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Hernia repair in the presence of ascites

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ABSTRACT

Background: The model for end-stage liver disease (MELD) has been validated as a prediction tool for postoperative mortality, but its role in predicting morbidity has not been well studied. We sought to determine the role of MELD, among other factors, in predicting morbidity and mortality in patients with nonmalignant ascites undergoing hernia repair.
Methods: All patients undergoing hernia repair in the American College of Surgeons National Surgical Quality Improvement database (2009–11) were identified. Those with nonmalignant ascites were compared with patients without ascites. A subset analysis of patients with nonmalignant ascites was performed to evaluate the association between MELD and morbidity and mortality with adjustment for potential confounders. The association of significant factors with the rate of morbidity was displayed using a best-fit polynomial regression.
Results: Of 138,366 hernia repairs, 778 (0.56%) were performed on patients with nonmalignant ascites. Thirty-day morbidity (4% *versus* 19%) and mortality (0.2% *versus* 5.3%) were significantly more frequent in patients with ascites ($P < 0.001$). In univariate analysis of the 636 patients with a calculable MELD, MELD was associated with both morbidity and mortality ($P < 0.001$ each). In multivariate analysis, MELD remained significantly associated with morbidity (odds ratio [OR] = 1.11). Ventral hernia repair (OR = 2.9), dependent functional status (OR = 2.3), alcohol use (OR = 2.3), emergent operation (OR = 2.0) white blood count (OR = 1.1), and age (OR = 1.02) were also significantly associated with morbidity ($P < 0.05$).
Conclusions: Before hernia repair, the MELD score can be used to risk-stratify patients with nonmalignant ascites not only for mortality but also morbidity. Morbidity rates increase rapidly with MELD above 15, but other factors should additionally be accounted for when counseling patients on their perioperative risk.

1. Introduction

Ascites is the accumulation of fluid within the peritoneal cavity. The presence of ascites has been associated with an increase in intra-abdominal pressure, and may increase tension on the abdominal wall with weakening of the abdominal fascia [1,2]. Abdominal wall hernia is common in patients with ascites. Indeed, umbilical hernias, which occur in ~3% of the population at large, are present in ~20% of patients with cirrhosis and ascites [3,4].

The etiology of ascites encompasses a range of diagnoses. The most common cause of ascites in the United States is

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cirrhosis, which accounts for ~80% of cases [5]. Ascites can also occur secondary to malignancy, heart failure, constrictive pericarditis, infectious peritonitis, and nephrotic syndrome, to name a few. Hence, ascites is often a harbinger of high-acuity physiology.

In the case of cirrhosis, the model for end-stage liver disease (MELD) is a predictive model used in liver transplant allocation. MELD was originally developed to predict 3-mo mortality following a transjugular intrahepatic portosystemic shunt procedure and incorporates serum creatinine, total bilirubin, and international normalized ratio (INR) [6]. The success of this risk stratification tool has lead to its application as a predictor of perioperative mortality for nontransplant surgery [7–9].

There is some evidence that MELD score is a useful predictor of patient morbidity in elective surgery irrespective of underlying liver disease [10]. This method of physiologic stratification has not previously been applied to the broad class of abdominal wall hernias, of which patients with ascites are at a higher risk for both occurrence and recurrence. Thus, using a national dataset, we sought to determine the role of MELD score, among other factors, in predicting a 30-d postoperative morbidity and mortality in patients with nonmalignant ascites undergoing hernia repair.

2. Methods

The American College of Surgeons National Surgical Quality Improvement Program Participant Use File (2009–2011) was selected to identify a national cohort of patients undergoing hernia repair. Patients aged ≥18 y were selected for inclusion if they underwent an inguinal (current procedural terminology [CPT] = 49505, 49507, 49520–1, 49525, 49650–1), umbilical (CPT = 49,585, 49,587), or ventral (CPT = 49,560–1, 49,565–6, 49,652–7) hernia repair as the primary operative procedure. In 2011, the American College of Surgeons National Surgical Quality Improvement database contained 252 variables on 442,149 cases from 315 participating sites [11,12].The dataset has been widely used and has been found to be both a reliable and valid clinical registry [13–15].

The inclusion criteria for the study group were the presence of ascites without disseminated malignant tumor within 30 d of surgery. Patients with disseminated malignant tumor within 30 d of surgery were excluded from analysis because we could not control for the possibility of advanced intra-abdominal disease on the surgical outcomes studied (i.e., carcinomatosis might complicate the required operation). Those patients without ascites formed the control group. The primary outcome of the study was 30-d morbidity. Morbidity was defined as previously described [16]. Briefly, morbidity included the occurrence of at least one of the following: superficial skin infection or deep surgical site infection; organ space infection; sepsis or septic shock; progressive renal failure or acute renal failure requiring dialysis; deep vein thrombosis or pulmonary embolism; pneumonia, intubation for >48 h, or reintubation; hemorrhage requiring transfusion of at least 4 U of blood; stroke or coma; urinary tract infection; or myocardial infarction or arrest requiring resuscitation [12]. Mortality was considered the secondary outcome of interest.

The independent variable of interest was the MELD score. A MELD score was calculated for all patients with nonmalignant ascites with available data according to the formula: MELD = 3.78 (Ln serum bilirubin [mg/dL]) + 11.2 (Ln INR) + 9.57 (Ln serum creatinine [mg/dL]) + 6.43. This was modified to be consistent with the United Network for Organ Sharing definition; patients on dialysis were treated as having a creatinine of 4.0, and any laboratory value between 0 and 1 was considered 1 for the purposes of the MELD formula [17]. Other independent patient variables included in the analysis were: sex, age, race, functional status (independent or dependent), body mass index (underweight <18.5, normal = 18.5–24.9, overweight = 25–29.9, and obese ≥30), dialysis dependence, esophageal varices, alcohol use (defined as >2 drinks per day in the 2 wk before index admission), hypertension, diabetes, smoking, cardiac disease history (history of congestive heart failure, angina, or prior coronary intervention via angioplasty, stent, or bypass), chronic obstructive pulmonary disease, steroid use within 30 d, and weight loss (defined as >10% body weight in 6 mo before surgery). The analyzed preoperative laboratory values within 90 d of operation included: creatinine, bilirubin, INR, albumin, white blood cell count, platelets, and hematocrit (HCT). Operation time, intraoperative transfusion requirement, and the operation type, as defined previously, were the operative variables considered.

Descriptive statistics were examined. Univariate analysis was performed using a chi-square or Fisher exact test, as appropriate for categorical variables, and a Wilcoxon rank-sum test for continuous variables. The subset of patients with nonmalignant ascites was then analyzed separately. Multivariate logistic regression including all factors significantly associated with morbidity in univariate analysis was used to evaluate the association between MELD score and morbidity with adjustment for potential confounders. The population attributable risk (PAR) was calculated for each factor found to be significant in the multivariate analysis. The PAR measures the impact of an individual factor on the morbidity rate by accounting for both the relative risk and the prevalence associated with exposure to an individual factor. For continuous variables, the relative risk was calculated as the ratio of the risk for the 95th percentile divided by the risk for the median. PAR was calculated by dichotomizing at the median [18]. The association of select significant factors with the rate of morbidity was displayed using a best-fit polynomial regression. A P value <0.05 was considered statistically significant. All data were transferred into STATA format using Stat/Transfer Version 11.0 statistical program (Circle Systems Inc, Seattle, WA) and analysis was performed using STATA 12.0/IC statistical software (STATA Corp, College Station, TX). This study was reviewed and deemed exempt from approval by the University of Pennsylvania Institutional Review Board.

3. Results

Of 138,366 hernia repairs, 778 (0.56%) were performed on patients with nonmalignant ascites. Patients with ascites had an increased incidence of numerous other comorbidities and laboratory abnormalities Table 1. Emergent operations were significantly more frequent among patients with ascites