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ORIGINAL ARTICLE

Morbidity- and mortality-related prognostic factors of nontraumatic splenectomies

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Summary *Background:* Splenectomy is a common surgical procedure, but few reports focus on nontraumatic splenectomies. The aim of this study was to determine the predictors of morbidity and mortality of patients submitted to elective nontraumatic splenectomy.
Methods: A descriptive cross-sectional study of 152 consecutive, nonselected, nontraumatic patients operated on by splenectomy between 1996 and 2010 was carried out. Clinical, laboratory, and surgical data, histological findings, perioperative mortality, and postoperative complications according to Clavien-Dindo classification, were recorded. Factors related to morbidity and mortality were analyzed.
Results: Of the 152 patients (89 male and 63 female; mean age 49.8 ± 17.8 years), 74 (48.7%) were operated on for malignant hematologic disorders, 44 for benign hematologic process, and 34 for other nonhematologic disorders. The spleen was enlarged in 95 patients (62.5%) and 78 patients (51.3%) had hypersplenism. The overall complications rate was 40.1%: Grades I and II in 27 cases (17.7%), and Grades III and IV in 23 patients (15.1%). Perioperative mortality was 7.2% (11 patients). In univariate analysis, significant negative predictors for morbidity were age ($p = 0.004$), anemia ($p = 0.03$), leukocytosis ($p = 0.016$), and blood transfusions ($p < 0.001$). In the multivariate analysis, only the need for blood transfusion remained as an independent prognostic factor ($p = 0.001$). Related to mortality, negative prognostic factors were age ($p = 0.003$), leukocytosis ($p = 0.048$), American Society of Anesthesiologists (ASA) score ($p < 0.001$), blood transfusion ($p < 0.001$), pleural effusion ($p = 0.031$), and pneumonia ($p = 0.001$). Pneumonia remained an independent prognostic factor of mortality ($p = 0.024$).

Conflicts of interest: The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.

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Conclusion: Blood loss is the most important prognostic factor for postoperative complications after nontraumatic splenectomies. Pneumonia is the main prognosis factor for perioperative mortality.

1. Introduction

Splenectomy is a common surgical procedure related to spleen trauma. However, many other elective surgical indications for splenectomy have been described in non-trauma patients including hematological disorders, lymphoma staging, and primary tumors of the spleen. In fact, splenic surgery is indicated in an interesting and wide variety of disease processes.[1–3]

There are many studies in which the prognosis factors related to the morbidity and mortality in traumatic splenectomies have been analyzed.[4–6] However, very few studies of the prognosis factors in nontraumatic splenectomies have been reported.[7–10]

The aim of this study was to identify and analyze factors related to the perioperative morbidity and mortality in elective, nontraumatic splenectomies.

2. Patients and methods

A descriptive cross-sectional study of 152 consecutive, nonselected, nontraumatic patients operated on by splenectomy between 1996 and 2010 was carried out. Registration of the patient's medical data in an electronic database was recorded according to the guidelines of the Ethics Committee of our institution. The authorization to use these data was given by the patients in a written and informed consent. The setting was a tertiary-care hospital that attends a population of approximately 400,000 people. Exclusion criteria included incidental splenectomies, and splenectomies performed during en-bloc resection for malignancy in an adjacent organ, such as the stomach, colon, adrenal gland, or pancreas.

The following variables were recorded:

(1) Clinical data: age, sex, the anesthetic risk evaluation according to the American Society of Anesthesiologists score (ASA), splenic disorders that indicated the splenectomy, splenomegaly, and hypersplenism. In accordance with the European Association for Endoscopic Surgery (EAES) guidelines,[11] splenomegaly was defined as a long axis exceeding 15 cm, as measured by ultrasound along its longer dimension. Hypersplenism[12] was defined by thrombocytopenia and/or neutropenia resulting from blood cell sequestration in an enlarged spleen; in some cases, this can also be responsible for mild anemia. The definitive diagnostic of the splenic disorder was obtained from the histopathological study of the removed spleen.
(2) Preoperative laboratory variables: anemia (hemoglobin $<$ 13 g/dL in males and $<$ 12 g/dL in females), leukocytosis ($>$ 11 $\times$ 10^9/L), leukopenia ($<$ 4 $\times$ 10^9/L), and thrombopenia ($<$ 100 $\times$ 10^9/L).
(3) Surgical variables: surgical procedure (laparoscopic vs. nonlaparoscopic approach), total surgical time (defined as the time from the skin incision for portal placement to the end of skin suturing), and perioperative blood transfusions.
(4) Macroscopic histological findings: size (centimeters) and weight (grams) of the specimen of spleen removed.
(5) Postoperative variables: postoperative hospital stay, perioperative complications, and perioperative mortality. Perioperative mortality was defined either as any death occurring within 30 days of surgery or any later death that was considered to be a direct consequence of a postoperative complication. To evaluate the severity of the complications, the Clavien-Dindo classification[13,14] was used: Grade I and Grade II are complications that include only minor deteriorations from the normal postoperative course and can be easily treated with drugs, blood transfusion, and nutritional supply; Grade III complications require interventional treatment; Grade IV complications are life-threatening complications with intensive care unit management; and Grade V means death of the patient.

Univariate analyses were performed to compare each independent variable (age, sex, ASA, splenic disorders, splenomegaly, hypersplenism, surgical procedure, surgical time, blood transfusions, and size and weight of the removed spleen) with either the morbidity (Clavien-Dindo Grades I and II vs. Grades III and IV) and mortality variables. Two models of multivariate analysis were created in order to identify risk factors of postoperative morbidity and perioperative mortality, respectively.

2.1. Statistical analysis

Data were analyzed using the statistical package SPSS version 15.0 for Windows (SPSS Inc., Chicago, IL, USA). Results of continuous variables were given as mean [$\pm$ standard deviation (SD), confidence interval (95% CI)]. Categorical variables were expressed as percentages. The Chi-square test or Fisher's test was used to compare categorical data. For the parametric distribution, Student *t* test or one-way analysis of variance (ANOVA) test were used to compare the mean values of two or more groups, respectively. For nonparametric variables, the Mann-Whitney *U* test or the Kruskal-Wallis test were used to compare the median values of the response variable. Two stepwise logistic regression analyses were performed. In the first model, the outcome variable was "postoperative complications", and in the second model, the outcome variable