Prediction of intraoperative complexity from preoperative patient data for laparoscopic cholecystectomy.

Abstract:

Different reasons may cause difficult intraoperative surgical situations. This study aims to predict intraoperative complexity by classifying and evaluating preoperative patient data. The basic prediction problem addressed in this paper involves the classification of preoperative data into two classes: easy (Class 0) and complex (Class 1) surgeries. Preoperative patient data were collected from 337 patients admitted to the Klinikum rechts der Isar hospital in Munich, Germany for laparoscopic cholecystectomy (LAPCHOL) in the period of 2005-2008. The data include the patient's body mass index (BMI), sex, inflammation, wall thickening, age and history of previous surgery, as well as the name and level of experience of the operating surgeon. The operating surgeon was asked to label the intraoperative complexity after the surgery: '0' if the surgery was easy and '1' if it was complex. For the classification task a set of classifiers was evaluated, including linear discriminant classifier (LDC), quadratic discriminant classifier (QDC), Parzen and support vector machine (SVM). Moreover, feature-selection was applied to derive the optimal preoperative patient parameters for predicting intraoperative complexity. Classification results indicate a preference for the LDC in terms of classification error, although the SVM classifier is preferred in terms of results concerning the area.
under the curve. The trained LDC or SVM classifier can therefore be used in preoperative settings to predict complexity from preoperative patient data with classification error rates below 17%. Moreover, feature-selection results identify bias in the process of labelling surgical complexity, although this bias is irrelevant for patients with inflammation, wall thickening, male sex and high BMI. These patients tend to be at high risk for complex LAPCHOL surgeries, regardless of labelling bias. Intraoperative complexity can be predicted before surgery according to preoperative data with accuracy up to 83% using an LDC or SVM classifier. The set of features that are relevant for predicting complexity includes inflammation, wall thickening, sex and BMI score.

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