ORIGINAL ARTICLE

Short-term outcomes after liver resection for malignant and benign disease in the age of ERAS

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Abstract

Introduction: Enhanced Recovery After Surgery protocols have been implemented effectively after liver resection and provide benefits in terms of general morbidity rates. In order to optimise peri-operative care protocols and minimise morbidity, further investigation is required to identify factors associated with poor outcome after liver resection.

Methods: A retrospective analysis of patients undergoing liver resection and enhanced recovery care between January 2006 and September 2012 was conducted. Data were collected on patient outcome and demographics, operative and pathological details. Univariate and multivariate analyses were performed to determine independent predictors of adverse outcome.

Results: 603 patients underwent liver resection during the study period. Morbidity and mortality rates were 34.3% and 1.5% respectively. The only predictor of major morbidity was extended resection (OR 4.079; 95% CI 2.177–7.642).

Conclusions: Extended resection is associated with major morbidity. When determining optimum peri-operative care, ERAS protocols must incorporate care components that can mitigate against morbidity associated with extended resection.

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Introduction

Liver resection offers definitive surgery for a number of malignant and benign conditions. Traditionally liver resection has been associated with high post-operative mortality and morbidity rates.[1] With centralisation of services to high volume centres, mortality rate has steadily declined to an accepted rate of less than five per cent.[2] Morbidity rates, however, remain high at up to 45%.[3] Not only is peri-operative morbidity delaying discharge, causing patient suffering and increased risk of mortality, but it is also associated with decreased overall long term survival following surgery for malignant disease.[4]

Therefore the minimisation of morbidity is fundamental to improving outcomes. Enhanced Recovery After Surgery (ERAS) programmes have been utilised extensively in colorectal surgery and have been shown to not only reduce hospital admission time but can reduce morbidity rates and is now established as standard of care.[5] In liver resectional surgery there has been increasing interest in ERAS protocols.[6] Not only is ERAS after liver surgery deemed safe and feasible but two recent RCTs[7,8] have shown reduced morbidity rates after liver resections.

Predictors of morbidity have been assessed before,[3,9] however, a recent assessment of predictors of outcome after resection of all tumour types, in a general population undergoing enhanced recovery multi-modal peri-operative care is lacking.

The investigating unit is experienced at providing enhanced recovery care after liver surgery.[10–12] In order to formulate successful post-operative ERAS protocols and continue to effectively reduce surgical complications it is critical to evaluate the factors associated with post-operative morbidity and determine areas of care that can be optimised after liver resection. The aim of this study was to quantify outcomes and assess the predictors of morbidity after liver surgery when enhanced recovery care principles have been applied.

Methods

Approval from the NHS Lothian review board was obtained prior to commencing the data collection. All patients who underwent a liver resection between January 2006 and September 2012 within the Royal Infirmary of Edinburgh, UK, were identified from the prospectively collated Lothian Surgical Audit database. The Caldicott Guardian approval was obtained and these principles of data management were adhered to.

Peri-operative protocol

All patients undergoing liver resection underwent review in a multi-disciplinary team meeting where their radiological investigation was assessed by the surgical and radiological team in an attempt to ascertain resectability. This decision was made in concert with the oncology team and a decision made regarding pre-operative chemotherapy, further staging and suitability for surgery if appropriate.

Peri-operative care at the Royal Infirmary of Edinburgh, is based on a protocol first described by van Dam *et al.* (2008)[11] (Table 1) and has been utilised in subsequent clinical trials.[10,12]

The patients were routinely reviewed in the out-patient clinic approximately 4 weeks post discharge and discussed in the MDT meeting where pathological analysis of the specimen was reported and follow up and adjuvant chemotherapy was decided upon.

Data collection

Demographic details, namely age, gender and comorbidities were collected from the patient case files. Presence of co-morbidity was determined when at least one co-morbidity was described in the pre-operative clinic assessment.

Pre-operative oncological data were obtained from the transcription of the Multi-Disciplinary Team (MDT) meeting prior to resection. From this report primary resectability, portal vein emobilisation (PVE) and neoadjuvant chemotherapy were obtained. Confirmation of PVE was obtained from CT report. Neoadjuvant chemotherapy was also confirmed from the MDT report and deemed to be positive if chemotherapy was commenced prior to resection. Pre-operative blood tests were obtained from the laboratory investigations contained within the electronic patient records.

The extent of the procedure and use of in-flow occlusion were determined with major resection being defined as resection of three or more segments. Extended resection was defined as resection of five or more segments as per the Brisbane criteria.[13]

Intra-operative and post-operative blood transfusion information was obtained from the Blood Transfusion Service database of prospectively collected data. Day of operation from the operation note and admission dates were compared with the dates of transfusion of RCC and reported as receiving transfusion accordingly.

Admission data were gained from the patient case records and clinical course, complications and index length of stay were documented. Post-operative complications were also gathered from the patent records, namely the discharge letter from the discharging surgeon. The nature of the complication was recorded as per the operating surgeons' discharge documentation. Morbidity severity was subsequently categorised into major morbidity (Clavien Dindo grade three or above) and minor morbidity (Clavien Dindo grade below three).

Histopathological data were gained from the original pathology report. Underlying tumour pathology, size and number were recorded. Abnormalities in the underlying liver parenchyma was also confirmed from the pathology report as was resection margin with a R1 resection being confirmed if the tumour edge was within 1 mm of the resection margin.

Table 1 Enhanced recovery protocol

Time point	Recovery elements
Day before surgery	
	Normal oral nutrition until midnight No preanesthetic medication
DOS	
	Short-acting i.v. anaesthetic agent No nasogastric drainage; if used, remove immediately after surgery Warm i.v. fluids, and upper and lower body air-warming device Prophylactic antibiotics Avoidance of excessive i.v. fluids No routine drainage of the peritoneal cavity Epidural analgesia Restart oral intake of water/nutrition *ad libitum*
POD 1	
	Arterial and central lines out Patient mobilizes around bed Discontinuation of intravenous fluids if haemodynamically stable and drinks more than 1 L of fluid Normal diet Continue epidural 1000 mg paracetamol every 6 h
POD 2	
	Continue mobilization Patient to mobilize 1000 mg paracetamol every 6 h Urinary catheter out Normal diet Oral analgesia Transfer to general ward
POD 3	
	Epidural out Continue mobilization Normal diet Check discharge criteria
POD 4	
	Check discharge criteria