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How to predict difficult laparoscopic cholecystectomy? Proposal for a simple preoperative scoring system

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Scoring system;
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Abstract

BACKGROUND: Few studies have used operative time as a reflection of the surgical difficulty to create a preoperative score of operative difficulty in laparoscopic cholecystectomies (DiLCs score).

METHODS: Patients who benefited from cholecystectomy between 2010 and 2015 were reviewed. Difficult procedures were identified using the deviations from the operative time for simple cholecystectomies. Logistic regression analyses were carried out to build risk-assessment models and derive the DiLC score.

RESULTS: Overall, 644 patients were identified. Multivariate analyses identified male sex, previous cholecystitis attack, fibrinogen, neutrophil, and alkaline phosphatase count to be predictive of operative difficulties. Risk-assessment model was generated with an area under the receiver-operator curve of .80. Internal validation was performed using the bootstrap method.

CONCLUSIONS: The DiLC score is a simple and reliable tool which could be used to improve patient counseling, optimize surgical planning, detect procedures at risk, identify patients eligible for outpatient care, and enhance resident training.
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Since its introduction by P. Mouret in 1987, laparoscopic cholecystectomy (LC) has become the procedure of choice for the management of symptomatic gallstone disease. Advantages of LC compared with open cholecystectomy are well described and usually include decreased postoperative pain, shorter ileus, earlier oral intake, and earlier return to normal activities with better cosmesis.[1–6] Nevertheless, LC remains a highly technical procedure which can lead in troublesome cases to dramatic complications, especially when the surgeon is faced with serious inflammation at the cystic pedicle during emergency LC for acute cholecystitis, increasing operative time, conversion rate, and favoring bile duct injury and postoperative complications. However, the distinction between emergency and planned LC is not sufficient to correctly predict operative

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difficulties, which increases the operative risk and favors disorganization of the surgical team and the operating room.[7,8] The use of a predictive score of operative difficulty is thus of primary interest to identify high-risk procedures and could be helpful to improve patient counseling, optimize surgical planning and room efficiency, detect patients at risk of complications and change, when necessary, the operative technique or the surgeon, identify patients eligible for outpatient care, and select those for resident training.

Most existing scores evaluate the risk of conversion from laparoscopic to open procedure,[9,10] or use subjective scales to identify high-risk patients and derive risk-assessment models.[11–15] However, because of high-correlation level with surgeon's experience, conversion is not a good reflection of operative difficulty.[9] In contrast, operative time is considered for a surgeon out of his learning curve as reproducible criteria of the encountered difficulty.[9,16] Among studies reporting on the operative difficulty, only Sakuramoto et al[16] used operative time as the primary end point. However, their study included patients operated on by only 2 surgeons over a 10-year period and did not use readily available data in the final score, rendering the results challenging for application to other centers.

The aim of the present study is to propose a reliable and simple predictive score of operative difficulty for LC based on preoperative objective parameters using operative time as the reflection of technical difficulty.

Methods

All consecutive patients who underwent a cholecystectomy from May 2010 until May 2015 at Sainte-Anne Military Teaching Hospital, an urban tertiary care center, were retrospectively identified. The study was approved by the Sainte-Anne Hospital Institutional Review Board. Inclusion criteria were cholecystectomies performed for biliary colic or acute cholecystitis, or after antibiotic treatment of a previous cholecystitis attack. Patients were excluded if they were less than 18 years old, if they had open cholecystectomy in first intention, or if they presented choledocholithiasis or intensive care unit-associated acalculous cholecystitis. According to Tokyo Guidelines,[17–19] patients were preoperatively diagnosed to have acute cholecystitis if they presented local and systemic signs of inflammation and if imaging findings were characteristic of acute cholecystitis. Similarly, patients were preoperatively diagnosed to have choledocholithiasis or acute cholangitis if they demonstrated clinical or biological signs of systemic inflammation, cholestasis, and typical imaging findings.

The clinico-pathological data included demographics, comorbidities, American Society of Anesthesiologists score, body mass index, operative indication, deadline between surgery and the onset of symptoms, laboratory values, surgeon identification, operative time, need for conversion, intraoperative complications, blood loss, postoperative outcomes, and length of hospital stay.

At first, the median operative time of each surgeon for the achievement of an elective LC during which the surgeon experienced no technical difficulty (no adhesion, no bile spillage, and no injury to the duct or the artery) was retrieved and recorded as the "individual base time". Cholecystectomies during which technical difficulties were encountered were then identified for each surgeon when the operative time for a procedure exceeded 1.5 times the surgeon's individual base time. Patients were finally classified into 2 groups: easy cholecystectomies (operative time $<$1.5 times the surgeon's individual base time) and difficult cholecystectomies (operative time $\geq$1.5 times the surgeon's individual base time and procedures converted to open surgery). Operative time was calculated from skin incision to the end of skin suture.

All surgeons who performed cholecystectomies had more than 3 years' experience and had therefore completed their learning curves. Operations were performed in the French position, with open insertion of one 10-mm umbilical port and two 5-mm ports. The dissection started at Calot's triangle with retrograde dissection of the cystic pedicle using the "flag technique" to ensure successful achievement of the Strasberg's critical view of safety.[20] Cystic duct and cystic artery were exposed and then divided between clips. Intraoperative cholangiographies were systematically performed to ensure bile duct clearance and avoid undetected bile duct injuries (BDIs). Laboratory values were obtained immediately before the operation. Intraoperative complications and reasons for conversion were noted as tight adhesions, severe inflammation, unclear anatomy, bleeding, and BDI classified according to the Strasberg classification.[21] Postoperative complications were classified according to the Dindo-Clavien classification.[22]

Statistical analysis

Statistical analyses were performed using IBM SPSS 20.0 (IBM Inc., New York, NY) and the 'ModelGood' package for R 3.1 (R Foundation for Statistical Computing, Vienna, Austria). Categorical variables are described in terms of frequency (percentages) and continuous variables as the median (range) or mean ($\pm$standard deviation [SD]). Owing to the retrospective nature of this work, some variables were missing. Percentages are thus recorded as valid percentages based on the number of patients with the data available for each parameter. Continuous data were first studied in a linear way, and then stratified into categorical variables using receiver-operator characteristic (ROC) curves and distribution histograms to identify significant thresholds. Cut-off values were finally rounded to facilitate their employment in the final score. Univariate analyses were conducted using a Student *t* test or a Mann-Whitney test for continuous variables, and a chi-square test or Fischer's exact test for categorical

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