

Blunt Abdominal Trauma in Children: Non-Operative Management in Splenic Injury

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ABSTRACT

Aim: To determine the outcome of non-operative management (NOM) in treatment of splenic injury in children with blunt abdominal trauma.

Study design: Cross sectional study.

Place and duration of study: Department of Paediatric Surgery, Nishtar Medical University Hospital Multan during July 2017 to June 2019.

Methods: In this study the cases of both gender and age less than 14 years suffering from blunt abdominal trauma with splenic injury were included. The injury was confirmed and graded on computed tomography scan. Then these cases were conservatively and medically managed, following non-operative management strategy. The cases with worsening hemodynamic were subjected to surgery. The patients were observed till full recovery and discharge from hospital. Mode of injury, grade of injury, initial haemoglobin, transfusion requirements, hospital stay and outcome were noted. Angiography and angioembolization were not used due to non-availability.

Results: In this study there were 21 cases. 18 (85.7%) were male. The mean age of the participants was 7.36 ± 3.28 years. Regarding outcomes complete recovery was seen in 18 (85.7%) of the cases, splenectomy was done in 3 (14.7%). Splenectomy was needed in patients having grade IV or grade V injury. Mean hospital stay was 6.76 ± 4.83 days.

Conclusion: Non-operative management of blunt splenic injury is the treatment of choice. Spleen can be salvaged and usually least complications are associated with this strategy.

Key words: Spleen, non-operative management, splenectomy, trauma.

INTRODUCTION

Road side accidents and trauma incidents involving children have increased rapidly in the recent times and have led to increased emergency burden for optimization and corrective surgeries¹. Trauma is on the way to become one of the leading causes of death in the world². The spleen and the liver are the most commonly injured intra-abdominal organs in pediatric patients, similar to adult patients³. In cases of closed abdominal trauma such as blunt trauma cases, injury to spleen is common and can pose a great threat to hemodynamic stability⁴.

Spleen has a significant role in the immune system. Its role against encapsulated organisms means that the removal of spleen can cause increased risk of certain infections⁵. Therefore the approach should be to preserve the spleen in patients with solid organ injuries. Surgery used to be the treatment of choice. This approach has changed gradually over the past 2 decades. It was observed that splenic lesions can be managed without surgery⁶. The spleen has shown the ability of self-healing and this observation has helped in evolving of a treatment strategy revolving around non-removal of spleen and managing the patient medically². This therapeutic approach is called non-operative management (NOM). It is defined as the management performed in a patient, after a

primary and secondary survey and after taking the relevant investigations, which support the decision of not performing surgery immediately³. Previously, treatment of choice for the patients with splenic injuries was used to be splenectomy, but now conservative approach or medical management with preservation of spleen is considered as first choice³. Furthermore, non-operative management (NOM) has become the main management strategy being used for solid organ injuries². This approach has its own limitations as the age, presence of multiple injuries, a large haemoperitoneum, high-grade splenic injury and high Injury Severity Score (ISS) are reported as risk factors for failure of NOM⁷.

Splenic injury can be graded according to different parameters. The most widely practiced grading scale is the one proposed by American Association for Surgery of Trauma (AAST)⁸. It grades splenic injury into 5 grades depending on injury in the form of hematoma and laceration. Focused Abdominal Sonography in Trauma (FAST), contrast enhanced ultrasonography and computed tomography (CT) can be used for diagnosis but CT is considered as the investigation of choice. It greatly helps to grade the injured spleen according to AAST scale. It is also helpful to identify the injuries to other solid organs and status of intestine and any collection in peritoneum.

Non operative management (NOM) includes conservative medical management as well as angiography and embolization of the splenic artery⁹. However, the

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facilities of angiography and embolization are not always available everywhere. It is true for resource depleted countries of the developing world. In such areas surgical intervention is still being practiced. We do not have facility of embolization available but due to great benefit of non-operative management, we planned to execute this approach for management of splenic trauma without involving the embolization in this strategy. We planned this study to see results of NOM in a third world country hospital to share the outcome of conservative management. **Objective:** To determine the outcome of non-operative management (NOM) in treatment of splenic injury in children with blunt abdominal trauma.

PATIENTS AND METHODS

This cross sectional study was carried out at Department of Paediatric surgery, Nishtar Medical University Hospital Multan during July 2017 to June 2019. In this study the cases of both gender and age less than 14 years suffering from blunt trauma with splenic injury confirmed on CT scan and irrespective of its severity grade were included. The patients were received in the accident and emergency department of Department of Paediatric surgery. Initial assessment and resuscitation was performed there. Age, weight, mode of injury, time lapse between injury and presentation and haemoglobin at presentation were noted. The cases needing ventilator support in the beginning and those with other visceral injuries were not included in the study. Thereafter these patients were shifted to trauma bay of department of paediatric surgery. These cases were conservatively managed with maintenance of fluid and electrolyte balance, hemodynamic stability, pain killers

and antibiotics. Their baseline parameters were checked regularly. The cases with worsening hemodynamic status were referred for surgery. The patients were kept admitted till full recovery and discharged from hospital in stable condition. The following variables like outcome of patient (conservatively managed, splenectomy performed or not), number of transfusions needed, length of hospital stay were noted. The patients were followed up after one week and after 3 months of discharge.

Statistical Analysis: The data was analysed by SPSS 20.0. Frequency and percentages were presented for qualitative and mean \pm SD for quantitative data.

RESULTS

During the study period 51 patients with blunt abdominal trauma were managed in the department. After exclusion of patients having multiple visceral injuries, 21 cases of blunt trauma to spleen were included in the study. There were 18 (85.7%) male patients and 03 (14.3%) female patients. The mean age of the participants was 7.36 ± 3.28 years (table 1). Mean weight of the patients was 20.83 ± 7.52 kg. Mean time of arrival after injury was 4.51 ± 3.81 hours and mean haemoglobin at presentation was 9.53 ± 1.24 g/dl (table 1). Regarding outcomes, complete recovery was seen in 18 (85.7%) of the cases, splenectomy had to be performed in 3 (14.3%) patients. Most of the patients (9) were having grade I injury, all managed conservatively. However 4 (19.04%) patients were having injury of grade IV and V, 3 of them needed surgical intervention and spleen was removed (figure 1). 2.2 ± 1.0 transfusions were given to the patients. Mean hospital stay was 6.76 ± 4.83 days (table 1).

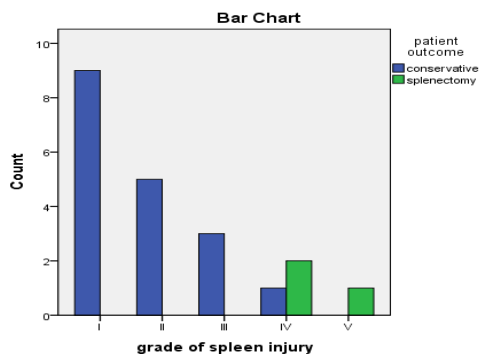
Table 1: (n= 21)

	Age of patient (years)	Weight of patient (kg)	Hb at presentation	Time lapse between injury and presentation (hours)
Mean	7.362	20.833	9.533	4.505
Median	6.700	18.500	9.700	3.000
Mode	4.2	11.2	10.1	2.0
Std. Deviation	3.2841	7.5211	1.2395	3.8097
Range	10.2	20.4	4.5	14.0
Minimum	2.4	11.2	7.6	1.0
Maximum	12.6	31.6	12.1	15.0

Table 2:

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Hospital stay (in days)	21	16	2	18	6.76	4.826
Number of transfusions	21	4	1	5	2.19	1.030

Figure 1: Grade of injury and outcome



DISCUSSION

Trauma is on the way to become 3rd leading cause of death in the world according to WHO⁽⁹⁾. Blunt abdominal trauma is one of the leading presentations of trauma in children⁽⁷⁾. Trauma to abdomen is caused by traffic collisions with more than half being car occupants, motor bike travellers and pedestrians. The other causes of abdominal trauma fall from height, fight, sports injuries especially skates or bicycle, hard hit or crush⁽³⁾. In our study almost same pattern was observed. Out of 21 patients, 12 (57.1%) of patients presented with history of road traffic accident, following fall from height 3 (14.3%), history of fight 3 (14.3%), hit by a bull 2 (9.5%) and fall of wall over body 01 (4.5%). Among the intra-abdominal viscera, spleen is the

most commonly injured organ⁸). The blunt trauma involving the spleen occurs more commonly in males as was found by Tugnoli et al¹⁰. Same was observed in our study, where 18 (85.7%) out of 21 children were male. The injury to spleen is sustained by the kids of all age groups but generally higher age groups are involved. In our study mean age was 7.362 ± 3.2841 years. In a study by Arslan et al mean age was 11.1 ± 3.7 . It is also showing the higher age range among the trauma patients¹¹. The injury to spleen can have devastating effects on the life of the injured. It can result in death of the patient and this fear was forcing the treating physicians to operate upon the patients with early in the course of treatment. The surgical intervention generally resulted in the splenectomy¹². However spleen plays an important role in the immunity of the children and needs to be saved as long as possible⁵. Interestingly about 100 years ago Billoth suggested that injured spleen has the ability of self-healing². On the basis of these findings and keeping in mind the importance of spleen Upadhyaya reported non operative management (NOM) of patients with trauma to spleen¹³. This approach has gained acceptance and now has become initial management strategy not only for splenic trauma but for other solid organ injuries as well⁸.

The first step in the NOM is to classify the grade of injury. Different investigations can be used to assess the grade of splenic injury. Focused Abdominal Sonography in Trauma (FAST) is the initial tool to get first hand picture of the intra-abdominal viscera¹⁴, used sensibly this can increase the suspicion for injury¹⁵. Conventional ultrasonography or Contrast enhanced ultrasonography (CE-US) is next investigation to be used in selected patients¹⁶, however computed tomography (CT) is the main imaging technique to be used in trauma patients¹⁷. This modality helps to grade injury according to AAST grades. This helps in initiation of NOM.

Haemodynamic stability is the initial requirement in the NOM. Therefore haemoglobin at presentation and transfusions requirements during stay are important factors in outcome of NOM. In our study mean haemoglobin was 9.53 ± 1.23 g/dl. The interesting finding was that we had three splenectomy and two of them had Hb less than 8 g/dl at presentation. Similarly patients having less than 8 g/dl were generally having injury of higher grade while Hb more than 10 g/dl was found in patients having milder grade injury. Medina et al made and Arslan et al made similar findings^{3,18}. In our study, there were 2.19 ± 1.03 transfusions given to patients. Lesser haemoglobin and higher grade of injury required more transfusions. Patients needing surgical intervention also required more transfusions. Johnsen et al showed that number of transfusions in an effort to stabilize the patient was an independent risk factor for failure of NOM². Medina et al proposed increased transfusion requirements in patients undergoing surgical intervention³ and Arslan et al reported similar transfusion requirements for their patients¹⁸.

Time lapse between injury and presentation in the emergency department has important implications on outcome⁶. Our patients reached to hospital 4.51 ± 3.81 hours after injury. Early arrival produced good results in form of successful NOM. Kirkpatrick described that delay in presentation and later on delay in decision for surgical

intervention can have higher mortality risk⁶. In our study, patient stayed in hospital for 6.76 ± 4.82 days after injury. The longer stay was seen in patients with higher grade of injury or in the patients going through surgical intervention. Two out of three patients who had splenectomy stayed for more than 8 days in the hospital. Delvi et al also found longer hospital stay for operative patients as was observed by Roberts et al^{19,20}. Grade of injury can help in determining the possible outcome. In our study 03 out of 04 patients having grade IV and V injury had to go under splenectomy. Lynn et al and Medina et al had same observations^{8,3}. However there is one point to be noted. In our study unfortunately we did not have facility of angiography and embolization. Studies have shown their efficacy and importance regarding a useful adjunct in NOM^{14,20}.

Overall, our 18 (85.7%) patients were managed non operatively. 3 (14.3%) were operated for splenectomy. This success rate is comparable to other studies of similar management strategy. Berg et al and Coccoloni et al had almost 90% success rate in their experience of NOM^{21,22}. Main reasons for failure of NOM include high grade of injury³, high velocity injury¹⁷, delayed presentation¹², hemodynamic instability despite resuscitative measures³ and unavailability of paediatric trauma centre or surgical department²³. It can be speculated that if we had facilities of embolization, we could have avoided few of splenectomies in our series. This facility could also have decreased hospital stay or transfusion requirements in some of our patients. NOM is very effective in management of blunt splenic injuries but there are certain complications related to it. Delay in identifying the unresponsiveness of patient can result in morbidity and mortality of patient⁹, although in view of Peev et al, if there is a structured protocol being followed, delay in operation does not cause such problems¹⁴. Oumar found cases of pseudocyst of spleen as a complication of NOM¹³. Pseudoaneurysm of splenic artery was found by Zhu et al during follow up^{25,26}. Splenic abscess can also be a problem. Fortunately we did not encounter such problems in our patients. There have been reports of mortality in patients of splenic trauma during NOM or as a result of complications during follow up²⁷. There was no mortality in our study.

CONCLUSION

Non-operative management of blunt splenic injury is the treatment of choice. Spleen can be salvaged and usually least complications are associated with this strategy.

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