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Clinical assessment before hepatectomy identifies high-risk patients

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ABSTRACT

Background: Liver resection is associated with significant morbidity, and assessment of risk is an important part of preoperative consultations. Objective methods exist to assess operative risk, including cardiopulmonary exercise testing (CPX). Subjective assessment is also made in clinic, and patients perceived to be high-risk are referred for CPX at our institution. This article addresses clinicians' ability to identify patients with a higher risk of surgical complications after hepatectomy, using selection for CPX as a surrogate marker for increased operative risk.

Materials and methods: Prospectively collected data on patients undergoing hepatectomy between February 2008 and November 2013 were retrieved and the cohort divided according to CPX referral. Complications were classified using the Clavien–Dindo system.

Results: CPX testing was carried out before 101 of 405 liver resections during the study period. The median age was 72 and 64 in CPX and non-CPX groups, respectively ($P < 0.001$). The resection size was similar between the groups. No difference was noted for grade III complications between CPX and non-CPX tested-groups; however, 19 (18.8%) and 28 (9.2%) patients suffered grade IV–V complications, respectively ($P = 0.009$). There was no difference in long-term survival between groups ($P = 0.63$).

Conclusions: This study attempts to assess clinicians' ability to identify patients at greater risk of complications after hepatectomy. The confirmation that patients identified in this way are at greater risk of grade IV–V complications demonstrates the value of preoperative counseling. High-risk patients do not have worse long-term outcomes suggesting survival is determined by other factors, particularly disease recurrence.

1. Introduction

Liver resection is undertaken for a spectrum of liver pathology, in particular for colorectal metastases, and remains an operation with a high rate of perioperative complications, including a mortality range of 1.4%–5.3% [1–3] and morbidity range of 22%–55.5% [1,2,4,5]. Preoperative assessment of the potential risk of liver resection allows

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counseling of patients regarding treatment options and can inform decision making in perioperative planning, including tailoring anesthetic techniques and the provision of critical care facilities. Although many scoring systems exist for stratifying operative risk in general surgery including the Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (POSSUM) score [6], the American Society of Anesthesiologists (ASA) physical status classification system [7] and Charlson comorbidity index [8], none of these scoring systems have been validated for patients undergoing liver resection and preoperative assessment is still largely subjective. Assessment of an individual patient's fitness to undergo surgery can also be performed using cardiopulmonary exercise testing (CPX), which involves a period of supervised exercise during which physiological parameters are measured [9]. This technique is commonly offered to patients who are perceived to be at higher risk of operative complications and has been shown to be of value in stratifying potential risk in patients undergoing pancreatic [10], vascular [11], and thoracic surgery [12]. However, in addition to assessment of physiological function, prediction of operative risk is influenced by the extent of the anticipated liver resection and also a patient's psychological preparedness [13]. These factors are routinely considered by surgeons in encounters with patients when liver surgery is contemplated and patients may be advised against surgery when the risks of surgery are considered to be high.

There is a large element of subjectivity in the clinical assessment of operative risk and also the possibility of variation between individual surgeons. Measurement of the accuracy of subjective predictions of perioperative risk is difficult, as a record of the estimated potential risk to patients is rarely made in a consistent fashion and postoperative outcomes may not be recorded methodically. Validation of subjective assessments made in this way is, however, important to ensure that surgery is offered appropriately to patients and for patients to be confident that they are receiving reliable advice. This article addresses the ability of clinicians to identify patients with a higher risk of surgical complications using the selection of patients for enhanced preoperative assessment with CPX testing as a surrogate marker of increased risk and determining correlation with postoperative complications. Comparison with CPX variables has not been undertaken.

2. Methods

Review of a prospectively maintained database was undertaken from February 2008–November 2013. The study group included all patients undergoing liver resection for malignant parenchymal liver lesions. Patients undergoing liver surgery for obstructing lesions of the proximal hepatic duct or in the presence of chronic liver disease were excluded, as surgery in these situations is associated with higher risk [2,14]. Liver resection was undertaken with standard techniques and described according to the Brisbane classification [15].

CPX testing was introduced as a preoperative assessment tool in our hospital in February 2008 on a trial basis. Initially it was available for use at the discretion of referring consultants for patients considered to be at higher risk of surgical complications. This was wholly based on a subjective assessment of comorbidity, body habitus, perceptions of physical fitness, and psychological wellbeing, and no predefined criteria were used. As the technique was under trial, it was not used as a method to select patients for surgery. The results of CPX testing were used to counsel patients and inform perioperative therapeutic strategies. After November 2013, CPX testing has been undertaken on all patients offered liver resection.

Postsurgical outcomes were classified according to the Clavien–Dindo system [16], and grade III–V complications used as indicators of significant postoperative complications. Broadly, grade III complications require postoperative intervention (commonly for bile leaks), grade IV complications include organ failure, and grade V complication is death. Liver failure was classified according to the International Study Group for Liver Surgery consensus definition of post-hepatectomy liver failure [17] and renal failure according to the RIFLE scoring system [18].

Additional retrieved data included age and gender, diagnosis, diabetes mellitus status, preoperative liver-specific chemotherapy, number of liver segments resected, length of hospital stay, and survival. The ASA grade was determined by the responsible anesthetist at the time of surgery and the Charlson comorbidity score was calculated retrospectively.

Statistical analysis was carried out using chi square, Mann–Whitney *U*, and Mantel–Cox tests where appropriate and a *P* value of <0.05 was considered statistically significant. Survival curves were constructed by IBM (Armonk, NY) SPSS software using the Kaplan–Meier method. In follow-up analysis, survival was measured from the time of first liver resection, and follow-up was completed on 21st October 2014. Patients undergoing repeat liver resection who had their first resection before the start of the study period were excluded from survival analysis. Patients who died within 30 d of surgery were also excluded.

Confirmation was obtained from the South-West Health Research Authority that research ethics committee review was not required because patient data were collected prospectively as a normal part of hospital care and all data were anonymized. No patient consent was required for this study.

3. Results

Details of patients selected for the study are shown in Figure 1. The proportion of cases where CPX investigation was undertaken was similar throughout the 5 y of the study period with 24, 32, 22, and 23 CPX tests performed in consecutive quartiles. Patient and operative characteristics are shown in Table 1. Patients being referred for CPX were older, more likely to be male, and have diabetes. The proportion having a major resection, the median number of segments resected, and the proportion receiving preoperative chemotherapy did not differ between the two groups. Patients were less likely to have a CPX test before a repeat liver resection. The Charlson preoperative risk score and ASA grade were significantly higher among patients undergoing CPX assessment. Clavien–Dindo IV and V complications were