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Morbidity and mortality after total splenectomy for lymphoid neoplasms

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ABSTRACT

Background: Splenectomy is indicated for selected patients with lymphoid neoplasms. We examined surgical morbidity and mortality in this high-risk patient population using a contemporary national cohort, with attention to hospitalization status before surgery.

Materials and methods: The American College of Surgeons National Surgical Quality Improvement Program database (2005-2013) was queried for patients with lymphoid malignancies undergoing splenectomy. Stepwise statistical analyses were performed to identify factors associated with increased risk of death and serious morbidity (DSM). A risk scoring system was developed to predict DSM.

Results: In 456 patients, morbidity rate was 24.1%, and mortality rate was 2.4%. Albumin <3 g/dL (odds ratio [OR] = 2.6, $P = 0.005$), hematocrit <30% (OR = 2.8, $P < 0.0001$), and a history of chronic obstructive pulmonary disease (OR = 3.4 $P = 0.009$) were independent predictors of DSM. Rates of DSM were stratified by these risk factors (RFs): 13.5% (0 RF), 34.4% (1 RF), and 58.5% (2-3 RF), $P < 0.0001$. Patients admitted before surgery (IP) were more likely to have RF compared with those undergoing surgery on the day of admission (SDS); 74.6 *versus* 26.4%, $P < 0.001$. Morbidity (39.7% *versus* 18.2%, $P < 0.0001$) and mortality (7.1% *versus* 0.6%, $P < 0.0001$) were significantly increased in the IP group.

Conclusions: Splenectomy for lymphoid neoplasm in hospitalized patients is associated with substantial morbidity and mortality. Risk stratification in this group may aid in perioperative management to mitigate DSM.

Introduction

Splenectomy is performed for a wide variety of indications, with low rates of postoperative complications and favorable survival outcomes overall. Recent cohort studies comparing laparoscopic and open techniques report mortality rates of approximately 1.3%-3%[1,2] with morbidity rates of 7.4%-26.6%.[2-5] However, there is considerable variability in short-term postoperative outcomes depending on the specific indication for splenectomy. In recent series of splenectomy for myeloid neoplasm, reported morbidity and mortality rates were 38%-47% and 5%-18%, respectively.[6,7] For patients undergoing open splenectomy for hematologic malignancies, one study reported an overall postoperative morbidity rate as high as 52.4%.[8] This may reflect a combination of patient factors such as side effects of various systemic therapies for underlying malignancy and operative factors such as increased difficulty of splenectomy in patients with

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splenomegaly from their underlying disease. Prior studies examining risk for patients requiring splenectomy for lymphoid or hematologic malignancies, however, have largely been limited to single-institution experiences.[6,7,9,10] Moreover, there are little data regarding the impact of preoperative hospital status in this specific cohort, particularly how outcomes may vary between inpatients and elective (same day admission) surgical patients. This distinction is significant in that it may identify a subgroup that is at particular risk for increased complications after splenectomy for hematologic indications and may contribute to the elevated rates of morbidity and mortality that have been previously observed.

Recent data published using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) data set described predictive factors of morbidity and mortality of patients undergoing splenectomy for both benign and malignant indications.[11] This comprehensive study reported splenectomy for malignant disease to be an independent predictor for postoperative complications, and overall patients with malignancy had a higher complication rate compared with those undergoing splenectomy for benign disease ($P < 0.001$).

In the present study, we evaluated morbidity and mortality after splenectomy specifically for lymphoid neoplasms using a nationwide cohort. Through such analysis, we aimed to determine specific patient factors associated with increased rates of death and serious morbidity (DSM). We also evaluated the risk associated with splenectomy in patients who were admitted to inpatient status in the days before their operation (IP); we hypothesized that this subgroup may represent a unique population with regard to risk for postoperative complications. Results from this study could help inform physicians and patients and aid in the decision-making for surgery in these often complex and challenging clinical situations.

Materials and methods

Inclusion criteria

Patients who underwent splenectomy for neoplasm of lymphoid origin were selected from ACS NSQIP participant user file (PUF) from the years 2005 to 2013. Specifically, patients in the study had an admission diagnosis of "Malignant Lymphoid Neoplasm" (International Classification of Disease Ninth Revision 200.x, 201.x, and 202.x) and underwent splenectomy, as identified by Current Procedure Terminology codes 38100, 38101, 38102, and 38120. These procedure codes captured all cases of total splenectomy (including open and laparoscopic techniques); partial splenectomy cases were excluded from the analysis. Those patients who underwent resection of other major abdominal organs including esophagus, stomach, liver, pancreas, small bowel, kidney, and colon at the time of splenectomy were also excluded from the study. In 2013, the ACS NSQIP PUF captured 651,940 submitted cases from 435 participating institutions.[12] Patients included in this database are tracked for 30 d, regardless of admission status, with documentation of predetermined preoperative comorbidities and postoperative complications. Standard approach to data collection has been previously described and validated.[13-15]

Outcomes

Primary outcomes were 30-d DSM. Parameters of serious morbidity were defined by the occurrence of one or more of the following: wound complications (deep surgical site infection or wound dehiscence); organ space infection; complications related to sepsis (sepsis or septic shock); renal complications (progressive renal failure or acute renal failure requiring dialysis); venous thromboembolic complications (deep vein thrombosis or pulmonary embolism); respiratory complications (pneumonia, intubation lasting longer than 48 h, or reintubation); bleeding complications (hemorrhage requiring transfusion of at least 4 units of blood); neurologic complications (stroke or coma); or cardiac complications (myocardial infarction or arrest requiring resuscitation).[16] Each subset of serious morbidity occurrence was also analyzed as a secondary outcome separate from DSM. Additional secondary outcomes were postoperative complications not assigned within the definition of "serious morbidity" including superficial surgical site infection, and urinary tract infection.

Analysis variables

Independent patient variables included were: gender, age (<70 or ≥ 70 y), race, functional status (independent or partially/completely dependent), body mass index (underweight <18.5, normal $= 18.5$-25, overweight $= 25.1$-29.9, and obese ≥ 30), hypertension, diabetes, smoking, chronic obstructive pulmonary disease (COPD), cardiac disease (history of congestive heart failure, angina, or previous coronary intervention via angioplasty, stent, or bypass), ascites, steroid use within 30 d of surgery, weight loss (defined as >10% body weight within the 6 mo before surgery), chemotherapy within 30 d of surgery, radiation therapy within 90 d of surgery, and admission status before surgery; divided into admission before surgery (IP) and admission on day of surgery (SDS). Laboratory values that were available in the NSQIP database and were analyzed and treated as categorical variables and included creatinine (≥ 2 or <2 mg/dL, albumin [≥ 3 or <3 g/dL], bilirubin [≥ 2 or <2 mg/dL], white blood cell [WBC] count [<3000, 3000-12,000, or $\geq 12{,}000$ cell/μL], hematocrit [HCT; >30% or $\leq 30\%$], international normalized ratio [<1.5 or ≥ 1.5], and platelet count [$\leq 50{,}000$ or $>50{,}000$/mcL]).

Statistical methods

Descriptive statistics were measured. The Student's *t*-test was performed for continuous variables, and Pearson's chi-square or Wilcoxon rank-sum was applied for categorical variables as deemed appropriate. Preoperative factors (patient and clinical variables) approaching significance ($P < 0.1$) on univariate analysis were included in a forward stepwise logistic regression model to determine factors significantly associated with DSM. Operative factors (total operative time, intraoperative transfusion, and so forth), which would not be available for preoperative clinical decision-making, were