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Splenic conservation: Variation between pediatric and adult trauma centers

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ABSTRACT

Objectives: Nonoperative management of hemodynamically stable children and adolescents with splenic injury regardless of grade has become standard; however, numerous studies have shown a wide variation in management. We compared the treatment and outcomes of adolescent splenic injuries in our region, which includes a pediatric level I trauma center (PTC) and an adult level I trauma center (ATC).

Methods: A retrospective review of the trauma registry was performed on patients 14 to 17 y old with blunt splenic injury admitted to either the local PTC or ATC from January 1999 through December 2010. Demographics, interventions, and hospital course were recorded and compared using Fisher exact, Student *t*-test, and multivariate analysis.

Results: Eighty-six adolescent patients presenting to the PTC and 65 patients presenting to the ATC met the criteria over the 12-y period. Although the ATC received more significantly injured and slightly older patients, logistic multivariate analysis demonstrated that the location of presentation was the only independent factor associated with splenectomy ($P = 0.0015$). A higher injury severity score was associated with a longer length of stay (LOS), but the nonoperative approach was not associated with a longer LOS ($P = 0.96$).

Conclusions: Our study demonstrates that the location of presentation was independently associated with splenectomy while controlling for a higher injury severity score at the ATC. With the higher percentage of nonoperative management, treatment at the PTC was not associated with an increased LOS (total or intensive care unit).

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1. Introduction

The management of children with traumatic splenic injury has shifted over the past two decades to a nonoperative strategy. Current clinical practice guidelines recommend nonoperative management of hemodynamically stable children with traumatic spleen injury, regardless of grade [1]. Reports have shown this strategy to be successful in over 90% of these patients [1]. Prior studies have demonstrated that children are more likely to be treated with a nonoperative strategy at a children's hospital than at an adult hospital [2,3]; however, one report suggests that this difference has resolved due to adult centers' adoption of more frequent use of nonoperative management [4].

The purpose of this study was to determine if there is still a discrepancy in the nonoperative management of blunt pediatric splenic injury between adult and pediatric centers in our region. In Western New York there are two level I trauma centers separated by 4 miles: one pediatric center and one adult center. Adolescent children aged 14 to 17 in our region have been transported and treated at both adult and pediatric trauma centers, providing this opportunity for comparison. To our knowledge, management and outcomes of pediatric blunt splenic injury has not been studied in our region to see if a difference in management strategy exists between the two centers.

2. Methods

An Institutional Review Board–approved retrospective review was performed at the Women and Children's Hospital of Buffalo (a designated New York State level I regional pediatric trauma center [PTC]) and the Erie County Medical Center (a designated New York State level I regional (adult) trauma center [ATC]). Patients aged 14 to 17 y of age with blunt splenic injury admitted to either center from January 1999 through December 2010 were included. The Trauma One database was analyzed for patients admitted with ICD-9 codes for splenic injury between the ages of 14 and 17 during the specified time period. Variables included age, sex, injury severity score (ISS), grade of splenic injury, procedures performed, total length of hospital stay, and total length of intensive care unit (ICU) stay. Patients with any penetrating mechanism of injury were excluded, as were all deaths in the field, during transport, or in the emergency department prior to a surgical evaluation. Patients were categorized into two groups: those with operative management by splenectomy and those with nonoperative management.

Statistical analysis was performed using the SAS 9.3 system (SAS Institute Inc, Cary, NC). Univariate and multivariate analyses were performed using Fisher exact test for categorical values and Student t-test for continuous values. Logistic regression was used to identify significant associations between splenectomy and the above variables. A P value of 0.05 or less was defined as significant.

3. Results

During the study period, 24 splenectomies were performed: 2 at the PTC and 22 at the ATC ($P < 0.0001$). Patients were on

Table 1 – Characteristics of adolescent patients treated at the PTC versus ATC.

	PTC n = 86	ATC n = 65	P value
Splenectomy	2	22	0.0001
Age (y)	15.19	16.35	0.0001
Grade (1–5)	2.90	2.78	0.4716
ISS	14.35	24.78	0.0001
ICU LOS (d)	2.58	6.86	0.0001
Total LOS (d)	5.79	12.29	0.0001

average younger at the PTC than at the ATC (15.19 versus 16.35 y, $P < 0.0001$). Splenic injury grade was evenly distributed between the hospitals (2.90 at the PTC versus 2.78 at the ATC); however, ISS was higher at the ATC (24.78 versus 14.35, $P < 0.0001$). As demonstrated in Table 1, the predominantly nonoperative approach of a splenic injury (observation) at the PTC did not result in longer ICU length of stay (LOS) or in the total LOS, which were both lower at the PTC (LOS 5.8 versus 12.3, $P < 0.0001$). A scatterplot demonstrated that a higher ISS (regardless of splenectomy) was associated with a longer LOS at both locations.

A logistic multivariate analysis using the Wald χ^2 demonstrated that the location of presentation ($P = 0.0015$) was the most significant factor in whether children received a splenectomy (Table 2). Age, sex, and LOS had no effect on splenectomy. ISS ($P = 0.06$) and grade of injury ($P = 0.09$) did not reach statistical significance in the Wald χ^2 test. Since the P value approached statistical significance, an odds ratio estimate was calculated for each variable (Table 3), which also demonstrated that location of presentation was the most significant factor in splenectomy (point estimate 70.8, 95% confidence interval 5.1–977.2).

Of the children who had nonoperative management (Table 4), the ISS was greater at the ATC (18.3 versus 14.1, $P = 0.026$), as it was greater in the study overall (24.78). The ISS of the nonoperative patients was less than that of the splenectomy group at both centers, as expected. In the splenectomy group, ISS did not differ statistically ($P = 0.27$) between the facilities, although the number of splenectomies at the PTC was small.

Indications for the 22 splenectomies at the ATC were 10 patients with stable vitals without blood transfusion who received a diagnosis of a "high-grade" splenic injury on computed tomography, 1 patient with an associated bowel injury, 5 patients with unstable vitals after blood transfusion, and 6 patients with unstable vitals without preoperative blood products given. The splenectomies at the ATC were evenly

Table 2 – Logistic multivariate analysis using Wald χ^2 for each splenectomy risk factor.

Effect	Wald χ^2	P value
Location	10.1120	0.0015
Age (y)	0.5532	0.4570
Sex	0.0096	0.9218
Grade (1–5)	2.8535	0.0912
ISS	3.5241	0.0605
ICU LOS (d)	0.2485	0.6181
Total LOS (d)	0.0021	0.9637

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