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Variation in treatment of blunt splenic injury in Dutch academic trauma centers

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ARTICLE INFO

Article history:
Received 22 April 2014
Received in revised form
17 August 2014
Accepted 28 August 2014
Available online 4 September 2014

Keywords:
Blunt splenic injury
Treatment variation
Splenic salvage

ABSTRACT

Background: The incidence of splenectomy after trauma is institutionally dependent and varies from 18% to as much as 40%. This is important because variation in management influences splenic salvage. The aim of this study was to investigate whether differences exist between Dutch level 1 trauma centers with respect to the treatment of these injuries, and if variation in treatment was related to splenic salvage, spleen-related reinterventions, and mortality.

Methods: Consecutive adult patients who were admitted between January 2009 and December 2012 to five academic level 1 trauma centers were identified. Multinomial logistic regression was used to measure the influence of hospital on treatment strategy, controlling for hemodynamic instability on admission, high grade (American Association for the Surgery of Trauma 3–5) splenic injury, and injury severity score. Binary logistic regression was used to quantify differences among hospitals in splenic salvage rate.

Results: A total of 253 patients were included: 149 (59%) were observed, 57 (23%) were treated with splenic artery embolization and 47 (19%) were operated. The observation rate was comparable in all hospitals. Splenic artery embolization and surgery rates varied from 9%–32% and 8%–28%, respectively. After adjustment, the odds of operative management were significantly higher in one hospital compared with the reference hospital (adjusted odds ratio 4.98 [1.02–24.44]). The odds of splenic salvage were significantly lower in another hospital compared with the reference hospital (adjusted odds ratio 0.20 [0.03–1.32]).

Conclusions: Although observation rates were comparable among the academic trauma centers, embolization and surgery rates varied. A nearly 5-fold increase in the odds of operative management was observed in one hospital, and another hospital had significantly lower odds of splenic salvage. The development of a national guideline is recommended to minimalize splenectomy after trauma.

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http://dx.doi.org/10.1016/j.jss.2014.08.063

1. Introduction

The prevalence of intra-abdominal injury among patients who present to the emergency department with blunt abdominal trauma is approximately 13% [1]. The spleen is one of the most commonly injured organs after the occurrence of blunt trauma.

Since the 1990s, angio-embolization has been used as an alternative to operative management in the treatment of blunt abdominal injury. Currently, nonoperative management (NOM) involving close observation of the patient, supplemented with splenic artery embolization (SAE) when necessary, has become the standard treatment for hemodynamically stable patients. Recent reports, have, however, revealed that there is variation in treatment of splenic injury [2–5]. A recent report from the National Trauma Data Bank, for example, indicated that the incidence of splenectomy at a number of institutions varies from 18% to as much as 40%, and that this percentage is highly dependent on the definition that is applied to NOM [4]. This is important because it has been shown that variation in management can influence splenic salvage [5,6]. Banerjee *et al.* [6] compared trauma centers with high rates (defined as >10%) of SAE with centres with low rates (<10%) and found that patients treated at high SAE volume centers were less likely to undergo splenectomy, both after observation and SAE.

As there is no national protocol in the Netherlands, which stipulates preferred treatment strategy, variation in management is likely to exist. In this study, we investigated whether there were any differences in the treatment of blunt splenic injuries at five (academic) level 1 trauma centers. We also related these variations in treatment to splenic salvage, spleen-related reinterventions, and mortality rates.

2. Methods

In this retrospective observational study, the Trauma Registry databases of five academic level 1 hospitals (study period 2009–2012) were consulted to identify patients with blunt splenic injury. Abbreviated Injury Scale diagnosis codes starting with 5442 were used to retrieve the eligible patients from the registries. The study population consisted of adult (aged ≥16 y) patients.

2.1. Data collection

The following data were collected: age, gender, systolic blood pressure, hemoglobin level, and Glasgow Coma Scale on admission, endotracheal intubation (yes or no), imaging for diagnosing splenic injury, grade of splenic injury (graded according to the American Association for the Surgery of Trauma [7]), the presence of a splenic contrast extravasation at intravenous contrast-enhanced abdominal computed tomography scanning, associated injuries and Injury Severity Score (ISS), treatment type (observation, SAE, or operative treatment), complications, hospital and intensive care unit length of stay, splenic salvage (spleen *in situ* at discharge), the need for and type of reintervention, readmission (if yes), and mortality. American Association for the Surgery of Trauma (AAST) grading was assessed from the original radiology report when available. We graded patients with a diagnosis "Contusion (hematoma) No Further Specified (NFS)" and "Spleen NFS" as grade 1 injury, "Laceration NFS", and "Rupture NFS" as grade 2 injury for data analysis. In the patients who only received a Focused Assessment for Sonography with Trauma, we could not assess the grade of splenic injury nor whether a contrast extravasation (variables scored as unknown) was present. The associated intra-abdominal injuries were further specified into injuries with an operation indication (such as perforation of a hollow organ, dissection of a major abdominal vessel or a diaphragmatic rupture) and grade ≥3 solid organ injury since associated injuries might influence the decision to perform surgery.

2.2. Trauma setting and definitions

In level 1 trauma centers, all facilities for care are available and trauma patients with all types of injuries can be treated. In level 2 centers, extensive resources for trauma care are available apart from neurosurgery; except for patients with severe traumatic brain injury, all trauma patients can be treated. In level 3 centers, limited facilities for trauma care are available; only patients with non–life-threatening injuries can be treated.

Initial treatment strategy was defined as the first documented treatment strategy for the splenic injury. The operative management group consists of the patients in whom a splenectomy was performed and the patients in whom spleen-preserving surgery was applied. Failure of treatment was defined as the need for a splenic (re)intervention as follows: SAE or splenic surgery for patients who were initially selected for observation, re-SAE or splenic surgery for patients who were initially embolized, and splenic reoperation for patients initially treated with spleen conserving surgery or a reoperation after initial splenectomy. Reinterventions performed for other abdominal injuries were not counted as spleen-related reinterventions. Complications were defined as all complications during admission, including the spleen-related complications.

The vital signs values that were used are the first values measured on arrival at the emergency department. For patients that were transferred, the values (if known) and treatment strategy (if performed) in the hospital of initial assessment were used. Hemodynamic (HD) instability was defined as a systolic blood pressure <90 mm Hg. Patients were analyzed in the unstable group if splenic injury was the documented cause of the HD instability or if there was a reasonable-to-strong assumption that splenic injury was the cause of instability.

All five hospitals have acceptable distance and transport times to the angiography suite as well as 24/7 availability of a skilled interventional radiologist and availability of an