

## Original Article

# Outcome of Non-operative Management of Blunt Splenic Trauma

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## ABSTRACT

**Objective:** To evaluate the outcome of non-operative management (NOM) and compare it with the operative treatment in splenic trauma

**Design:** A retrospective comparative study

**Setting:** Riyadh Medical Complex, Riyadh, Kingdom of Saudi Arabia

**Subjects:** Files of 83 patients managed for blunt splenic trauma over a five year period were reviewed. Patients were divided in two groups: operative group and non-operative group.

**Intervention:** Thirty five patients were hemodynamically unstable and underwent laparotomy with either splenectomy, splenorrhaphy or partial splenectomy (operative group). Forty eight patients were hemodynamically stable. The diagnosis of splenic injury was confirmed on CT abdomen. These were initially managed conservatively by serial clinical and laboratory monitoring in the intensive care unit (ICU) followed by

bed rest for 5-7 days in the general ward (non-operative group).

**Main outcome measures:** Outcome was compared in terms of hospital stay, complications, blood transfusion requirements, morbidity and mortality between two groups.

**Results:** Among 35 patients (42%) with laparotomy, the spleen was removed in 25 patients and preserved in 10 patients. Forty eight patients (58%) were hemodynamically stable and were treated non-operatively. The non-operative group had a more advanced injury grade, required less blood transfusion and had shorter hospital stay than the operative group. Non-operative management failed in four patients and had a success rate 91.7%.

**Conclusion:** NOM of blunt splenic trauma in hemodynamically stable patients is safe and effective. It results in shorter hospital stay, low morbidity and mortality.

KEY WORDS: blunt splenic trauma, non-operative treatment, splenic preservation, splenectomy

## INTRODUCTION

Ever since Reinger reported the first successful splenectomy for splenic injury in 1892<sup>[1]</sup>, it had become the standard treatment of traumatic rupture of the spleen. Early in the 20th century, many studies revealed the importance of spleen in the immunity and the asplenic state putting the person at lifelong risk of susceptibility to infection<sup>[1,2]</sup>. This led to a shift in the management towards splenic preservation (splenorrhaphy, mesh splenorrhaphy, or partial splenectomy) following trauma in the last few decades<sup>[3]</sup>. The liberal use of computed tomography (CT) in blunt abdominal trauma has reduced the rate of non-therapeutic celiotomy, as many cases of splenic injuries can be detected on CT in hemodynamically stable patients who could be observed and treated non-operatively<sup>[4]</sup>. Non-operative management (NOM) for pediatric blunt splenic trauma was first reported by Upadhyaya in 1968 followed by many studies in

the eighties which reported favorable results of NOM in pediatric patients<sup>[5-8]</sup>. At the same time many investigators have applied the NOM to adults splenic trauma and reported encouraging results<sup>[9-11]</sup>. NOM is considered the method of choice in treating blunt splenic injuries in hemodynamically stable patients in most trauma centers these days. However, few aspects remain controversial and need to be evaluated. This comparative study was carried out at the Riyadh Medical Complex to evaluate the outcome and experience of managing blunt splenic trauma between operative and non-operative groups.

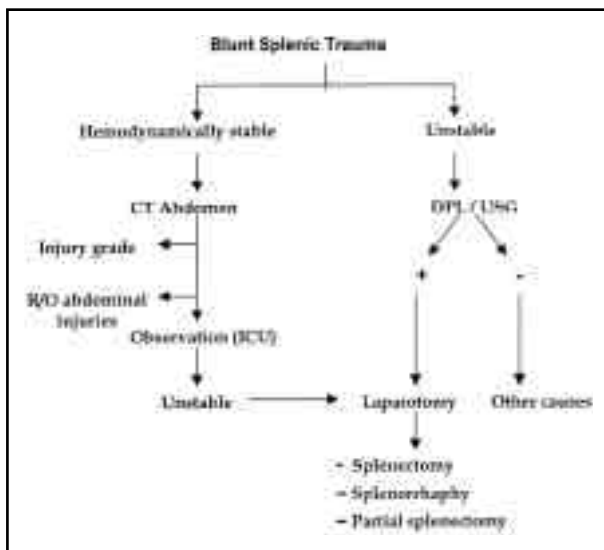
## PATIENTS AND METHODS

The medical records of 83 patients with splenic injuries due to blunt abdominal trauma over a five year period from January 2000 to December 2004 were retrospectively reviewed for demographic data, mechanism of injury, hematological and

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Fig. 1: Algorithmic approach to Blunt Splenic Trauma



imaging investigations, associated injuries, blood transfusion, complications, treatment and surgical procedures, morbidity, mortality and hospital stay. The patients were divided into two groups; the operative management group included patients who were hemodynamically unstable and required exploratory laparotomy. The surgical procedures were either splenectomy, splenorrhaphy or partial splenectomy. The NOM was applied in hemodynamically stable patients on presentation or who were hypotensive and stabilized with minimal intravenous fluids in emergency room. The patients with blunt splenic trauma were managed according to the algorithm shown in Fig. 1. The diagnosis of intraperitoneal hemorrhage was confirmed by diagnostic peritoneal lavage (DPL) or positive abdominal ultrasonogram (USG) for free intraperitoneal fluids in hemodynamically unstable patients. The imaging modalities employed for hemodynamically stable patients were abdominal ultrasonogram and CT scan of the abdomen. The splenic injuries were classified according to the splenic injury scale of the American Society for the Surgery of Trauma (ASST) (Table 1). Patients with high class injuries were admitted to the Intensive Care Unit (ICU) for close monitoring for the first 48 hours with serial clinical examinations and hemoglobin checkup. Patients with isolated splenic minor injuries were observed in the surgical ward with close monitoring. Patients were kept on bed rest for 5-7 days. The failure of NOM was considered when the patient became hemodynamically unstable during observation or required more than two units of blood transfusion for splenic injury. They underwent exploratory laparotomy. The outcome of both groups was compared with emphasis on the patients' age, class of injuries, numbers of blood transfusion, morbidity, mortality

Table 1: ASST\* splenic organ injury scale

CLASS I	Hematoma subcapsular < 10% surface area laceration capsular tear < 1 cm parenchymal depth
CLASS II	Hematoma subcapsular 10 - 50% surface area Intraparenchymal < 5 cm diameter Laceration 1 - 3 cm parenchymal depth not involving a parenchymal vessel
CLASS III	Hematoma subcapsular > 50% surface area or expanding Ruptured subcapsular or parenchymal hematoma Intraparenchymal hematoma > 5 cm Laceration > 3 cm parenchymal depth or involving trabecular vessels
CLASS IV	Laceration of segmental or hilar vessels producing major devascularization (> 25% of spleen)
CLASS V	Laceration completely shattered spleen Hilar laceration injury which devascularized spleen

\* American Society for the Surgery of Trauma

and hospital stay. Statistical analysis was carried out employing exact Fisher test, Chi-square test, and analysis of variance for comparative analysis of the data using IBM-compatible PC and SPSS 10.0 for Windows (SPSS Inc., Chicago).

## RESULTS

A total of 83 patients with splenic injuries due to blunt abdominal trauma were treated at the Riyadh Medical Complex over the five year period under review. There were 72 men and 11 women. The mean age was 23.5 years (range 4-63 years). The mechanisms of injury were as follows: motor vehicle accident in 60 patients, fall from height in 13 and sport injuries in 10 patients.

Thirty five patients were hemodynamically unstable and underwent exploratory laparotomy (operative management group) due to ongoing bleeding from the injured spleen. The remaining 48 patients were hemodynamically stable and were selected for NOM.

Thirty five patients underwent exploratory laparotomy due to ongoing intraperitoneal hemorrhage. There were 30 male and 5 female patients. The mean age was 24 years (4 - 63 years). Seven patients were less than 13 years of age. All patients presented to emergency room with hypovolemic shock. DPL was performed in 30 patients and was positive. The other five patients underwent USG which showed free intraperitoneal fluid. The associated injuries were as follow: thoracic injuries in 18, extremities injuries in 11, head injuries in nine, spinal injuries in two, and pelvic injury in two patients. The associated intra-abdominal injuries were liver in seven, retroperitoneal hematoma in five, mesenteric tear in four, renal injuries in two, duodenum in one, diaphragm in one, and pancreas in one patient. The class of splenic injuries were low and moderate in

**Table 2:** Comparative analysis of operative and NOM groups

Operative (n = 35, 42%)	NOM (n = 48, 57.8%)
Age < 13 years: 7 patients	Age < 16 years: 13, p < 0.000001
Associated injuries (1.6 injury / patient)	Associated injuries (1 injury / patient)
Injuries grade: Severe (IV, V) 40%	Injuries grade: Severe (IV, V) 23%, p = 0.1519
Blood transfusion: all patients (100%)	Blood transfusion: only 18 patients (37.5%)
Received (1 - 10 units)	Received (1 - 6 units)
Mean: 3.7 units per patient	Mean: 0.8 units per patient, p = 0.015
Hospital stay (7 - 61) days	Hospital stay (3 - 32) days
Mean 18.6 days	Mean 11.2 days, p = 0.008
Complication	Failure: 4 patients (8.33%)
Death : 5 (severe head injury)	Death : No

21 patients (I in 3, II in 8 and III in 10) and high in 14 patients (class IV in 8, class V in 6).

Splenectomy was performed in 25 patients, splenorrhaphy in seven and partial splenectomy in three patients. All patients received blood transfusion. The average number of blood units transfused was 3.7 units /patient (range 1-10 units). Postoperative complications included atelectasis in six patients, pleural effusion in five, urinary tract infection in five, chest infection in four, hematoma in splenic bed in two, wound hematoma in two and wound infection in one patient. One patients developed complete adhesive bowel obstruction at 10th postoperative day and required laparotomy for adhesiolysis. The mean hospital stay was 18.6 days (range 7 - 61 days). Five patients died due to severe head injuries and multiple trauma and the mortality rate in this group was 14 %.

Forty eight patients were hemodynamically stable and were treated conservatively. There were 42 male and six female patients with a mean age of 21 years (range 5 - 51years). Sixteen patients were under 13 years. Ten patients presented with shock. They were resuscitated and stabilized with intravenous fluids (mean 1.75 l / patient, range: 1.5 - 2.5 l / patient) and blood transfusion. Eighteen patients (37.5%) received blood transfusion. The mean number of blood units transfused was 0.8 units / patient (range: 1 - 6 units). The remaining 38 patients were hemodynamically stable at presentation. Abdominal USG was performed in 28 patients. It was able to detect splenic trauma in 24 patients and showed free intraperitoneal fluids in rest of cases with a sensitivity of 85%. An abdominal CT scan was performed in all patients to confirm and classify the splenic injuries. The class of injury were as follows: low and moderate in 37 patients (class I in 13, class II in 16, class III in 8)

and high class in 11 (class IV in 8, class V in 3) according to the CT findings. The associated injuries were as follows: thoracic injuries in 22, extremities in six, head injury in nine, spinal in three and pelvis in two patients. The intraperitoneal injuries were as follows: liver injuries in three (class I in 1, class II in 2), retroperitoneal hematoma in two, pelvic hematoma in one and renal trauma in two patients. The mean hospital stay was 11.2 days (range: 3-32 days). The NOM was successful in 44 patients (91.7%). Four patients became hemodynamically unstable after initial period of conservative treatment. They required exploratory laparotomy and splenectomy with failure rate of NOM of 8.3%. All patients with NOM failure were above 13 years; two had class IV, one class V and one class III trauma.

Comparison of outcome in both operative and NOM groups (Table 2) showed that the operative group had a relatively less number of pediatric patients (20 Vs 33% for NOM patients; p = 0.000001). The number of associated injuries was higher in the operative group (1.6 injuries / patient Vs 1 injury / patient in NOM group). As regard the severity of injury, the operative group had a higher class (V, IV) of injuries than NOM group (40 Vs 23%). The incidence of low and moderate class injury (I, II, III) in the operative group was 60% as compared to 77% in non-operative group (p = 0.1519). All operative group patients received blood (100%) as against only 18 (37.5%) in NOM group. The blood transfusion rate was 3.7 units / patient in operative group and 0.8 units / patient in NOM group (p = 0.015). The hospital stay was longer in operative group (18.6 days Vs 11.2 days in NOM group, p = 0.008). There was no mortality in NOM group, while five patients died in the operative group. These patients had severe head injuries and polytrauma (5 injuries / patient).

## DISCUSSION

The management of splenic trauma has evolved with time, from splenectomy towards splenic preservation and NOM over the last 25 years. The susceptibility to infection and post-splenectomy sepsis was well established early in the 20th century<sup>[1,2]</sup>. Green *et al* reported major septic complications rate of 5.9% (pneumonia, septicemia, meningitis) in post-splenectomy patients<sup>[12]</sup>. The overwhelming post-splenectomy infection (OPSI) can occur in 0.5% cases with a high mortality (> 50%)<sup>[13-15]</sup>. This led the surgeons to attempt preserving the spleen and avoid splenectomy whenever possible. Splenorrhaphy, mesh splenorrhaphy and partial splenectomy have been employed as most common procedures of splenic salvage. In a retrospective review of splenic trauma in 1982,

Hebler *et al* found that splenorrhaphy and NOM patients had lower mortality and less infectious complications<sup>[9]</sup>. Morgestern *et al* in 1983 treated 17 patients nonoperatively without failure. In 1984, Zucker *et al* noted only one failure (4%) in 14 adults and 10 children with blunt splenic trauma treated nonoperatively<sup>[10,11]</sup>. Recently the NOM has replaced the splenic salvage procedures in hemodynamically stable patients in most trauma centers.

In this study a total of 83 patients with blunt splenic trauma were reviewed. We treated 48 patients (57.8%) non-operatively. The NOM failed in four patients and had a success rate of 91.6%. The remaining 35 patients underwent exploratory laparotomy. Splenectomy was performed in 25 patients and the spleen was preserved in 10 patients. The overall splenic salvage rate was 70%. These results are similar to Pachter *et al* where 65% of patients with splenic trauma were treated nonoperatively with success rate of 98% and the overall splenic salvage rate was 71%<sup>[16]</sup>. However, others have reported only 40% success rates for NOM and a splenic salvage rate of 50%<sup>[17]</sup>. Cogbill *et al* showed that NOM has a higher success rate in children (failure rates being 17% in adults and only 2% for children)<sup>[18]</sup>. The largest multicentre study about NOM was by Hunt *et al*, where a total of 2258 cases with splenic trauma were reviewed over a five year period<sup>[19]</sup>. They found that the NOM rate increased with time from 33.9% to 46%. Pachter *et al* reported increased frequency of NOM from 13% (from 1978-1989) to 54% (from 1990-1996)<sup>[16]</sup>.

NOM is considered method of choice in the management of hemodynamically stable patients with high success rates and low morbidity<sup>[16,17,19]</sup>. There are, however, some controversies which need to be addressed. It was argued that NOM will require more blood transfusion than surgically treated patients. Our study shows that all patients (100%) who were treated surgically received blood transfusion at the rate of 3.7 units per patient (range = 1-10 units) while only 18 patients (37%) from the NOM group received blood at the rate of 0.8 units / patient. Similar results were reported by Smith<sup>[20]</sup>. Another critique for NOM has been that the patients might have missed intra-abdominal injury which could need surgical intervention. Cogbill *et al* treated 112 patients non-operatively and they had only one missed injury (0.91%)<sup>[18]</sup>. We did not observe any missed intra-abdominal injuries in NOM patients. The major concern for NOM is that this treatment is contraindicated in patients with neurological impairment. Archer *et al* found no significant differences in morbidity, mortality and failure of treatment or missed visceral injuries in patients with or without neurological injuries<sup>[21]</sup>. We had five patients with Glasgow Coma Score < 9

treated successfully with NOM. Our study supports NOM for splenic trauma even in patients with neurologic impairment provided they have CT abdomen with oral and intravenous contrasts and are closely monitored with frequent clinical examination, preferably in a high dependency or intensive care unit initially. The age of patient has been another concern. Godley *et al* cautioned in their study that age > 55 years is a contraindication for NOM<sup>[22]</sup>. The authors reported 10 failures of NOM out of 11 patients aged > 55 years. However Pachter *et al* found no difference or increased failure rate in patients over 55 years<sup>[16]</sup>. Our study did not have any patient more than 50 years in the NOM group. Therefore we cannot comment on this aspect which remains to be elucidated by further studies.

The management of the advanced class of splenic injuries is the most controversial issue in NOM. Cogbill *et al* concluded that class I and II can be treated safely and class III can be treated with high prediction of failure and recommended that class IV and V should be treated surgically<sup>[18]</sup>. Powell *et al* observed that class III, IV and V splenic injuries are poor prognostic indicators for NOM<sup>[23]</sup>. Scalfani *et al* showed that advanced class of splenic injuries can be treated non-operatively when they treated 17 patients with class IV splenic trauma with a success rate of 84%<sup>[24]</sup>. Our study included nine patients with class III injury with one failure (11%) and 11 patients with class IV and V trauma with three failures (27%). We conclude that advance class like III, IV and V can be treated nonoperatively with high prediction of failure.

While one reason for increased blood transfusion requirements and higher morbidity and mortality in operated patients could be operative intervention itself and more severe injury class, hemodynamically stable patients or patients who had been hemodynamically stabilized with initial volume replacement, obviously need less blood transfusion, have shorter hospital stay and lower morbidity and mortality rates during NOM.

In the present study, 33 patients from NOM group had an USG follow up and 15 patients had CT which showed some degree of improvement in all patients. The follow up CT gives the surgeon feeling that his patient is in the right way and makes him feel comfortable by observing the radiological improvement of the injury. Actually some recent studies showed that routine follow-up CT for patients managed non-operatively is unnecessary if the patient remained clinically stable<sup>[25,26]</sup>. Patients should avoid contact sport for eight weeks at least after having NOM with a CT follow up<sup>[16]</sup>.

## CONCLUSION

NOM for blunt splenic trauma in hemodynamically stable patients is safe, effective, associated with less blood transfusion, shorter hospital stay, low morbidity and no mortality. However, NOM should be practiced in hospitals where the facilities of ICU or HDU are available.

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