Selective nonoperative management of blunt splenic injury: An Eastern Association for the Surgery of Trauma practice management guideline

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BACKGROUND: During the last century, the management of blunt force trauma to the spleen has changed from observation and expectant management in the early part of the 1900s to mainly operative intervention, to the current practice of selective operative and nonoperative management. These issues were first addressed by the Eastern Association for the Surgery of Trauma (EAST) in the Practice Management Guidelines for Non-operative Management of Blunt Injury to the Liver and Spleen published online in 2003. Since that time, a large volume of literature on these topics has been published requiring a reevaluation of the current EAST guideline.

METHODS: The National Library of Medicine and the National Institute of Health MEDLINE database was searched using Pub Med (www.pubmed.gov). The search was designed to identify English-language citations published after 1996 (the last year included in the previous guideline) using the keywords *splenic injury* and *blunt abdominal trauma*.

RESULTS: One hundred seventy-six articles were reviewed, of which 125 were used to create the current practice management guideline for the selective nonoperative management of blunt splenic injury.

CONCLUSION: There has been a plethora of literature regarding nonoperative management of blunt splenic injuries published since the original EAST practice management guideline was written. Nonoperative management of blunt splenic injuries is now the treatment modality of choice in hemodynamically stable patients, irrespective of the grade of injury, patient age, or the presence of associated injuries. Its use is associated with a low overall morbidity and mortality when applied to an appropriate patient population. Nonoperative management of blunt splenic injuries should only be considered in an environment that provides capabilities for monitoring, serial clinical evaluations, and has an operating room available for urgent laparotomy. Patients presenting with hemodynamic instability and peritonitis still warrant emergent operative intervention. Intravenous contrast enhanced computed tomographic scan is the diagnostic modality of choice for evaluating blunt splenic injuries. Repeat imaging should be guided by a patient's clinical status. Adjunctive therapies like angiography with embolization are increasingly important adjuncts to nonoperative management of splenic injuries. Despite the explosion of literature on this topic, many questions regarding nonoperative management of blunt splenic injuries remain without conclusive answers in the literature. (*J Trauma Acute Care Surg*. 2012;73: S294–S300. Copyright © 2012 by Lippincott Williams & Wilkins)

KEY WORDS: Guideline; spleen; blunt abdominal trauma; surgery.

STATEMENT OF THE PROBLEM

During the last century, the management of blunt force trauma to the spleen has changed from observation and expectant management in the early part of the 1900s to operative intervention for all injuries, to the current practice of selective operative and nonoperative management. The current nonoperative paradigm in adults was stimulated by the success of nonoperative management of solid-organ injuries in hemodynamically stable children. The advantages of nonoperative management include lower hospital cost, earlier discharge, avoiding nontherapeutic celiotomies (and their associated cost and morbidity), fewer intra-abdominal complications, and reduced transfusion rates associated with an overall improvement in mortality of these injuries.[1] Pachter et al.,[2] in 1998, showed that 65% of all blunt splenic injuries and could be managed nonoperatively with minimal transfusions, morbidity, or mortality, with a success rate of 98%. These issues were first addressed by the Eastern Association for the Surgery of Trauma (EAST) in the Practice Management Guidelines for Non-operative Management of Blunt Injury to the Liver and Spleen published online in 2003.[3] Since that time, a large

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volume of literature on these topics has been published. As a result, the Practice Management Guidelines Committee of EAST set out to develop updated guidelines for the nonoperative management of splenic injuries. This practice management guideline update has been split into separate recommendations for the nonoperative management of blunt hepatic and splenic injuries in adult trauma patients, rather than the amalgamated recommendations included in the 2003 practice management guideline.

Reports of nonoperative management in adults with injuries to the liver continue to support nonoperative management in hemodynamically stable adults, but questions still exist about efficacy, patient selection, and details of management.[4–8] These questions include the following:

- Are the 2003 recommendations still valid?
- Is nonoperative management appropriate for all hemodynamically stable adults regardless of severity of solid-organ injury or presence of associated injuries?
- What role should angiography and other adjunctive therapies play in nonoperative management?
- Is the risk of missing a hollow viscous injury a deterrent to nonoperative management?
- What is the best way to diagnose injury to the spleen?
- What roles do computed tomographic (CT) scan and/or ultrasonography have in the hospital management of the patient being managed nonoperatively?
- Is the need for transfusion greater for patients managed nonoperatively?
- Should patients be placed on a "bed rest" activity status, and if so, for what duration?
- Finally, what period and evaluation is needed before releasing patients back to full activity?

PROCESS

Identification of References

References were identified by research librarians at the University of Rochester, Miner Medical Library. The MEDLINE database in the National Library of Medicine and the National Institute of Health was searched using Entrez PubMed (www.pubmed.gov). The search was designed to identify English-language citations between 1996 (the last year of literature used for the existing guideline) and 2010 using the keywords *splenic injury* and *blunt abdominal trauma*. The articles were limited to humans, clinical trials, randomized controlled trials, practice guidelines, meta-analyses, and reviews. Two hundred twenty-three articles were identified. Case reports and small case series were excluded. The committee chair and members then reviewed the articles for relevance and excluded any reviews and tangential articles. One hundred seventy-six articles were reviewed of which 125 were used to create the nonoperative management of blunt splenic injures recommendations. (Table, Supplemental Digital Content 1, http://links.lww.com/TA/A195)

Quality of References

The methodology developed by the Agency for Healthcare Policy and Research (AHCPR) of the US Department of Health and Human Services was used to group the references into three classes.[9]

Class I: Prospective randomized studies (no references).
Class II: Prospective, noncomparative studies; retrospective series with controls (19 references).
Class III: Retrospective analyses (case series, databases or registries, and case reviews) (105 references).

Based on the review and assessment of the selected references, three levels of recommendations are proposed.

Level 1

The recommendation is convincingly justifiable based on the available scientific information alone. This recommendation is usually based on Class I data; however, strong Class II evidence may form the basis for a Level 1 recommendation, especially if the issue does not lend itself to testing in a randomized format. Conversely, low-quality or contradictory Class I data may not be able to support a Level 1 recommendation.

Level 2

The recommendation is reasonably justifiable by available scientific evidence and strongly supported by expert opinion. This recommendation is usually supported by Class II data or a preponderance of Class III evidence.

Level 3

The recommendation is supported by available data, but adequate scientific evidence is lacking. This recommendation is generally supported by Class III data. This type of recommendation is useful for educational purposes and in guiding future clinical research.

RECOMMENDATIONS

Upon review of the updated literature, it was found that the majority of recommendations from the 2003 guideline remain valid. The previous guidelines were incorporated into the greatly expanded current recommendations as appropriate. A multitude of unanswered questions remain in the literature for nonoperative management of blunt splenic injuries.

Level 1

1. Patients who have diffuse peritonitis or who are hemodynamically unstable after blunt abdominal trauma should be taken urgently for laparotomy.

Level 2

1. A routine laparotomy is not indicated in the hemodynamically stable patient without peritonitis presenting with an isolated splenic injury.
2. The severity of splenic injury (as suggested by CT grade or degree of hemoperitoneum), neurologic status, age >55 and/or the presence of associated injuries are not contraindications to a trial of nonoperative management in a hemodynamically stable patient.
3. In the hemodynamically normal blunt abdominal trauma patient without peritonitis, an abdominal CT scan with

intravenous contrast should be performed to identify and assess the severity of injury to the spleen.
4. Angiography should be considered for patients with American Association for the Surgery of Trauma (AAST) grade of greater than III injuries, presence of a contrast blush, moderate hemoperitoneum, or evidence of ongoing splenic bleeding.
5. Nonoperative management of splenic injuries should only be considered in an environment that provides capabilities for monitoring, serial clinical evaluations, and an operating room available for urgent laparotomy.

Level 3

1. After blunt splenic injury, clinical factors such as a persistent systemic inflammatory response, increasing/persistent abdominal pain, or an otherwise unexplained drop in hemoglobin should dictate the frequency of and need for follow-up imaging for a patient with blunt splenic injury.
2. Contrast blush on CT scan alone is not an absolute indication for an operation or angiographic intervention. Factors such as patient age, grade of injury, and presence of hypotension need to be considered in the clinical management of these patients.
3. Angiography may be used either as an adjunct to nonoperative management for patients who are thought to be at high risk for delayed bleeding or as an investigative tool to identify vascular abnormalities such as pseudoaneurysms that pose a risk for delayed hemorrhage.
4. Pharmacologic prophylaxis to prevent venous thromboembolism can be used for patients with isolated blunt splenic injuries without increasing the failure rate of nonoperative management, although the optimal timing of safe initiation has not been determined.

Unanswered questions

There was not enough literature available to make recommendations regarding the following:

1. Frequency of hemoglobin measurements
2. Frequency of abdominal examinations
3. Intensity and duration of monitoring
4. Is there a transfusion trigger after which operative or angiographic intervention should be considered?
5. Time to reinitiating oral intake
6. The duration and intensity of restricted activity (both in-hospital and after discharge)
7. Optimum length of stay for both the intensive care unit (ICU) and hospital
8. Necessity of repeated imaging
9. Timing of initiating chemical deep venous thrombosis (DVT) prophylaxis after a splenic injury
10. Should patients with severe injuries/or embolized injuries receive postsplenectomy vaccines?
11. Is there an immunologic deficiency after splenic embolization?

SCIENTIFIC FOUNDATION

Nonoperative management has become the standard of care for the hemodynamically stable patient with a blunt splenic injury.[1,10] Patients who have peritonitis or those who are hemodynamically unstable with evidence of intraperitoneal hemorrhage (a positive FAST examination result or positive DPL) should undergo immediate exploratory laparotomy.[11,12] Factors previously thought to completely preclude nonoperative management include splenic injury grade, head injury, high Injury Severity Score, degree of hemoperitoneum, age greater than 55 years, number of transfusions, and pooling of contrast or a blush on CT scan. More recent literature has shown that the severity of splenic injury (as suggested by CT grade or degree of hemoperitoneum), a contrast blush seen on CT scan, neurologic status, age greater than 55 years, and/or the presence of associated injuries are no longer contraindications to a trial of nonoperative management.[4–6,13–18] The percentage of adult patients with blunt splenic injury going directly from the emergency department to the operating room for laparotomy varies from 6.9% to 66.7% among the trauma centers in an EAST multi-institutional study.[19] Some centers continue to be more likely to operate on higher-grade injuries or those with a vascular blush.[20] Concern over delay in diagnosis of hollow viscous injuries with nonoperative management of splenic injuries has been allayed in several studies. Fakhry et al.[21] reported full thickness hollow viscous injury in only 0.3% of 227,972 blunt trauma admissions. Any suspicion of hollow viscous injury or change in abdominal pain pattern indicates a need for operation because 9.6% of patients with a solid-organ injury and an Abbreviated Injury Scale score of 2 or greater also had a hollow viscous injury.[22] In addition, because increasing numbers of solid-organ injuries are detected in a patient with blunt trauma, the incidence of hollow viscous injury increases.[22] The overall incidence of missed injury is quite low and should not influence decisions concerning eligibility for nonoperative management.[23,24] Adopting a standardized protocol of nonoperative management for isolated splenic trauma based on hemodynamics reduces resource use and hospital costs, without any detriment to care.[25]

Intravenous contrast-enhanced CT scan is now the criterion standard in diagnosing a splenic injury.[26,27] With a single-phase CT scan, an extra splenic accumulation of contrast-enhanced blood is usually indicative of active splenic hemorrhage, whereas a focal accumulation of contrast-enhanced blood within the splenic parenchyma is usually indicative of a contained vascular injury.[27,28] This contrast extravasation on a single-phase CT scan, the presence of a "blush," has not only been used to predict failure of nonoperative management but also has been considered an indication for laparotomy or angiographic intervention.[29] The development of multislice CT scan has improved sensitivity, and more rapid imaging has allowed for the visualization of the major vascular structures in different phases following contrast enhancement, leading to increased sensitivity for detecting contrast extravasation.[30] The clinical implications of these findings in the initial management of a patient with a splenic injury, however, remain controversial because the resulting angiograms often show no active bleeding despite having seen a "blush" on CT scan.[31–35] An EAST membership survey by Fata et al.[36] showed that nearly 30% of participating centers do not immediately perform angiography for a contrast blush visualized on CT scan. Several studies have shown that of patients directed toward angiography owing to a blush on CT scan, some

of whom had persistent tachycardia and falling hematocrit level; only 5% to 7% of all patients with blunt splenic injury actually had extravasation on angiography that required angioembolization.[37,38] Follow-up imaging for splenic injuries remains debated. The study by Fata et al.[36] also found that only 14.5% of the surveyed surgeons routinely obtain follow-up abdominal CT scans. Sharma et al.[14] and Shapiro et al.[39] found that repeated CT scans did not change patient management in most cases, while Weinberg et al.[40] showed that repeated CT imaging at 24 hours to 48 hours in all Grade 2 and higher splenic injuries identifies latent pseudoaneurysms that then undergo angioembolization with improved outcome.

The role of angioembolization in the management of blunt splenic injury remains controversial because there are many studies of similar patient populations with opposite results. Angiography with embolization should be considered for patients with AAST Grade greater than III injuries, presence of a contrast blush, moderate hemoperitoneum, or clinical evidence of ongoing splenic bleeding.[38,41–46] Multiple studies have shown that angioembolization may increase the nonoperative salvage rate for patients with splenic injuries.[20,47–51] Cooney et al.[37] showed that using a combination of clinical and CT scan criteria, identified a small percentage of patients with splenic injury that were likely to benefit from selective arterial embolization. Although their use of selective arterial embolization salvaged two thirds of their patients with high-grade splenic injury or decreasing hematocrit level, there was a failure rate resulting from persistent bleeding and/or subsequent infarction. Rajani et al.,[48] Davis et al.,[20] and Dent et al.[38] suggested that nonoperative management could be more successful when angioembolization is used, while Harbrecht et al.,[52] Duchesne et al.,[53] and Smith et al.[54] saw no improvement in their splenic salvage rate. Complications of angioembolization occur in 20% of patients and include failure to control bleeding (11–15%), missed injuries, and splenic abscesses.[47,52] Patients with active bleeding into the peritoneum on CT scan are at high risk of failure with attempted embolization.[55] There is also much debate regarding whether the spleen should be embolized proximally or distally and what material should be used to embolize the spleen.[49,56] Ekeh et al.[57] noted no relationship between location of angioembolization and the presence of either major (splenic bleeding, splenic infarction, splenic abscess, and contrast-induced renal insufficiency seen in 27% of patients) or minor (fever, pleural effusions, and coil migration seen in 53% of patients) after angioembolization complications. Recent small studies have shown that splenic embolization may not have major long-term impact on immune function.[58,59]

Peitzman et al.[19] showed that a lack of protocols, large variability in physician practice, and questionable clinical decision making contributes to the failure of nonoperative management of splenic injuries. Of the trauma centers that participated in that EAST multi-institutional trial, only one-third had written protocols for management and decision making for adults with blunt splenic injury.[6] This was still true in 2005 when Fata et al.[36] showed that only 30% of the respondents had formal written protocols in place for managing splenic injuries, and of them, only two-thirds stated that they usually or always followed the protocol.

Nonoperative management of splenic injuries should only be considered for patients who are hemodynamically stable and have an absence of peritoneal signs and in an environment that has the capability for monitoring, serial clinical evaluations, and an operating room available for urgent laparotomy.[55,60] Nonoperative management of splenic injury consists of a period of in-hospital or ICU observation or monitoring, serial abdominal examinations, serial hematocrit measurements, and a period of immobility (bed rest/postdischarge restricted activity). What remains unclear in the literature is the duration and frequency required of all of these interventions. The risk of bleeding with nonoperative management has led to a variety of management guidelines, many of which incorporate a period of strict bed rest and hospitalization.[1] Pediatric studies have shown that a number of surgeons have reported data showing that they will discharge patients as early as 3 days following splenic injury and lift activity restriction after as early as 8 weeks.[61–64] In adults, timing of in-hospital mobilization does not seem to contribute to delayed hemorrhage in a retrospective study by London et al.[65]; however, this has not been confirmed in a prospective fashion. Fata el al.,[36] in an EAST member survey, showed that for Grade I injuries, 32.3% of respondents admitted patients to a continuously monitored environment, while for Grade II splenic injuries, 75% of the admitted patients to a continuously monitored bed. Izu et al.[66] discharged patients with Grade I injuries as early as 1 day to 2 days after injury if their hemoglobin and vital signs were stable. Length of stay times for Grade II and higher injuries differed significantly in published studies. In most studies patients, those with Grade III and higher injuries were admitted to the ICU for variable lengths of time. Patients with Grade III or greater injuries had a minimum overall length of stay of at least 3 days.[66–69] Frequency of serial hematocrits varied by 6, 8, and 12-hour intervals for patients with splenic injuries.[67]

Fata et al.[36] found that clinical judgment was the predominant factor cited by EAST members in return-to-activity decisions for all grades of splenic injury. Most of the EAST members (81%) did not use CT scan following discharge for Grade I and II injury to make activity recommendations. However, the proportion using CT scan increased steadily for higher grades of injury. With respect to follow-up and discharge instructions for timing of returning to full activity including full contact sports, no detectable patterns emerged from the study of Fata et al. Even with Grade I and II injuries, responses ranged from less than 6 weeks (37.6%), 2 months to 3 months (39.3%), to 4 months to 6 months (19.7%). For Grade III injuries, 19.8% of the sample would allow return to full activity within 6 weeks, 56% within 2 months to 3 months, and 19.2% within 4 months to 6 months. For Grade IV and V injuries, the majority of respondents were divided between 2 months to 3 months (45.8%) and 4 months to 6 months (31%). With Grade IV and V, 5% would choose to restrict activity for a period longer than 6 months.[36] There is no true literature consensus regarding what constitutes appropriate in-hospital and posthospital management of patients with blunt splenic injury once they have been selected for nonoperative management. Frequency of serial hematocrits, abdominal examinations, monitoring, when a diet should be

started, how long should patients be kept at bed rest, the optimum length of stay for both the ICU and hospital, and how long should activities be limited are all questions to which there are no clear-cut answers in the literature.

Nonoperative management of splenic injuries in adults is attempted in approximately 85% of all patients with blunt splenic injury, with failure rates ranging from 8% to 38%.[46,52] Patients with a vascular blush or pseudoaneurysm on CT scan, Grade III injuries with large hemoperitoneum or a Grade IV or V injury are thought to be at high risk of failure.[46,70,71] Multiple studies have attempted to predict those at risk for failure of nonoperative management. Velmahos et al.[46] showed that 40% of patients with Grade IV injuries and 16% of Grade V injuries had attempted nonoperative management, and 34.5% of Grade 4 injuries and 60% of Grade V injuries failed NOM. Of those patients who fail nonoperative management, 75% fail within 48 hours of injury, 88% within 5 days, and 93% within 1 week of injury.[19,72] The 180-day risk of splenectomy following nonoperative management and discharge home is 1.4% in a recent review of a statewide hospital discharge data system.[73] Patients should be educated about the potential for delayed splenic rupture when discharged after nonoperative management of their splenic injury.

Chemical DVT prophylaxis may not increase the failure rate of nonoperative management as shown by Eberle et al.[74] In their study, early (<3 days) use of low–molecular weight heparin did not seem to increase failure rates or blood transfusion requirements for patients with splenic injuries. Another study by Alejandro et al.[75] showed that the early use (<48 hours) of low–molecular weight heparin in trauma patients with splenic injuries was not associated with an increased rate of blood transfusion requirements or an increased rate of failure of nonoperative management. Although the use of chemical DVT prophylaxis has been shown not to negatively impact nonoperative management of splenic injuries, there is no literature consensus about safe initiation time.

SUMMARY

There has been a plethora of literature regarding nonoperative management of blunt splenic injuries published since the 2003 EAST practice management guideline was written. Nonoperative management of blunt splenic injuries is now the treatment modality of choice in hemodynamically stable patients, irrespective of the grade of injury. Its use is associated with a low overall morbidity and mortality when applied to an appropriate patient population. Nonoperative management of blunt splenic injuries should only be considered in an environment that provides capabilities for monitoring and serial clinical evaluations and has an operating room available for urgent laparotomy. Patients presenting with hemodynamic instability and peritonitis still warrant emergent operative intervention. Intravenous contrast-enhanced CT scan is the diagnostic modality of choice for evaluating blunt splenic injuries. Repeated imaging should be guided by a patient's clinical status. Adjunctive therapies like angiography with embolization remain important adjuncts to nonoperative management of splenic injuries. Despite the explosion of literature on this topic, many questions regarding nonoperative management of blunt splenic injuries remain without conclusive answers in the literature.

FUTURE INVESTIGATION

Topics for future studies include the following:

1. Frequency of hemoglobin measurements
2. Frequency of abdominal examinations
3. Intensity and duration of monitoring
4. Is there a true transfusion threshold after which operation or angiography should be considered?
5. Optimal time to reinitiate oral intake
6. Necessity of repeated imaging
7. Duration and intensity of restricted activity (in-hospital and after discharge)
8. What exactly constitutes a "failure" of nonoperative management?
9. Timing of initiating pharmacologic DVT prophylaxis after injury
10. Necessity of postsplenectomy vaccination for patients with severe injuries/or embolized injuries
11. Immunologic affects of splenic embolization
12. Optimum length of stay for both the ICU and hospital.

DISCLOSURE

The authors declare no conflicts of interest.

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