

NON-OPERATIVE MANAGEMENT OF BLUNT HEPATIC AND/OR SPLENIC TRAUMA: A PROSPECTIVE STUDYRavikar Jayraj¹, Tejaswi Shashikanth N², Harindranath H. R³, Vinayak Chavan⁴**HOW TO CITE THIS ARTICLE:**

Ravikar Jayraj, Tejaswi Shashikanth N, Harindranath H. R, Vinayak Chavan. "Non-Operative Management of Blunt Liver and/or Splenic Trauma: A Prospective study". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 21, March 12; Page: 3682-3688, DOI: 10.14260/jemds/2015/530

ABSTRACT: PURPOSE: The incidence of blunt splenic and hepatic injuries are on a rise not only because of an increase in the overall incidence of Road Traffic Accidents but also due to more liberal use of radiological tests in the work-up of these patients. Spleen and liver are respectively the first and the second most common intra-abdominal organs to be injured in blunt abdominal injury. However, most of these patients can be treated without a formal laparotomy and its associated complications, as long as they remain hemodynamically stable. Although few studies have proven the efficacy of conservative management, most of them are retrospective. This prospective study aims to evaluate the efficacy of conservative management of blunt liver and/or splenic injuries. **MATERIALS AND METHODS:** Over a 12-month period, a total of 56 patients with blunt hepatic and/or splenic injury were evaluated prospectively. Fourteen [25%] patients underwent immediate exploration for hemodynamic instability and the rest 42 patients constituted the study group. Injury Severity Score [ISS] was used to assess the extent of overall injury. Unstable patients underwent emergent laparotomies, and stable patients had abdominal computed tomography (CT) scans to grade the source and severity of their injury. Hepatic and splenic injuries were graded using AAST grading for solid organ injuries. Those with nonhepatic, nonsplenic operative indications underwent exploration, and the remaining patients were intentionally managed nonoperatively in the trauma intensive care unit. Frequent measurement of vitals and estimation of hemoglobin and hematocrit was done. The outcome was measured in terms of total blood transfused, total duration of hospital stay and complications due to conservative management. **RESULTS:** A total of 56 patients presented to our ED with blunt abdominal trauma. Fourteen patients had to undergo emergent surgery for hemodynamic stability. The rest 42 were intentionally managed without surgery. In our study, Spleen was the most commonly injured organ and accounted for about 78% of all patients. In 5.1% patients, both splenic and hepatic injury was observed. The mean age of the group was 31 years with approximately 80% of all patients being males. Road traffic accidents were the most common mode of injury overall [78.5%] but in women, assault with a blunt weapon was more common. Conservative management was successful in 87.8% of all blunt splenic injuries and 100% of blunt hepatic injuries. Three patients [7.1%] needed delayed laparotomies and failed conservative management. All 3 patients had AAST Grade IV splenic injury. Two patients [4.7%] were diagnosed to have biliary leaks without bilioma formation. Both leaks resolved completely after they were percutaneously aspirated. Conservative management was associated with decreased blood transfusion requirement, lesser duration of stay in the hospital and was associated with minimal complications, all of which were successfully managed without surgery. Patients with AAST grade IV splenic injury, massive hemoperitoneum and increased transfusion requirements were associated with a higher risk of failing conservative management. Initial pulse rate, systolic blood pressure, ISS and hemoglobin did not appear to influence the outcome of the study. There were no deaths reported in the study. **CONCLUSION:** Conservative

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management of blunt hepatic and/or splenic injury is safe and effective as long as patients are selected based on strict inclusion/exclusion criteria. AAST grade IV splenic injury or higher, massive hemoperitoneum, requirement of >3.5 units of blood and new-onset hemodynamic instability were independent predictors of failure of conservative management.

KEYWORDS: Blunt trauma, liver, spleen, adults, hemodynamic stability, non-therapeutic laparotomy, AAST injury grading.

INTRODUCTION: Trauma is the leading cause of death and disability in the first four decades of life and is the third most common cause of death overall. Hundreds of thousands who survive their injuries experience long-term or permanent disabilities, costly medical expenses, change in lifestyle, pain and suffering.¹

According to the World Health Organization [WHO], Road traffic incidents caused a total of 1.24 million deaths worldwide in the year 2010. That is one person killed every 25 seconds.²

With over 130,000 deaths annually, India recently earned the dubious distinction of having the worst road traffic accident rate in the world. This was revealed by the WHO in its first ever Global Status Report on road safety.³ Between 1970 -2011, the number of road traffic accidents in India increased 4.4 times. There was also a 9.8 times increase in fatalities and a 7.3 times increase in the number of persons injured. This was against a backdrop of approximately 100-fold increase in the number of registered motor vehicles and a 4-fold increase in the road network.⁴

The city of Bangalore, the capital of Karnataka, is no different to these trends. According to Bangalore City Traffic Police, in the year 2010, there were a total of 6500 accidents in Bangalore alone. Fatalities were observed in 816 of these with 858 deaths.⁵

Not only are spleen and liver are respectively first and the second most common organs injured in blunt abdominal trauma, they are also more frequently diagnosed now due to the incorporation of CT in the management of these patients. Although non-operative management of blunt hepatic and splenic injuries has been previously described, most of the studies are retrospective. In addition, the criteria for NOM has vastly differed among different centers and include different thresholds of age, hemodynamic status, grade of the organ injury, presence or absence of extra-abdominal injuries, abdominal tenderness etc. There are also studies that have found significant complications while managing patients with blunt liver and/or splenic trauma non-operatively. A non-therapeutic laparotomy not only adds to the morbidity of the patient but also reflects poorly on the treating surgeon. In this study, the present investigator tries to evaluate the efficacy of NOM of blunt liver and/or splenic injuries and the complications arising out of it.

METHODOLOGY: This clinical study was conducted from the 1st of July 2013 to 30th of June 2014 in Victoria and Bowring and Lady Curzon Hospitals attached to Bangalore Medical College and Research Institute. Both hospitals are located in the heart of the city of Bangalore and handle significant number of trauma patients routinely. The study group comprised of adult patients [≥ 18 years] with isolated blunt liver and/or splenic injury who were hemodynamically stable. Hemodynamic stability was defined as a pulse rate of less than 100 beats per minute, systolic blood pressure of more than 100 mm of Hg.

After explaining the design and purpose of the study, an informed and written consent was taken from all participants of the study. The socio-demographic data and clinical variables were

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recorded as per proforma designed for this study. All prospective subjects were screened as per ATLS protocol. Injury Severity Score [ISS] was used to assess the overall extent of damage.

After initial resuscitation, hemodynamically stable patients underwent initial evaluation with an erect X-ray abdomen and an ultrasound abdomen. Patients found to have hemoperitoneum in the absence of any other solid organ and hollow viscus injury underwent contrast enhanced CT scan of the abdomen to localize and grade the liver and/or splenic injury. AAST classifications were used to grade liver and splenic injuries.

AAST GRADING OF BLUNT SPLENIC INJURY:

Grade I- Subcapsular hematoma of less than 10% of surface area. Capsular tear of less than 1 cm in depth.

Grade II- Subcapsular hematoma of 10-50% of surface area. Intraparenchymal hematoma of less than 5 cm in diameter. Laceration of 1-3 cm in depth and not involving trabecular vessels.

Grade III- Subcapsular hematoma of greater than 50% of surface area or expanding and ruptured subcapsular or parenchymal hematoma. Intraparenchymal hematoma of greater than 5 cm or expanding. Laceration of greater than 3 cm in depth or involving trabecular vessels.

Grade IV- Laceration involving segmental or hilar vessels with devascularization of more than 25% of the spleen.

Grade V- Shattered spleen or hilar vascular injury.

Advance one grade for multiple injuries up to grade III.

AAST grading of blunt hepatic injury:

Grade I:

Hematoma: sub capsular, <10% surface area.

Laceration: capsular tear, <1 cm depth.

Grade II:

Hematoma: sub capsular, 10-50% surface area.

Hematoma: intraparenchymal <10 cm diameter.

Laceration: capsular tear, 1-3cm depth, <10 cm length.

Grade III:

Hematoma: sub capsular, >50% surface area, or ruptured with active bleeding.

Hematoma: intraparenchymal >10 cm diameter.

Laceration: capsular tear, >3 cm depth.

Grade IV:

Hematoma: ruptured intraparenchymal with active bleeding.

Laceration: parenchymal disruption involving 25-75% hepatic lobes or involves 1-3 Couinaud segments (within one lobe).

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Grade V:

Laceration: parenchymal disruption involving >75% hepatic lobe or involves >3 Couinaud segments. (within one lobe)

Vascular: juxtahepatic venous injuries (IVC, major hepatic vein)

Grade VI:

Vascular: Hepatic avulsion.

All subjects of the study were advised strict bed rest. Hourly monitoring of pulse rate, blood pressure, urine output and temperature was done. Hemoglobin and hematocrit were repeated daily. Compatible blood was transfused, if required. Patients with associated injuries were examined by respective specialists with close coordination. Follow-up ultra-sonograms or CT were done only if there was a significant drop in hemoglobin, abdominal distension or vomiting.

RESULTS: A total of 56 patients presented with blunt splenic and/or hepatic injuries during the study period. Out of these, 14 [25%] underwent immediate laparotomy for the presence of associated hollow viscus injury and/or hemodynamic instability. The rest 42 patients were intentionally managed non-operatively and formed the study group.

More than 70% of the patients were in the age group 18-39 years. Mean age of patients was 31 ± 11.99 . Males accounted for almost 91% of the study group. As with other studies, most common mechanism of injury was road traffic accident [78.5%] followed by fall from height [14.3%] and assault [7.1%].

Out of the 42 patients in the study group, isolated splenic injury accounted for 73.8% of all patients. Isolated liver injury was present in 16.6% and both splenic and hepatic injury was present in 4.7%. The distribution of injury severity was as follows: splenic injury Grade 1 [25.6%], Grade 2 [30.7%], Grade 3 [17.9%], Grade 4 [2.5%], Grade 5 [0]. Hepatic injury Grade 1 [36.4%], Grade 2 [45.4%], Grade 3 [18.2%], Grade 4 [0], Grade 5 [0], Grade 6 [0]. Also, none of the patients in whom NOM was successful had massive hemoperitoneum while all 3 patients in whom NOM failed had massive hemoperitoneum detected on CT.

Most patients also had associated injuries. In our series, the most common associated injury was skin and soft tissue injury [53.98%] followed by pelvis and extremities [28.5%]. Chest and thoracic injuries was found in 17.9% and head injury was found in 7.7% patients.

As per table 1, planned NOM failed in 3 patients. All 3 patients had Grade 4 splenic injury with massive hemoperitoneum and underwent delayed exploration for deterioration of vitals. All 3 patients underwent splenectomy and recovered uneventfully. Patients who eventually failed NOM had higher pulse rate, ISS and lesser systolic BP at admission. They also required more blood transfusions and stayed in the hospital for a longer time. Overall, NOM was successful in 90.9% of blunt splenic injuries and in all blunt hepatic injuries.

Characteristic	NOM success [n=39]	NOM failure [n=3]
Age [years]	31 ± 11.99	37 ± 34.2
Pulse [bpm]	83.7 ± 8.76	96 ± 2
Systolic BP [mm Hg]	114 ± 11	107 ± 4.3

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ISS	20 ± 12.3	37 ± 9.8
Blood transfusions [units]	2 ± 1.46	5.3 ± 0.98
Duration of stay [days]	6.92 ± 5.22	14.9 ± 4.35

Table 1: Patient characteristics of NOM success and NOM failure.

Only 2 [4.7%] patients developed complications in the form of biliary leak without bilioma formation. Both patients were managed nonoperatively and the leaks resolved within 5 days. Delayed laparotomy was required in 7.1% patients. There were no deaths reported in our study.

DISCUSSION: In this prospective, observational study, we document the safety of conservative management of blunt liver and/or splenic injuries in hemodynamically stable patients.

It was Reigner in 1890 who first did a splenectomy in a laborer who fell from height and presented with a thready pulse and abdominal distension. This set the stage for routine splenectomies which would be done for all patients with splenic injuries for the next two generations.⁶ However, things changed with the recognition of the immunological functions of spleen. With the risk of developing Overwhelming Post Splenectomy Infection [OPSI], treating trauma surgeons were forced to find methods to salvage the damaged spleen. At present, Nonoperative management is the most commonly employed method of splenic salvage.⁷

Liver injuries are often first diagnosed on entering the abdomen in the unstable patient with a positive FAST examination. And as with splenic injuries, most hepatic injuries have already stopped bleeding by the time of evaluation. This, usually, is reflected in the patient's hemodynamic status. Even more than in the setting of splenic injuries, physiological stability is the major predictor of successful NOM of hepatic trauma. This is true independently of injury severity in that even high-grade liver injuries should be considered for NOM as long as the patient is stable. The evolution of nonoperative approaches to liver trauma has required advances in evaluating and managing complications that may arise. The NOM of hepatic injuries is not without complications. In addition to delayed bleeding, they include bile leaks with bilioma formation, hemobilia, and development of liver abscesses.⁷

The success of NOM of pediatric blunt splenic injuries is well-documented. Powell et al⁸ conducted a study to highlight the significant differences in the management of blunt splenic trauma between adults and children. They found that the high rate of NOM in children was because of different injury mechanisms in them, and not simply because they were physically different from adults.

Although contrast-enhanced CT of the abdomen has revolutionized the management of blunt abdominal injuries, it's role in predicting the potential failures of NOM is controversial. The presence of a contrast-blush on initial CT predicted failure of NOM in the study conducted by Schurr et al.⁹ In a study conducted by Pietzman et al¹⁰ successful NOM was associated with higher blood pressure, hematocrit and lower ISS, grade of splenic injury and quantity of hemoperitoneum at admission.

However, the study by Kohn et al¹¹ showed that magnitude of splenic injury on CT scans did not affect the management of patients. The authors concluded that the decision to explore a patient emergently should be based on clinical criteria, including the patient's age and associated injuries.

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In our study, all three patients who failed NOM had AAST Grade IV splenic injury and massive hemoperitoneum on their initial CT. But since the sample size was limited by the short duration of study, the role of CT in predicting NOM failures need to be further studied.

The prognostic factors for failure of NOM that were identified in the study conducted by Olthoff et al¹² were patients older than 40 years, those having ISS of greater than 25 and those with splenic injury grade of 3 or higher. In the study conducted by Pietzman et al,¹⁰ the risk of NOM failure increased with increasing severity of the splenic injury. The failure rates were grade 1 [4.8%], grade 2 [9.5%], grade 3 [19.6%], grade 4 [33.3%].

Liver is a much sturdier organ. Multiple studies^{13,14,15} have proven that grade of the liver injury did not predict NOM failure and that treatment plans should be based on patients vitals. In our study, NOM of blunt hepatic injuries was successful in all patients of the study group. However, the study group was small and did not include severe injuries. This requires further evaluation.

Although conservative management of blunt liver and/or splenic injury was successful in 90% of all study patients, the sample size was limited and did not have adequate representation of more severe organ injuries. Also, the role of therapeutic angioembolization in the management of otherwise stable patients with “contrast-blush” on initial CT as an adjuvant to NOM could not be evaluated.

Overall, conservative or nonoperative management of blunt liver and/or splenic injuries is safe as long as the patient remains hemodynamically stable. If executed correctly, NOM leads to lesser transfusion requirements, duration of hospital stay and avoids an unnecessary laparotomy. It is associated with minimal consequences, most of which resolve spontaneously or can be treated non-surgically.

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