ROLE OF REPEAT COMPUTERIZED TOMOGRAPHY IN SELECTIVE NON-OPERATIVE MANAGEMENT OF BLUNT SPLENIC INJURY

Topic Areas: Patient Safety, Quality Improvement, Patient Experience
Statement of Support:

At Natividad Medical Center we are committed to ongoing quality improvement. The above study looked at our use of repeat CT scans for patients who suffered splenic injuries related to blunt trauma. This study will help guide improvements in care for these patients.

Please consider this study for the C. Duane Dauner Quality Award.

Sincerely,

Monica Hamilton, RN
Quality Management Administrator
Executive Summary:

- Splenic injuries are some of the most common injuries accompanying blunt abdominal trauma. Non-operative management (NOM) of these injuries is a standard of care for hemodynamically stable patients. Current guidelines at Natividad Medical Center recommend that a repeat CT scan should be performed for patients undergoing NOM of splenic injuries Grade III and above at 48 hours from admission – including those that undergo embolization. This 2-year retrospective study assessed the role of repeat CT scans in NOM by analyzing the indications for surgery in NOM failures. NOM was undertaken in 35 patients with splenic trauma of Grade III or higher. Scans were repeated in 28 (80%) patients with a median time of 65.68 hours. There was failure of NOM (NOMF) in 4 patients. All patients had clinical signs of peritonitis along with follow-up imaging prior to delayed surgery. The data suggests that repeat CT scans have a limited role in NOM of splenic trauma. Although this study is limited by our small sample size, we propose that instead of mandatory repeat CT scans, clinical judgement should be exercised to avoid unnecessary radiation exposure in clinically stable patients.
Background:

- Spleen injuries are graded on a scale of I through V based on the American Association for the Surgery of Trauma (AAST) spleen injury scale. A higher grade indicates a more severe injury. Management of splenic injury is largely dependent on the grade of injury seen on CT imaging in addition to the patient’s clinical appearance.

- Current guidelines at Natividad Medical Center recommend that a repeat CT scan should be performed for patients with Grade III and above splenic injuries managed non-operatively at 48 hours from admission. The logic is to identify delayed hemorrhagic complications in the patient undergoing non-operative management of blunt splenic trauma. Such complications include splenic pseudoaneurysm formation, delayed bleed and spleen capsule rupture. However, there is limited data to determine the necessity of repeated imaging regardless of clinical findings. This uncertainty pertains to when follow up CT scans should be performed, if at all. Some institutions only do repeat CT scans when there is clinical instability in which the patient’s vital signs or labs worsen or the patient expresses worsening pain as the days progress. Other institutions require follow up CT scans for everyone regardless of stage to avoid the risk of missing delayed complications prior to discharge.
Effort Description:

- A database was created in Microsoft Excel (Microsoft Excel; Microsoft Corporation, Redmond, WA) and consists of all patients with a documented splenic injury who arrived to Natividad Medical Center from January 2015 to January 2017. Natividad Medical Center is a 172 bed county hospital and level II trauma center. It has been providing care in Monterey County, California for 132 years and its trauma program was established in January 2015. It is the only trauma center within the county.

- The variables in the database included the following: splenic injury grade, baseline vital signs, timing of CT scans, complications during hospital stay, deep vein thrombosis prophylaxis, procedures performed, hospital length of stay, Intensive Care Unit (ICU) length of stay and discharge disposition. A total of 105 cases with documented splenic injury were evaluated from the entire trauma registry over the 2 year period.

- Descriptive statistics for each outcome pertaining to each grade was obtained. In depth review of the cases that failed NOM was performed. The goal was to compare these failures and observe for patterns in clinical presentation.
Results:

- Blunt splenic trauma was seen in 105 patients. One patient with severe multiple injuries died soon after arrival in the operating room during emergent laparotomy. After excluding one immediate death, 104 patients were assessed. Of these 104 patients, 49 had Grade III and above splenic injuries and were selected to evaluate current guidelines at Natividad Medical Center. Operative management was done in 14. This study pertains to the remaining 35 treated non-operatively.

- Non-operative management failed in 4 patients. Repeat CT scan was done prior to surgery and all 4 had deterioration of CT abnormalities. These patients also had increased abdominal pain with clinical signs of peritonitis. Out of the 35 patients treated non-operatively, 28 received repeat CT scans. Of these 28 patients, repeat CT scans were unchanged or improved in 21 patients and showed deterioration in 7. As illustrated above, 4 patients with deterioration on repeat CT failed non-operative management. The other 3 had repeat CT scans that revealed pseudoaneurysms or delayed bleeds which were managed with splenic artery embolization or observation. These 3 patients also presented with increasing abdominal pain and/or decreased hemoglobin and hematocrit.
Result Significance:

- There appears to be a limited role of follow-up imaging in NOM of clinically stable patients. Repeat CT scans should be done more selectively and guided by a patient’s clinical status. However, a follow up CT scan is still an important tool to evaluate for potential delayed bleeds in patients who have a normal initial abdominal CT scan. One patient in our study presented to the emergency department with abdominal pain after being assaulted; initial CT of the abdomen was normal and the patient was discharged. Repeat CT scan done 9 days after arrival to evaluate for persistent abdominal pain and unexplained drop in hemoglobin revealed an undiagnosed grade III splenic injury with moderate hemoperitoneum. The patient was subsequently taken to the operating room and treated successfully.

- There were several key limitations with this study. Given the study’s small sample size, this power of the study is inadequate to make any overarching definite conclusions about all patients who sustain grade III and above splenic injuries. Moreover given the small number of pseudoaneurysms detected and reviewed in this study, it is difficult to make generalized conclusions about the entire population regarding pseudoaneurysm management.
Sustainability and Scaling:

- Future investigation is needed at a later time as more spleen injuries are added to the database at this institution. This is the benefit of having a trauma registry that is continually updated. Periodic review of the practices and outcomes can provide insight into key areas where improvement is needed.

Key Lessons:

- While reviewing the data for this project we learned that we may be doing additional tests that are not necessary. Our data is limited by small sample sizes and some missing information in our registry. We anticipate reduced radiation exposure to patients with revisions to our guidelines based on this study.
Role of Repeat Computerized Tomography in the Selective Non-operative Management of Blunt Splenic Injury

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ABSTRACT

Splenic injuries are some of the most common injuries accompanying blunt abdominal trauma, non-operative management (NOM) of these injuries is a standard of care for hemodynamically stable patients. Computerized tomography (CT) imaging is helpful in evaluating solid organ trauma and determining treatment options; however, indications for follow up CT scans are unclear. Current guidelines at Natividad Medical Center recommend that a repeat CT scan should be performed for patients undergoing NOM of splenic injuries Grade III and above at four to six hours from admission. Including those that undergo embolization. This 2 year retrospective study assessed the role of repeat CT scans in NOM by analyzing the indications for surgery in NOM failures. NOM was undertaken in 55 patients with splenic trauma of Grade III or higher. Scans were repeated in 35 (64%) patients, with a median time of 65.6 hours. There were failures of NOM (NOMF) in 4 patients. All patients had clinical signs of peritonitis along with follow up imaging prior to delayed surgery. The data suggests that repeat CT scans have a limited role in NOM of splenic trauma. Although this study is limited by its small sample size, we propose that instead of mandatory repeat CT scans, clinical judgement should be exercised to reduce unnecessary radiation exposure in clinically stable patients. This study prompts further questions concerning the role of repeat computerized tomography in blunt splenic trauma and illustrates the need for a larger multicenter trial to address this question as well.

INTRODUCTION

Splenic injuries are graded on a scale of I through V based on the American Association for the Surgery of Trauma (AAST) splenic injury scale. A higher grade indicates a more severe injury. Grading is done by a radiologist after reviewing abdominal computed tomography (CT) scans with intravenous (IV) contrast looking for lacerations, hematomas, extravasation of contrast or pseudoaneurysms. Management of splenic injury is largely dependent on the grade of injury seen on CT imaging in addition to the patient’s clinical appearance.

Parent improvements in computerized tomography has allowed for selective non-operative management (NOM) of blunt splenic injuries in hemodynamically stable patients to become the new standard of care. It has been widely accepted as a well tolerated approach in pediatric populations. However the evidence regarding the best practices for non-operative management of adult populations is still not clear.

Some key points of NOM such as the need and timing of repeat CT scans are less defined. Previous studies done by Sharma, et al. and Shrapnp, et al. found that repeat CT scans did not change patient management in the majority of cases. In contrast, Weinberg et al. showed that repeated CT imaging at 24 hours to 48 hours in Grade II and higher splenic injuries identifies latent pseudoaneurysms that then undergo angiembolization with improved outcome.

Current guidelines at Natividad Medical Center recommend that a repeat CT scan should be performed for patients with Grade III and above splenic injuries managed non-operatively at 48 hours from admission. The logic is to identify delayed hemorrhagic complications in the patient undergoing non-operative management of blunt splenic trauma. Such complications include splenic pseudoaneurysms, delayed lacerated and splenic capsule rupture. However, there is limited data to determine the necessity of repeated imaging regardless of clinical findings. This uncertainty pertains to when follow up CT scans should be performed, if at all. Some institutions only do repeat CT scan when there is clinical instability in which the patient’s vital signs or labs worsen or if the patient expresses worsening pain as the days progress. Other institutions require follow up CT scans for everyone regardless of stage to avoid the risk of missing delayed complications prior to discharge.

METHODOLOGY

This project received an exemption status from the Institutional Review Board of Touro University of California - College of Osteopathic Medicine. It was classified as exempt for its retrospective analysis of anonymous data without any patient identifiable information. The database was created in Microsoft Excel (Microsoft Corp), Microsoft Corporation, Redmond, WA and census of all patients with a documented splenic injury who arrived at Natividad Medical Center from January 2015 to January 2017. Natividad Medical Center is a 172 bed county hospital and Level II trauma center. It has been providing care in Monterey County, California for 132 years and its trauma program was established in January 2015. It is the only trauma center within the county.

The variables in the database included: splenic injury grade, baseline vital signs, timing of CT scans, complications during hospital stay, deep vein thrombophylaxis, procedures performed, hospital length of stay, intensive Care Unit (ICU) length of stay and discharge disposition. A total of 105 cases with documented splenic injury were evaluated from the entire trauma registry over the 2 year period.

Descriptive statistics for each outcome pertaining to each grade was obtained. In depth review of the cases that failed NOM was performed. The goal was to compare these failures and observe for patterns in clinical presentation.

RESULTS

Blunt splenic trauma was seen in 105 patients. One patient with severe multiple injuries died soon after arrival in the operating room during emergent laparotomy. After excluding one immediate death, 104 patients were assessed. Of these 104 patients, 49 had Grade II and above splenic injuries and were selected to evaluate current guidelines at Natividad Medical Center. Operative management was done in 24. This study pertains to the remaining 35 treated non-operatively.

Non-operative management failed in 4 patients. Repeat CT scan was done prior to surgery and all had deterioration of CT abnormalities. These patients also had increased abdominal pain with clinical signs of peritonitis. Out of the 35 patients treated non-operatively, 28 received repeat CT scans. Of these 35 patients, repeat CT scans were unchanged or improved in 21 patients and showed deterioration in 7. As illustrated above, 4 patients with deterioration on repeat CT failed non-operative management. The other 3 had repeat CT scans that revealed pseudoaneurysms or delayed bleeds which were managed with splenic artery embolization or observation. These 3 patients also presented with increasing abdominal pain and/or decreased hemoglobin and hematocrit.

CONCLUSIONS

Initial CT scans were done in 95 NOM patients; repeat CT scans were done in 28 patients. 7 of these 28 patients showed worse findings on follow up CT scans of who had worse repeat CT scans. 4 of 7 needed surgery because of clinical deterioration. All 4 patients had signs of hemodynamic instability or clinical signs of peritonitis. CT scan in the other 5 patients showed signs of splenic pseudoaneurysm or delayed splenic rupture. 2 of these patients received interventional radiology guided embolization of the splenic artery while the third patient refused treatment. All three patients had decreasing hemoglobin and hematocrit. The remaining 21 out of 28 patients had repeat CT scans despite hemodynamic stability and stable hemoglobin and hematocrit levels. Follow up scans of these patients revealed unchanged or improved findings.

There appears to be a limited role of follow-up imaging in NOM of clinically stable patients: Repeat CT scans should be done more selectively and guided by a patient’s clinical status. However, a follow up CT scan is still an important tool to evaluate for potential delayed bleeds in patients who have a normal initial abdominal CT scan. One patient in our study presented to the emergency department with abdominal pain after being assaulted; initial CT of the abdomen was normal and the patient was discharged. Repeat CT done 9 days after arrival to evaluate for persistent abdominal pain and unexplained drop in hemoglobin revealed an undiagnosed Grade III splenic injury with moderate hemorrhage. The patient was subsequently taken to the operating room and treated successfully.

There were several limitations with this study. Given the study’s small sample size, the power of this study is inadequate to make any overarching definitive conclusions about all patients who sustain Grade III and above splenic injuries. Moreover given the small number of pseudoaneurysms detected and reviewed in this study, it is difficult to make any generalizations to the entire population regarding pseudoaneurysm management. Future investigation is needed at a later time as more splenic injuries are added to the database at this institution. This is the benefit of having a trauma registry that is continually updated. Periodic review of the practices and outcomes can provide insight into key areas where improvement is needed.

DISCLOSURE

None of the planners, reviewers or presenting authors have any financial relationships with commercial interests to disclose.

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