergoing laparoscopic cholecystectomy for simple and severe cholecystitis between 2007 and 2014 were compared. Severe cholecystitis included hemorrhagic, gangrenous, emphysematous, xanthogranulomatous, and perforated cholecystitis. Prediction models for severe cholecystitis were developed based on multivariate analyses of preoperative clinical and radiologic variables.
Results: Independent factors related with severe cholecystitis were age $\geq$65 years, male gender, body mass index (BMI) $\geq$25, serum leukocyte count $\geq$10,000/mm^3, serum neutrophil fraction $\geq$80%, serum platelet count $\geq$20,000/mm^3, serum alanine transaminase (ALT) level $\geq$40 IU/L, admission via the emergency department, and radiologic features of gallbladder wall thickening $\geq$4 mm, and presence of pericholecystic fluid collection ($p < 0.05$). A standard risk assessment scale (range: 0–77) for severe cholecystitis was developed based on the individual hazard rate of these variables. Patients scoring $\geq$28 on the risk assessment scale showed an 8.6 higher odds of severe cholecystitis than those scoring <28 ($p < 0.01$).
Conclusion: Standard and quick-and-easy predictive models for severe cholecystitis have been

Conflicts of interest: All authors declare that they have no financial conflicts of interests to disclose.

* Corresponding author. Department of Surgery, Daejeon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Daeheung-dong 520-2, Joong-gu, Daejeon, Republic of Korea.
E-mail address: luislee@catholic.ac.kr (S.K. Lee).

http://dx.doi.org/10.1016/j.asjsur.2015.12.006

developed based on preoperative radiological and clinical variables, which is expected to help improve surgical outcome of patients with cholecystitis.

1. Introduction

Cholecystitis accounts for a substantial portion of hospital admissions related to gastrointestinal diseases, and cholecystectomy is the therapeutic gold standard to avoid its complications. According to the degree of inflammation, cholecystitis can be divided into simple and severe cholecystitis. Untreated simple cholecystitis resolves within 7–10 days if it does not progress to more severe cholecystitis.[1] The severe forms of cholecystitis include secondary changes such as hemorrhage, gangrene, emphysema, xanthogranuloma, and perforation.[2] Patients with severe cholecystitis usually require a higher number of intensive care unit admissions, prolonged postoperative hospital stays, and have increased morbidity and mortality.[3–6] To minimize those risks, it would be highly advantageous to predict the inflammatory severity preoperatively and to determine proper operative timing and method based on it.

Computed tomography (CT) has shown considerable diagnostic accuracy in diagnosing acute cholecystitis; however, CT has low discriminative value for differentiating between simple and severe cholecystitis. Bennett et al[7] reported that sensitivity and accuracy of CT for severe cholecystitis were 29.3% and 64.1%, respectively. Therefore, to enhance the diagnostic accuracy of CT scan, the more specific CT findings for severe cholecystitis should be stressed and supplemented by clinical variables. In this study, we intended to develop and validate scoring systems to predict severe cholecystitis based on preoperative clinical and radiologic parameters.

2. Methods

2.1. Study design and data collection

We prospectively collected and retrospectively reviewed data from patients who underwent laparoscopic cholecystectomies due to acute/chronic cholecystitis in Daejeon St. Mary's Hospital, College of Medicine, the Catholic University of Korea, between March 2007 and February 2014. After verification of the current data, the related radiology and pathology reports were supplemented as a part of this study. This study was approved by the institutional review board (IRB code: DC14RISI0068) of our institution. During the study period, 1023 cholecystectomies were performed either by the open or the laparoscopic approach. Our inclusion criteria of this study were patients who had undergone laparoscopic cholecystectomy due to acute/chronic cholecystitis without malignancy. According to our inclusion criteria, we excluded patients: (1) whose pathologic results indicated either absence of cholecystitis or the presence of malignancy ($n = 20$); and (2) who had initially attempted to undergo open cholecystectomy ($n = 10$). Thus, the remaining 983 patients became the subject of this study. We divided the study population into two groups based on the operative details and pathologic characteristics: simple cholecystitis and severe cholecystitis. Thereafter, we performed univariate and multivariate analyses using preoperative variables to find factors predictive of severe cholecystitis.

2.2. Terminology and definitions

Cholecystitis was defined based on the histological findings of an inflammatory infiltrate on examination of the gallbladder wall. Severe cholecystitis was defined as cholecystitis complicated by secondary changes, including hemorrhage, gangrene, emphysema, or perforation, and/or when pathological examination indicated xanthogranulomatous cholecystitis. Of severe cholecystitis, while gangrenous and xanthogranulomatous cholecystitis were pathologically diagnosed, the diagnoses of hemorrhagic, emphysematous, and perforated cholecystitis were considerably assisted by operative details. All the other findings were categorized as simple cholecystitis.

Our criteria for admission with the suspicion of acute cholecystitis via the emergency department are as follows: (1) patients who complain of intractable abdominal pain; (2) patients who raise a suspicion of abdominal sepsis evidenced by clinical findings; and (3) patients who have symptoms and physical examination suggestive of acute cholecystitis. Nearly all patients underwent an abdominal CT scan preoperatively. Abdominal ultrasound images were used sporadically when CT images were not available. Literature suggests that the gallbladder is generally considered distended if measures >5 cm in the short axis and >8 cm in length on the imaging study.[8] Therefore, in this study, gallbladder distension was defined when the value obtained by multiplying the short axis and the length of gallbladder was ≥ 40. The gallbladder wall was considered to be thickened when the thickest portion measured ≥ 4 mm.[8] Operation time referred to the time interval between the initial skin incision and completion of wound closure, as documented by an anesthesiologist. Conversion was defined as the completion of any part of a procedure using an open technique except for minimal wound extension (≤ 10 mm) for specimen delivery. In addition, the incidence of an addition of ports during surgery was also counted.

Postoperative complications were defined as those occurring within the same hospital stay as the surgical procedure. Intraabdominal hemorrhage was defined as bleeding requiring transfusion, radiological, or surgical

Please cite this article in press as: Kim K-H, et al., Risk assessment scales and predictors for simple versus severe cholecystitis in performing laparoscopic cholecystectomy, Asian Journal of Surgery (2016), http://dx.doi.org/10.1016/j.asjsur.2015.12.006