

# Selective nonoperative management of high grade splenic trauma

## *Tratamento não operatório do trauma de baço grave*

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### A B S T R A C T

The "Evidence-based Telemedicine – Trauma & Acute Care Surgery" (EBT-TACS) Journal Club performed a critical review of the literature and selected three up-to-date articles on the management of splenic trauma. Our focus was on high-grade splenic injuries, defined as AAST injury grade III-V. The first paper was an update of the 2003 Eastern Association for the Surgery of Trauma (EAST) practice management guidelines for nonoperative management of injury to the spleen. The second paper was an American Association for the Surgery of Trauma (AAST) 2012 plenary paper evaluating the predictive role of contrast blush on CT scan in AAST grade IV and V splenic injuries. Our last article was from Europe and investigates the effects of angioembolization of splenic artery on splenic function after high-grade splenic trauma (AAST grade III-V). The EBT-TACS Journal Club elaborated conclusions and recommendations for the management of high-grade splenic trauma.

**Key words:** Abdominal injuries. Wounds and injuries. Spleen. Therapeutics. Critical pathways.

### INTRODUCTION

Selective nonoperative management (SNOM) of blunt abdominal solid organ injury has become a well-established practice around the world. Allowing for expeditious triage of those with signs of hemodynamic instability of suspected intraabdominal source, peritonitis or patients unable to be evaluated who should undergo immediate laparotomy, many patients can safely undergo imaging and clinical observation. When appropriately applied to splenic injuries, SNOM has been described to be successful in approximately 60-98% of cases<sup>1,2</sup>. Whereas the role of SNOM in low-grade splenic injuries has been well documented, much less is known regarding its role for high-grade splenic injuries.

The participants of the "Evidence Based Telemedicine – Trauma and Acute Care Surgery" (EBT-TACS) Group conducted a critical review of the literature on the management of high-grade splenic injuries. Three recent articles were selected after an extensive literature search to address 3 critical issues related to the management of high grade splenic trauma: 1) Success rate and predictors

of failure of SNOM<sup>3</sup>; 2) The role, indications, and outcomes of angioembolization<sup>4</sup>; 3) The impact of angioembolization on splenic function and on the need for immunization<sup>5</sup>. Based on the discussion of the most up-to-date, relevant literature, recommendations were elaborated for the management of high-grade splenic trauma.

### STUDY 1

"Selective nonoperative management of blunt splenic injury: An Eastern Association for the Surgery of Trauma practice management guideline"<sup>3</sup>

### RATIONALE

Over the last century, the management of splenic injuries has evolved from expectant management to mandatory operative intervention to the current evidence based practice of SNOM. This nonoperative paradigm shift is supported by reports of lower morbidity and mortality when SNOM is applied to the management of the spleen. The purpose of the review article was to update the 2003

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Eastern Association for the Surgery of Trauma (EAST) Practice Management Guidelines for the nonoperative management of splenic injuries.

### QUESTION

1. Is SNOM of splenic injuries appropriate for all hemodynamically stable adults regardless of severity of solid-organ injury or presence of associated injuries?
2. What role should angiography and other adjunctive therapies play in nonoperative management?

### MAIN FINDINGS

1. Review of English literature between 1996 and 2010 using Entrez Pubmed ([www.pubmed.gov](http://www.pubmed.gov)). 125 articles including level I, II and III data were included. Case reports and small case series were excluded.
2. The severity of splenic injury (as per CT scan) and/or the presence of associated injuries are not contraindications to a trial of nonoperative management in a hemodynamically stable patient.
3. Angiography should be pursued for all injuries of an American Association for the Surgery of Trauma (AAST) grade of greater than III or higher, in the presence of a contrast blush, moderate hemoperitoneum, or evidence of ongoing splenic bleeding.
4. Contrast blush on CT alone is not an absolute indication for an operation or angiographic intervention.

### STRENGTHS

1. Diligent review of all available evidence in the English literature
2. Provides recommendations based of established grading system for levels of evidence.
3. Dismiss factors previously thought to preclude SNOM including splenic injury grade, head injury, Injury Severity Score, age, transfusion requirements and blush, and degree of hemoperitoneum on CT scan.
4. Raises 11 unanswered questions and topics for future investigation in the current literature regarding the management of those who have sustained splenic injury including how often hemoglobin checks should be performed, frequency of abdominal examinations, transfusion trigger in this patient population, timing of deep venous thrombosis prophylaxis, duration and intensity of restricted activity and the need for repeat imaging.

### LIMITATIONS

1. Low level of evidence available in the literature. This review includes no randomized studies; only 19 prospective observational studies and 105 retrospective series.
2. Does not address nor provide recommendations regarding important practical aspects of the management of patients who have sustained splenic

injuries including frequency of serial abdominal examinations and hemoglobin checks for those subjected to SNOM, duration of monitoring, transfusion threshold, duration and intensity of bedrest, timing of initiating DVT prophylaxis and necessity of postsplenectomy vaccination for those patients with severe injuries and/or subjected to angioembolization.

## STUDY 2

“At first blush: Absence of computed tomography contrast extravasation in grade IV and V adult blunt splenic trauma should not preclude angioembolization”<sup>4</sup>

### RATIONALE

Contrast blush (CB) when identified on initial screening of patients who have sustained splenic injuries has been demonstrated to be an important predictor of failure of SNOM. Therefore, guidelines for the management of splenic injuries have recommended angioembolization (AE) of splenic vessels when CB is present on initial CT scan. The present study aims to evaluate the predictive value of absent CB on initial CT of high-grade (AAST IV-V) blunt splenic injuries.

### QUESTION

1. What are the role, indications and outcomes of AE of SNOM of splenic trauma?
2. What is the implication of absent CB on initial CT of patients who have sustained high-grade splenic injuries?

### MAIN FINDINGS

Over a 12-year study period, a total of 158 patients sustained high-grade splenic injuries and were eligible for inclusion. 95 patients had CB on initial CT scan, AE was performed in 88 of these with extravasations found in 86. Three of these 88 patients failed SNOM.

51 patients had high-grade injuries without CB, 20 of those underwent AE and 17 went had angiographic extravasation. No failure of SNOM in this group was demonstrated. The other 31 high-grade injuries without CB or AE had 8 failures of SNOM.

In summary:

1. AE should be performed in all patients with CB on initial CT scan subjected to SNOM after splenic injury. Failure of SNOM is 71% when no AE is performed.
2. The absence of CB on initial CT scan of patients who have sustained high-grade splenic injuries does not reliably exclude active bleeding. 85% of those undergoing angiogram had active extravasation and underwent AE. When AE was performed, no patients failed SNOM. When no angiography was performed in that population, failure of SNOM was 26%.

**STRENGTHS**

1. One of the largest studies to date specifically addressing the predictive value of blush on CT scan after splenic trauma. Overall, 1,056 patients were screened for enrollment and 556 patients were eligible for enrollment. High-grade splenic injury patients accounted for 29% of their enrolled study population.

2. Compares their findings with 6 other studies in the literature evaluating failure of SNOM of high-grade splenic injuries with and without AE.

3. Proposes a clinical management decision algorithm for blunt splenic injuries that is comprehensive and evidence based.

**LIMITATIONS**

1. Retrospective study over a large study period conducted in single trauma center .

2. No adjusted analysis performed.

3. CT scan technology over the study period was not provided. Data such as the size of contrast blush, the presence of abdominal free fluid and the presence of associated solid organ injuries were not provided.

4. The study does not provide data on the reasons for failure of SNOM. Transfusion requirements, hemoglobin levels, presence of peritonitis or development of hemodynamic instability were not provided.

5. Data on central embolization versus peripheral embolization versus both for the management of splenic artery extravasation was not provided.

**STUDY 3**

“Preserved splenic function after angioembolization of high grade injury”<sup>5</sup>

**RATIONALE**

Angiography with splenic artery angioembolization (AE) has become an integral adjunct in the management of splenic trauma with multiple studies reporting increased success rate of SNOM of high-grade splenic injuries after AE. What is less clear however, is the presence of residual splenic function after AE and whether these patients would benefit from immunization against encapsulated bacteria such as *Streptococcus pneumoniae*, *Haemophilus influenzae* type B, and *Neisseria meningitidis* to decrease the risk of overwhelming postsplenectomy sepsis. The present study was performed to evaluate splenic function and the need for immunization after splenic artery AE of high-grade splenic injuries (AAST III-V).

**QUESTION**

1. What are the effects of splenic artery AE on splenic function?

2. Is there a need for immunization in patients who underwent splenic artery AE?

**MAIN FINDINGS**

1. In both splenectomized and AE groups, leukocyte and platelet counts were elevated when compared to control group. Howell-Jolly bodies were found only in smears of splenectomized patients.

2. No significant differences in immunoglobulin titers were found between splenic artery AE patients and controls. Splenectomized patients had higher titers of pneumovax®/PPV23 IgA, IgG and 5 of 12 pneumococcal serotype specific IgGs and IgMs when compared to controls.

3. Flowcytometric analysis revealed no significant differences in B-lymphocyte function in any of the treatment groups when compared to controls. Minor decreases in the proportion of CD8<sup>+</sup> and CD4<sup>+</sup> were detected among splenic artery AE patients and splenectomized patients, respectively when compared to controls.

4. Abdominal ultrasound demonstrated no differences in spleen measurements and vessel flow between splenic artery AE and control groups.

**STRENGTHS**

1. One of the first studies to match splenic artery AE and splenectomized patients to control groups.

2. Used a wide array of tests to estimate splenic function including blood counts, immunoglobulin assays, flowcytometry and ultrasound.

**LIMITATIONS**

1. Retrospective design with a small sample conducted in a single center.

2. Mean follow-up period after injury and when tests were performed were not provided.

3. The study was not designed to address the question whether patients who underwent splenic artery AE require vaccinations. Therefore, no conclusions can be made in that regard.

4. Injured patients were given only pneumovax®/PPV23 vaccine.

**CONCLUSIONS**

The spleen remains one of the most commonly injured organs after trauma and its management has considerably evolved over the last few decades from mandatory operative intervention to the current standard practice of selective nonoperative management. The bulk of literature on splenic injuries is composed of retrospective studies including Level III data. These studies quite often differ in methodology, in results and in conclusions. In the majority of those studies, low grade and high-grade splenic injuries are not analyzed individually.

The present review included 3 up-to-date studies on selective nonoperative management of splenic trauma.

ma addressing issues such as the safety of SNOM in high-grade splenic injuries, the predictive value of blush on initial CT scan and splenic function preservation after AE of high-grade splenic injuries. The following conclusions were made:

1. For patients with suspected intra-abdominal injury who demonstrate signs of peritonitis, hemodynamic instability or who are unevaluable, laparotomy remains the standard of care and there is no place for CT imaging or serial observation.

2. For those without peritonitis or shock, and who are evaluable, selective nonoperative management including initial CT scan with intravenous contrast to define the injury and serial abdominal examinations to detect deterioration of patient clinical condition has become the gold standard management option provided hospital capabilities are adequate for the practice of SNOM. Importantly, the severity of injury, and the presence of associated injuries, contrast blush or intra-abdominal free fluid do not necessarily contraindicate a trial of SNOM.

3. Pharmacological thromboprophylaxis can be safely initiated after splenic trauma including high-grade injuries although the optimal timing for that has not been clearly defined in the literature.

4. Angiography with angioembolization of splenic artery should be performed to enhance success of SNOM in the following situations: high-grade splenic injuries (AAST IV-V), presence of contrast blush, or evidence of ongoing splenic bleeding. As far as the predictive role of contrast blush on CT scan, its absence does not reliably exclude bleeding after high grade splenic trauma and active

extravasation can still be demonstrated in as high as 85% of cases.

5. AE does not seem to affect splenic function and therefore immunization after AE may not be necessary.

## RECOMMENDATIONS

The recommendations for the management of high-grade splenic injuries are:

1. Clinical examination remains the most important diagnostic tool in defining which high-grade splenic injury patients can be given a trial of SNOM.

2. Angiography with splenic artery AE should be performed routinely in hemodynamically stable patients with high grade splenic injuries as the risk of failure of SNOM is high and the absence of contrast blush does not reliably excluded active bleeding.

3. In high-grade splenic injuries, AE of splenic artery might not mandate vaccination against encapsulated bacteria.

4. Due to the lack of available literature, no recommendations could be made on practical aspects of the management of high grade splenic injuries such as duration of hospitalization and frequency of serial abdominal examinations and hemoglobin measurements, timing of initiation of thromboembolism prophylaxis, duration and intensity of restricted activity, optimal length of stay in the ICU and hospital.

\* The authors emphasize that these recommendations do not apply to services that do not have adequate resources to perform the SNOM.

## R E S U M O

A reunião de revista "Telemedicina baseada em evidências - Cirurgia do Trauma e Emergência" (TBE-CiTE) realizou uma revisão crítica da literatura e selecionou três artigos atuais sobre o tratamento do trauma de baço. O foco foi em lesão de baço grave, definida pela American Association for the Surgery of Trauma (AAST) como graus III a V. O primeiro artigo foi uma atualização do protocolo de 2003 da Eastern Association for the Surgery of Trauma (EAST) para o tratamento não operatório de trauma do baço. O segundo artigo foi apresentado na plenária de 2012 da AAST avaliando o papel do extravasamento de contraste na tomografia computadorizada em pacientes com lesão grave de baço (AAST IV-V). O último artigo é europeu e investigou o efeito da angioembolização da artéria esplênica na função do baço após lesão esplênica grave (AAST III-V). A reunião de revista TBE-CiTE elaborou conclusões e recomendações para o tratamento de lesão grave do baço.

**Descritores:** Traumatismos abdominais. Ferimentos e lesões. Baço. Terapêutica. Procedimentos clínicos.

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