The American Journal of Surgery (2016) 211, 102-108

The American Journal of Surgery®

Clinical Science

Morbidity and mortality of hepatectomy for benign liver tumors

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KEYWORDS:
NSQIP;
Liver metastases;
Benign liver tumors;
Hepatic adenoma;
Hepatic hemangioma;
Surgical outcomes

Abstract

BACKGROUND: This study compared the morbidity and mortality following hepatectomy for benign liver tumors and hepatic metastases.

METHODS: This retrospective cohort study compared patients who underwent hepatectomy for benign liver tumors and metastases reported to National Surgical Quality Improvement Program between 2005 and 2011.

RESULTS: A total of 5,542 patients underwent hepatectomy: 1,164 (21%) for benign and 4,378 (79%) for metastatic diseases. Patients with benign tumors were younger, predominantly female, and were less likely to have preoperative comorbidities (all $P < .037$). Rates of major complications including infections, embolism, renal failure, stroke, coma, cardiac arrest, reoperation, and ventilator dependence were similar between the 2 groups (all $P \geq .05$). Thirty-day mortality was .9% among patients with benign tumors and 1.4% among patients with metastases ($P = .128$). After adjusting for significant effects of age and major complications (both $P \leq .007$), benign vs malignant diagnosis and extent of hepatectomy was not associated with 30-day survival (both $P \geq .083$).

CONCLUSIONS: Despite patients with benign disease being younger and healthier, risks of major complications are similar after hepatectomy for benign and metastatic disease. Hepatectomy should be offered selectively for patients with benign liver tumors.

Partial hepatectomy is an accepted treatment for patients with resectable primary and/or secondary malignant liver tumors. The majority of liver resections are performed for the treatment of metastatic disease, in particular colorectal and neuroendocrine metastases.[1] Increasingly, however, benign liver neoplasms are being diagnosed and/or treated with operative resection.[2] Current indications for resection of benign tumors include perceived tumor-related symptoms, failure to exclude malignancy, or concern for malignant transformation.[3]

Recent published series report improved outcomes following major hepatic resection at high-volume centers

The authors declare no conflicts of interest.

Presented in part at the 55th Annual Meeting of the Society for Surgery of the Alimentary Tract, May 2–6, 2014, Chicago, Illinois and 2014 American College of Surgeons National Surgical Quality Improvement Program National Conference, July 26–29, 2014, New York.

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Manuscript received October 28, 2014; revised manuscript May 29, 2015

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http://dx.doi.org/10.1016/j.amjsurg.2015.06.010

with mortality rates below 3% to 5% compared with rates greater than 10% before the 1990s.[1,4–9] Factors associated with decreased mortality include improved understanding of liver anatomy, advances in perioperative and operative techniques and anesthesia care, better patient selection, and concentration of major resections at high-volume centers.[1,5,10–12] Despite improved overall outcomes, hepatic resection remains a high-risk operation with estimated morbidity as high as 20% to 45%.[4,11] To date, the majority of data estimating morbidity and mortality following hepatic resection for benign liver disease have included single center experiences; comparisons to patients with malignancy have not been adequately performed.

The aim of this study was to investigate the national outcomes following hepatic resection among patients with benign liver tumors. We utilized publically available data from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) public use file (PUF) to test the hypothesis that there is no difference in perioperative morbidity and mortality between patients undergoing liver resection for benign and metastatic tumors to the liver.

Methods

National Surgical Quality Improvement Program and study population

This study utilized patient records obtained from the ACS NSQIP PUF, which is available to all NSQIP participants. The NSQIP is currently the largest nationwide multidisciplinary surgical database in the United States. While detailed NSQIP methodology in patients undergoing hepatic surgery has been reported previously, a brief synopsis is as follows.[13,14] Within participating centers, preoperative patient characteristics, intraoperative processes of care, and postoperative adverse occurrences within 30 days after index operation are prospectively collected by trained risk-assessment data managers with nursing expertise. Data abstraction occurs consistently with standardized study definitions and regular conference calls. Frequent meetings and site visits are used to ensure fidelity of data. Within the database, the index operation is defined as the first operation during the hospitalization for patients undergoing multiple procedures during their hospital stay.

Patient selection, variable definitions, and outcomes

A retrospective study design was used to review NSQIP patient records for adults (age $\geq$ 18 years) undergoing liver resection between 2005 and 2011. Extent of liver resection was classified according to the index procedure using the current procedural terminology (CPT) codes: partial lobectomy (47120), trisegmentectomy (47122), total left hepatectomy (47125), and total right hepatectomy (47130). All analyzed variables reflect standardized NSQIP definitions.[15] Patients with benign liver tumors were defined using the following International Classification of Diseases, 9th revision (ICD-9) codes: 211.5 (benign liver neoplasm), 228.04 (hemangioma), and 573.8 (liver disorder, not specified). Patients with malignant metastatic disease to the liver were defined using the ICD-9 code 197.7 (secondary malignant neoplasm to the liver). All diagnoses were coded after pathologic confirmation. Patients with primary hepatic malignancy were specifically excluded to avoid confounding factors associated with primary hepatic neoplasms including underlying liver disease and cirrhosis.

Reported outcomes are those occurring within 30 days of the index operation and/or during the initial postoperative course if greater than 30 days, including superficial, deep, and organ space surgical site infections (SSI), wound disruption, pneumonia, reintubation, prolonged mechanical ventilation (>48 hours), acute renal failure, urinary tract infection, stroke, cardiac arrest, myocardial infarction, bleeding/blood product transfusion requirement, sepsis, septic shock, reoperation, and mortality. Measures of resource utilization for all patients included total hospital length of stay, and prolonged postoperative mechanical ventilation as a proxy for the rates of prolonged intensive care unit stay. The ACS NSQIP PUF has been designated by the University of Virginia Institutional Review Board for Health Sciences Research as a public dataset; as such this study is considered exempt from formal Institutional Review Board review.

Analysis

All statistical analyses were designed to test the null hypothesis that outcomes following hepatectomy are not significantly different between patients undergoing resection for benign liver tumors and metastases to the liver. Patient risk factors and postoperative outcomes were stratified by benign vs malignant diagnosis. Inferential statistics were calculated using univariate hypothesis testing. Categorical data are presented as percentages and were compared using either chi-square or Fisher's exact tests where appropriate. All continuous data are represented as median [interquartile range]. Normally distributed continuous data were compared using independent sample single factor analysis of variance, while non-normally distributed data were compared using the Mann–Whitney *U* test.

Two separate multivariable logistic regression models tested the effects of age, sex, American Society of Anesthesiologists (ASA) class, preoperative comorbidities, preoperative chemotherapy, operative extent, and benign vs malignant diagnosis on the development of postoperative complications, as well as the effects of all covariates on 30-day and in-hospital mortality. Operative extent of liver resection was classified as minor hepatectomy (47120) and