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Cirrhosis increases mortality and splenectomy rates following splenic injury

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Abstract

BACKGROUND: Cirrhosis may be a risk factor for mortality following blunt splenic injury (BSI) and it predicts the need for an operative intervention.

METHODS: We performed a case–control study at 3 level 1 trauma centers. Comparisons were made with chi-square test, Wilcoxon rank-sum test, and binary logistic regression, and stratified by propensity for splenectomy. Data are presented as odds ratios (ORs) and 95% confidence intervals (95% CIs).

RESULTS: Mortality was 27% (21/77) and cirrhosis was a strong risk factor for death (OR 8.8, 95% CI 3.7 to 21.1). Compared with controls, cirrhosis was an independent risk factor for splenectomy (OR 5.4, 95% CI 2.5 to 11.5), and only splenic injury grade was associated with splenectomy (OR 2.2, 95% CI 1.3 to 3.6). Only admission model for end-stage liver disease was independently associated with mortality after an operation (OR 1.7, 95% CI 1.1 to 2.8). After propensity score matching, we found no association between splenectomy and mortality in cirrhotic patients.

CONCLUSION: Cirrhosis dramatically increases mortality and the odds of an operative intervention in BSI patients with pre-existing cirrhosis, and BSI requires vigilant attention and early intervention should be considered.

The spleen is the most frequently injured intra-abdominal organ following blunt abdominal trauma and failure to stop exsanguination is the most common cause of preventable traumatic death. In the past, splenic injury mandated operative management, although numerous recent studies suggest that nonoperative management (NOM) of select patients with splenic trauma is safe, effective, and may be associated with improved long-term outcomes.[1–6]

NOM is attempted in the majority of patients with blunt splenic injury (BSI), although up to 13% of patients initially managed nonoperatively will eventually require a splenic operation.[7,8] Deciding on NOM of splenic trauma requires knowledge of a patient's comorbid conditions, hemodynamic stability, and available hospital resources.[1,5,6] Risk factors for failed NOM include age, increasing Injury Severity Score

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(ISS), splenic injury grade (SIG), hemoperitoneum, a "blush" on computed tomography, and hypotension.[2,9] Despite a pathophysiology that includes portal hypertension, splenomegaly, and thrombocytopenia and its association with mortality in all trauma patients, cirrhosis has not been classically appreciated as a risk factor for failing NOM of BSI or requiring an immediate splenectomy.[10–12] A series of 12 patients demonstrated that 92% of patients with cirrhosis and BSI required a splenectomy, while a recent analysis of the National Trauma Data Bank (NTDB) demonstrated increased risk of failed NOM and mortality in cirrhotic patients with BSI.[13,14] This study has several key limitations.[15] Perhaps most importantly, the NTDB lacks information necessary to calculate a model for end-stage liver disease (MELD) score, an accepted prognostic score in chronic liver disease patients.[14] The MELD score may be particularly pertinent in patients with BSI and cirrhosis as the degree of liver dysfunction and subsequent portal hypertension could predispose patients to more severe ongoing bleeding.

This study was performed to confirm the findings of the previous registry-based study and small pilot study using a multicenter case–control design with the inclusion of MELD data. We hypothesized that cirrhosis would be associated with increased risk of operative intervention and mortality in patients with BSI.

Patients and Methods

We identified patients listed in the trauma registries of the 3 level 1 trauma centers that make up the Pacific Northwest Trauma Research Consortium. Cases were identified by screening the prospectively maintained trauma registries and inclusion criteria were age greater than or equal to 18 years, cirrhosis, and a splenic injury. Cirrhosis was defined as either a pre-existing diagnosis of cirrhosis or an explicit diagnosis of cirrhosis made during the index admission. These diagnoses were verified by clinical chart review. We included patients admitted from 1993 to 2013 and reviewed the medical records of identified patients. Operative management of a splenic injury was defined as either splenectomy or splenorrhaphy, while any embolization or diagnostic angiography on the spleen was defined as an angiographic intervention. Given the limitations of a retrospective chart review, we were unable to reliably determine the intent of the trauma surgeon to provide immediate transfer to the operating room. We therefore used time to the operating room as a surrogate for intention to operate immediately, and we defined immediate transfer to the operating room as a splenectomy less than or equal to 6 hours, a time cutoff used by prior studies in this field.[14]

We calculated admission MELD scores from laboratory data collected within 24 hours of admission using the accepted formula: [MELD score = (.957 × ln(serum creatinine) + .378 × ln(serum bilirubin) + 1.120 × ln(international normalized ratio) + .643) × 10].[16] Institutional trauma registry diagnosis of SIG was abstracted according to the American Association of Surgery for Trauma (AAST) scoring guidelines. Given that the International Classification of Disease - 9th edition codes 865.02 and 852.12 mapped to AAST scores 1 or 2, all patients with these International Classification of Disease - 9th edition codes were coded as AAST injury grade 2 for consistency.[17] This study was reviewed and approved by the institutional review boards of all 3 participating centers.

Control patients were identified by obtaining the list of trauma patients at our 3 centers with a diagnosis of a splenic injury but no concomitant diagnosis of cirrhosis. Cases were then matched with up to 4 controls based on sex, AAST SIG, age (within 10 years), and ISS (within 20 points) using the case–control match algorithm included in SPSS version 22 (IBM Corporation, Armonk, NY). When more than 4 controls matched within the defined parameters for a single case, the 4 control patients with the closest match were selected for inclusion.

Univariable comparisons were made with Fisher's exact test and a Mann–Whitney *U* test for categorical and nonparametric continuous data, respectively. Multivariable comparisons were made with binary logistic and linear regression analysis. Variables were selected for inclusion in these multivariable models by developing a Pearson correlation coefficient and including variables in the model if the significance of their correlation was less than or equal to .2. In a similar fashion, we used multivariable logistic regression to generate a propensity score for the likelihood of cases to undergo splenectomy. Propensity score matching exploits the fact that patients within propensity strata are equivalent in terms of their odds of proceeding to a splenectomy after BSI and effectively controls for the selection bias related to the choice of therapy, allowing more robust inferences from the data.[18] To compare cases to control patients, we employed stratified logistic regression. This allowed comparison of up to 4 control patients per case. In this final stage of the analysis, we excluded patients with zero matched controls.

Data are presented as medians with 25th and 75th quartile and odds ratios (ORs) with 95% confidence intervals (CIs); significance was set at *P* value less than .05. Comparisons were made with SPSS version 22 (IBM Corporation).

Results

We identified 77 patients with BSI and cirrhosis, of whom 79% (61/77) were male with a median age of 53 (45, 58) years. The most common etiologies of cirrhosis listed in the registries were alcohol use [43% (33/77)] and viral infection [31% (24/77)]. The most common mechanism of injury was a fall [35% (27/77)], followed by motor vehicle crash [27% (21/77)]. Median admission MELD score was 13 (8, 15), median ISS 22 (12, 34), and median SIG was 3 (2, 3).

After case–control matching, 67 cases were able to be matched to at least one control patient and 239 control