

# Pediatric Trauma Surgery: Understanding When NOT to Operate

Jeremy T. Aidlen, MD

Over forty years ago, long before the advent of computed tomography (CT), a pediatric surgeon suggested that not all patients who sustained blunt solid organ trauma required an operation. This was a radical departure from the surgical norms of the time. Untreated, splenic lacerations were thought to have a mortality of 90 to 100%, and trauma laparotomies were mandatory. Interestingly, the first report of a ruptured spleen which healed spontaneously dates back as far as 1881; however, it was contested and eventually dismissed by physicians of the day.<sup>1</sup> For years, surgeons have tried to preserve the spleen, with limited success. Stuart Thompson was the first to doubt that surgical intervention was required at all. Dr. Thomson had performed a laparotomy on a six year-old boy, and found the spleen in two halves, surrounded by adhesions and completely healed. He wondered whether a ruptured spleen could spontaneously recover.<sup>2</sup> In response, Thomson's fellows Upadhyaya and Simpson designed a clinical study. The conclusions of their review, published in 1968 were as follows: (1) Isolated splenic injury in children is well tolerated. (2) Deaths are due to associated severe injuries and not due to splenic rupture. (3) There is evidence of spontaneous healing in unoperated patients. (4) In most cases splenic bleeding had stopped at laparotomy.<sup>3</sup> There were many skeptics initially, but eventually this strategy of surgical restraint was validated, creating a new paradigm of care for the injured child. Today, the standard treatment of the hemodynamically stable child with splenic injury is nonoperative, and this concept has been successfully applied to most blunt injuries of the liver, kidney, and pancreas as well.<sup>4</sup>

The trauma algorithms of the 1960s were based on physical examination, plain radiography and laboratory evaluation. Since that time, CT scans have become a readily available, non-invasive, and accurate method of identifying and qualifying the extent of traumatic injuries. Care patterns have certainly evolved

as percutaneous interventional techniques have improved, and there is no doubt that advances in three dimensional imaging techniques have helped to limit unnecessary laparotomies. CT scans have also helped us finely tune our nonoperative management algorithms. Consensus guidelines on intensive care unit (ICU) length of stay, overall length of hospital stay, use of follow-up imaging, and physical activity restriction for clinically stable children with isolated spleen or liver injuries (CT grades I to IV) have been clearly defined. (Table 1)

## Today, the standard treatment of the hemodynamically stable child with splenic injury is nonoperative.

Focused Abdominal Sonography for Trauma (FAST) has become a useful screening tool for the detection of free intraperitoneal and pericardial fluid as well. Sonographic evaluation can help to limit radiation exposure from unnecessary CT scans performed for "low-likelihood" injuries. FAST is also particularly helpful in the evaluation of patients who are hemodynamically unstable. In this setting, a positive finding on FAST often prompts a surgical procedure. In doing so, FAST can help to prevent potentially

dangerous transports or delays in treatment. A lack of identifiable free fluid does not exclude a significant injury though, and CT remains the imaging modality of choice for the evaluation of the severely injured child when feasible.

While pediatric surgeons were the first to adopt a nonoperative strategy for solid organ injuries, our colleagues in adult trauma care have successfully applied many of the same methods to the management of their own patients. Likewise, pediatric surgeons rely heavily upon innovations in care developed by our adult counterparts. Young patients are quite dissimilar from adults however, anatomically, immunologically and physiologically. They do not share the same response to injury, and they do not benefit from the same patterns of treatment. Guidelines developed for pediatric patients should not be applied to young adults,<sup>5</sup> and the converse is also true. According to a recent review in New England, children with splenic injuries are still twice as likely to undergo an operation if they are cared for by someone other than a pediatric surgeon.<sup>6</sup> This underscores the importance of specialized pediatric care, even within a level one trauma center. A decision by the surgeon to operate on a child in this setting should be based on evidence of continued blood loss, such as low blood pressure, tachycardia, decreased urine output, falling hematocrit or failure to respond appropriately to resuscitative efforts. Surgery is not always avoidable, but the indica-

**Table 1. Proposed Guidelines for Resource Utilization in Children with Isolated Spleen of Liver Injury by CT Grade**

	Grade I	Grade II	Grade III	Grade IV
ICU days	0	0	0	1
Hospital stay (days)	2	3	4	5
Predischarge imaging	None	None	None	None
Postdischarge imaging	None	None	None	None
Activity restriction (weeks)*	3	4	5	6

\*Return to full-contact, competitive sports should be at the discretion of the individual pediatric trauma surgeon. The proposed guidelines for return to unrestricted activity include "normal" age-appropriate activities.<sup>1</sup>

tions have certainly changed with the times. The rates of successful nonoperative treatment of isolated blunt splenic and hepatic injury now exceed 90% in most pediatric trauma centers and in adult trauma centers with a strong pediatric commitment.<sup>7</sup>

Trauma kills more than 10,000 pediatric patients annually nationwide and causes some 10% of all pediatric hospitalizations.<sup>8</sup> Trauma is the leading cause of mortality and morbidity in children from ages 1 to 14 years and results in more death and disability than all other childhood disease combined.<sup>9</sup> A recent review of the **National Pediatric Trauma Registry (NPTR)** indicates that 8% to 12% of children with blunt trauma have an abdominal injury. Fortunately, more than 90% will survive. Although abdominal injuries are 30% more common than thoracic injuries, they are 40% less likely to be fatal.<sup>10</sup> Advances in pediatric critical care which have developed in parallel to our surgical guidelines have helped to improve outcomes following major injuries. We have come a long way. Still, it is important not to become too dogmatic about the success of our strategies. After all, they were only developed after a surgeon doubted the prevailing wisdom of his day, and decided NOT to operate.

## REFERENCES

1. Upadhyaya P. Conservative management of splenic trauma. *Pediatr Surg Int* 2003;19: 617-27.
2. Upadhyaya P, Simpson JS. Splenic trauma in children. *Surg Gynecol Obstet* 1968;126:781-90.
3. Stylianos S, Pearl R. *Abdominal Trauma: Pediatric Surgery*. Sixth Edition. – Grosfeld, 2006.
4. Mullins R, Trunkey D. Variation in treatment of pediatric spleen injury at trauma centers versus nontrauma centers. *J Amer Coll Surg* 2006;203:263.
5. Mooney D, Forbes P. Variation in the management of pediatric splenic injuries in New England. *J Trauma* 2004;56:328-33.
6. Stylianos S, Hicks B. *Abdominal and Renal Trauma: Pediatric Surgery*. Fourth Edition – Ashcraft, 2005.
7. Graves EJ. Detailed Diagnosis and Procedures, National Hospital Discharge Survey, 1989. Hyattsville, MD, National Center for Health Statistics, Vital Health Stat 13, 1991.
8. National Center for Injury Prevention and Control. *Injury Fact Book*. Atlanta, Centers for Disease Control and Prevention, 2001.
9. Cooper A, Barlow B, et al. Mortality and truncal injury. *J Pediatr Surg* 1994;29:33-8.
10. Stylianos S. APSA Trauma Committee. Evidence-based guidelines for resource utilization in children with isolated spleen or liver injury. *J Pediatr Surg* 2000; 35:164-9.

*Jeremy T. Aidlen, MD, is Assistant Professor of Surgery & Pediatrics, The Warren Alpert Medical School of Brown University.*

## Disclosure of Financial Interests

The author has no financial interests to disclose.

## CORRESPONDENCE

Jeremy T. Aidlen, MD  
Rhode Island Hospital  
Two Dudley Street, Suite 180  
Providence, RI 02905  
Phone: (401) 444-8579  
e-mail: JAidlen@usasurg.org

