

Original Research Article

Non operative management of isolated traumatic splenic injury

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ABSTRACT

Background: Road traffic accidents, sports injuries, assaults, and falls from height, are among most common causes of blunt splenic trauma. In 1970s, postsplenectomy complications were published by some authors, revealing the high mortality and morbidity related to overwhelming postsplenectomy infection (OPSI). Therefore, conservative management for splenic trauma was accepted as treatment of choice in all the patients to decrease mortality due to OPSI. Therefore, NOM of traumatic splenic injury has now been accepted as standard treatment of choice for all AAST grade I, II and III, whereas this was not found safe in higher grades of splenic trauma.

Methods: This is a hospital based prospective observational study, done on 45 hemodynamically stable patients of splenic trauma.

Results: Out of all studied parameters grade of injury, contrast blush on CT scan, grade of hemoperitoneum showed statistical significance with p value < 0.001, however gender, age, mode of injury, showed no statistical significance. In our study, out of 45 patients, 38 (84.44%) patients had successful NOM of splenic trauma.

Conclusions: Non-operative management (NOM) of blunt injury to the spleen in adults has become the standard of care in hemodynamically stable patients. This modality of treatment in paediatric patients is also highly successful and is standard treatment of choice in both adults and children. Success of NOM of isolated splenic injury depends on multiple factors such as availability of ICUs, high dependency units for strict monitoring, blood banks and availability of multidisciplinary team efforts encompassing anesthetics, trauma surgeons, radiologists, for successful outcome.

Keywords: Non operative management, AAST splenic trauma, Hemoperitoneum

INTRODUCTION

The spleen is a vascular solid organ of our body, which contributes to 5% of the cardiac output. Removing old blood cells from body and battling against encapsulated bacteria such as *Neisseria meningitidis*, pneumococcus, and haemophilus influenza are the specialized functions of spleen. Location of spleen in the body is left upper quadrant of abdomen below 9th, 10th and 11th rib. Children are more vulnerable to splenic injuries, as spleen lies exposed below the rib cage. The spleen has parenchyma and the capsule. Spleen is supplied by the

splenic artery and drained by the splenic vein and, in the cases of splenic trauma, there is a good potential for significant active haemorrhage.¹ Trauma accounts for major cause of morbidity and mortality. Non-penetrating (blunt) or penetrating injuries are two major significant causes of splenic trauma. Road traffic accidents, sports injuries, assaults, and falls from height, are among most common causes of blunt trauma. However, infections, malignancy and medical procedures can also cause splenic trauma.² Blunt trauma to left upper abdomen and left lower chest causes the spleen to be most susceptible to injury. Haemodynamic instability, with tachycardia,

hypotension, low urine output is the most reliable sign of injury to spleen.³ The initial assessment and management of a patient should be the same as for any trauma patient. Patients are received and managed as per the advanced trauma life support (ATLS) protocol, established by the American College of Surgeons Committee on Trauma, is accepted all over the world.⁴ In early twentieth century, splenectomy was preferred in cases of splenic trauma patients. In 1970s, post-splenectomy complications were published by some authors, revealing the high mortality and morbidity related to overwhelming post-splenectomy infection (OPSI).⁵ The estimated incidence of OPSI after splenectomy is 2-5 per 1000 asplenic patients per year, with highest risk of developing these infections within first 2 years of splenectomy.⁶⁻⁸ Therefore, conservative management for splenic trauma was accepted as treatment of choice in all the patients to decrease mortality due to OPSI.⁵ Non-operative management (NOM) of traumatic splenic injury has now become the standard means of management in all hemodynamically stable patients both children and adults.⁹ The workup of patients with traumatic splenic injury has now shifted largely from use of physical examination, laboratory findings, and diagnostic peritoneal lavage, plain X-ray, and to extensive use of high resolution radiographic investigations like FAST scan which is a protocol driven ultrasound of abdomen to look for free intra-abdominal fluid, for which a minimum of 200 ml of fluid in abdomen indicate a positive finding and computed tomography scanning, which is now accepted as gold standard for imaging in blunt abdominal trauma.^{10,11} Level one trauma centres are now provided with all facilities, to significantly manage and improve outcomes of patients with splenic trauma.¹⁰ The majority of patients, admitted with AAST grade I, II, and III traumatic splenic injury, are successfully treated with non-operative management. However, literature shows that, the use of non-operative management for grade IV or V injuries is still under debate.¹² Therefore, NOM of traumatic splenic injury has now been accepted as standard treatment of choice for all AAST grade I, II and III, whereas this was not found safe in higher grades of splenic trauma.¹³

Aim and objectives

Aim and objectives were to study different grades and their clinical presentation in traumatic splenic injury and to evaluate the outcomes of non-operative management in traumatic splenic injuries.

METHODS

Study place

Study was done in accident and emergency Department of General Surgery, Government Medical College and hospital Srinagar after taking clearance from ethical committee of institution. We included all patients with blunt abdominal trauma who arrived in emergency

department of general surgery at GMC Srinagar under different surgical units.

Study duration

Twenty-four months from September 2018 to September 2020

Study design

This is a hospital based prospective observational study. Sampling technique followed was convenient purposive technique.

Study population

This study conducted over a period of 24 months on total of 45 patients of splenic injury attending Accident and Emergency Department of General Surgery, Government Medical College and hospital Srinagar after taking clearance from ethical committee of institution. We included all patients with blunt abdominal trauma who arrived in emergency department of general surgery at GMC Srinagar under different surgical units.

Inclusion criteria

Inclusion were hemodynamically stable patients; blood transfusions <4 units; imaging documented splenic injury; isolated splenic injury.

Exclusion criteria

Exclusion criteria were hemodynamically unstable patients; multisystemic trauma; lesion other than splenic lesion possibly requiring surgical intervention; patients with bleeding diathesis; patients on anticoagulant drugs.

Study techniques

On reception at surgical casualty the patients were immediately shifted to emergency resuscitation unit and fluid resuscitation was started after obtaining blood samples for baseline investigations and blood grouping. Patients were resuscitated according to advanced trauma life support (ATLS) guidelines. Baseline characteristics of patients with trauma such as age, gender, heart rate, blood pressure, mode of injury, time since injury, any medical illness especially bleeding diathesis, anticoagulant therapy were recorded. The patients under resuscitation who did not respond to standard bolus fluid were shifted to emergency theater for more aggressive fluid resuscitation therapy. Multidisciplinary approach in resuscitation and stabilization alongside the attempt to screen intra-abdominal solid visceral injury was adopted in collaboration with anesthetists and radiologist. Patients who became hemodynamically stable after initial fluid resuscitation or presented with normal hemodynamics were accompanied to radiology suit for FAST Scan. FAST Scan was followed by CECT abdomen for further

characterization and grading of Splenic injury. Splenic injury was categorized using the organ injury scale of American association for the surgery of trauma (AAST). Blood samples were drawn at admission such as hemoglobin, haematocrit, platelet count, urea, creatinine, blood sugars, Na⁺/K⁺, ABG, ALP, AST, ALT, PT/INR and blood grouping. Hemodynamically stable patients after initial fluid resuscitation or patients with normal hemodynamics at presentation with isolated splenic injury began non-operative management. Hemodynamically unstable patients, non-responders & with concomitant visceral injuries were excluded from the study and were taken for operative management. Non-Operative management consisted of Admission of all grade I, II, III or higher splenic injuries to High Dependency Units. Consider ICU admission for grade IV or V splenic injuries. Monitoring hourly vital signs such as heart rate, blood pressure, temperature, respiratory rate, fluid balance with estimating input and output of fluids in the body, No. of packed red cell transfused; Strict bed rest; Nil by mouth and intravenous access; Serial haematocrit and hemoglobin 4 hourly for 24–48 h. If haematocrit is stable for 24–48 h and there have been no adverse haemodynamic events; Transfer the patient to regular ward; Advance diet; Daily haematocrit and hemoglobin; Bed rest for another 48–72 h and then ambulate in the hospital. If remains stable and tolerating diet, discharge day after ambulation begins (usually 5–7 days after admission). Patient is instructed to return to Emergency Department, if developing worsening left upper quadrant pain, dizziness, syncope, fever or hypotension; Patient is allowed back to school; Avoid sport; Patient is allowed back to sports activity: 6 weeks after Grade I–II injury; 3 months after Grade III–IV injury with improvement on repeat CT.

Follow up

Patients were followed weekly for 4 weeks, thereafter fortnightly for 3 months then monthly. On follow up general physical examination, hemoglobin, haematocrit, ultrasonography was done to note resolution of hematoma and hemoperitoneum. Patients were allowed to

resume work according to grades of splenic Injury as follows:^{14,15}

Grade I-II

Light activities: 2 weeks; sports activities: 6-8 weeks

Grade ≥III

Light activities: 4-8 weeks; sports activities: 10-12 weeks

Grade IV, V

Light activities: 10-12 weeks; Sports Activities: 10-12 weeks.

Statistical analysis

Statistical package for social science software [SPSS20.0] is used for statistical analysis. Categorical variables are expressed as percentages, whereas continuous variables are expressed as mean, standard deviation values. The difference between normally distributed numeric variables were evaluated by Student’s t-test or one-way analysis of variance. Fischer’s exact is employed for comparison of categorical variables as the sample size is small. Statistical significance is assumed for P-value or Fisher’s exact value<0.05.

RESULTS

Gender distribution

Total of 45 patients included in study of which 32 are males and 13 are female. Out of 32 males, 28 had successful conservative management and out of 13 females, 10 had successful conservative management (Table 1).

Table 1: Gender distribution.

S. no.	Gender	No. of patients	Percentage
1.	Female	13	28.89
2.	Male	32	71.12

Table 2: Conservative management.

Gender		Successful	Unsuccessful	Total
Female	Count	10	3	13
	%	22.2	6.7	28.9
Male	Count	28	4	32
	%	62.2	8.9	71.1
Total	Count	38	7	45
	%	84.4	15.6	100.0

P=0.394

Age distribution

Total of 45 patients included in study, 6 patients fall in age group (0-9) and all had successful NOM, 9 patients

fall in age group (10-19) and 8 had successful NOM, 9 patients fall in age group (20-29) and 8 had successful NOM, 6 patients fall in age group (30-39) and 5 had successful NOM, 13 patients fall in age group (40-49)

and 9 had successful NOM, 1 patients fall in age group (50-59) and 1 patients fall in age group (60-69) and all had successful NOM.

Table 3: Distribution according to age.

Age group (in years)	No. of patients (%)	Successful NOM (%)
0-9	6 (13.33)	6 (100)
10-19	9 (20)	8 (88.89)
20-29	9 (20)	8 (88.89)
30-39	6 (13.33)	5 (83.34)
40-49	13 (28.89)	9 (69.23)
50-59	1 (2.22)	1 (100)
60-69	1 (2.22)	1 (100)
70-79	0 (0)	0 (0)

Mode of injury

Out of 45 patients of splenic trauma in study, mode of trauma is fall from height in 26 patients, of which 22 had successful management and mode of trauma is road Traffic accidents in 19 patients, of which 16 patients had successful management.

Grade of injury

Out of 45 patients of splenic trauma in study, 3 patients had grade I injury, 8 had grade II injury, 27 patients had grade III injury, 5 patients had grade IV injury, and 2 Patients had grade V splenic injury. All patients of grade

I, II, & III had successful outcome of NOM, but patients with grade IV & V undergo splenectomy.

Hemoperitoneum

All patients of splenic trauma had haemoperitoneum at presentation. Out of 45 patients, 16 patients had mild haemoperitoneum, out of which 3 had grade I, 8 had grade II, 5 had grade III and none of patients had grade IV and grade V splenic trauma and all of them had successful outcome. 22 patients had moderate haemoperitoneum, and all of the 22 patients had grade III splenic trauma and all of them had successful outcome.

Total 7 patients presented with massive haemoperitoneum, out of which 5 patients had grade IV and 2 had grade V splenic trauma and all of them undergo splenectomy later on.

Table 4: Distribution according to mode of injury.

Mode of injury		Conservative management		Total
		Successful	Unsuccessful	
FFH	Count	22	4	26
	%	48.9	8.9	57.8
RTA	Count	16	3	19
	%	35.6	6.7	42.2
Total	Count	38	7	45
	%	84.4	15.6	100.0

P>0.999

Table 5: Distribution according to grade of injury.

Grade of injury		Conservative management		Total
		Successful	Unsuccessful	
Grade I	Count	3	0	3
	%	6.7	0.0	6.7
Grade II	Count	8	0	8
	%	17.8	0.0	17.8
Grade III	Count	27	0	27
	%	60.0	0.0	60.0
Grade IV	Count	0	5	5
	%	0.0	11.1	11.1
Grade V	Count	0	2	2
	%	0.0	4.4	4.4
Total	Count	38	7	45
	%	84.4	15.6	100.0

P<0.001

Table 6: Degree of hemoperitoneum according to grade of injury.

Hemoperitonium		Grade of injury					Total
		Grade I	Grade II	Grade III	Grade IV	Grade V	
Massive	Count	0	0	0	5	2	7
	%	0.0	0.0	0.0	11.1	4.4	15.6
Mild	Count	3	8	5	0	0	16
	%	6.7	17.8	11.1	0.0	0.0	35.6

Continued.

Hemoperitonium		Grade of injury					Total
		Grade I	Grade II	Grade III	Grade IV	Grade V	
Moderate	Count	0	0	22	0	0	22
	%	0.0	0.0	48.9	0.0	0.0	48.9
Total	Count	3	8	27	5	2	45
	%	6.7	17.8	60.0	11.1	4.4	100.0

Table 7: Hemoperitonium* conservative management

Hemoperitonium		Conservative Management		Total
		Successful	Unsuccessful	
Massive	Count	0	7	7
	%	0.0	15.6	15.6
Mild	Count	16	0	16
	%	35.6	0.0	35.6
Moderate	Count	22	0	22
	%	48.9	0.0	48.9
Total	Count	38	7	45
	%	84.4	15.6	100.0

P<0.001

Table 8: Outcome according to presence and absence of contrast blush on imaging.

Contrast blush On CT Scan		Conservative management		Total
		Successful	Unsuccessful	
NO	Count	38	0	38
	%	84.4	0.0	84.4
YES	Count	0	7	7
	%	0.0	15.6	15.6
Total	Count	38	7	45
	%	84.4	15.6	100.0

P<0.001

Table 9: Outcome according to grade of injury.

Conservative Management		Grade of Injury					Total
		Grade I	Grade II	Grade III	Grade IV	Grade V	
Successful	Count	3	8	27	0	0	38
	%	6.7	17.8	60.0	0.0	0.0	84.4
Unsuccessful	Count	0	0	0	5	2	7
	%	0.0	0.0	0.0	11.1	4.4	15.6
Total	Count	3	8	27	5	2	45
	%	6.7	17.8	60.0	11.1	4.4	100.0

Table 10: Final outcome of conservative management.

Outcome	No. of patients	%
Successful	38	84.44
Unsuccessful	7	15.56

P<0.001

Contrast blush on CT scan

Out of 45 patients in study, 7 patients had Contrast blush on CT Scan, and none of them had successful conservative management of splenic trauma.

Successful non-operative management

Out of 45 patients of splenic trauma in study group, out of which 3 patients had grade I, 8 patients had grade II, 27 patients had grade III and all of them, 38 (84.44%) patients had successful non-operative management of splenic trauma.

DISCUSSION

We enrolled a total of 45 patients in our study and studied different parameters.

Out of all studied parameters Grade of injury, contrast blush on CT scan, grade of hemoperitoneum showed statistical significance with P value<0.001, however gender, age, mode of injury, showed no statistical significance.

Grade of injury

Our study showed grade of injury is a predictor for outcome of study with p value<0.001. Out of 45 patients, 3 (6.7%) had Grade I, 8 (17.8%) had Grade II, 27 (60.0%) had grade III splenic injury, all of which showed successful NOM and 5 (11.1%) had grade IV, 2 (4.4%) had grade V splenic injury, both of which showed unsuccessful NOM (Table 5).

Our study concluded that rates of successful non-operative management is higher with lower grades of splenic trauma and with higher grades of splenic trauma, chances for successful non-operative management decreases. The results of our study are comparable to the study conducted by Leung et al in 2007, who in his study concluded that, the success rate of NOM has often been linked with the initial grading of splenic injury.¹⁶ They demonstrated a 100% operative rate on all grade V injuries. The other series, again from Thompson and Holland in 2006, reported 50%, 6% and 7% operative rates on a grade IV, III and II injuries, respectively, showing rates of successful NOM are higher with lower grades of splenic trauma.¹⁷

Contrast blush on CT scan

Our study showed that contrast blush on CT scan indicating major vascular injury is a predictor of outcome of study with P value<0.001. Out of 45 patients of splenic trauma in our study, 7 (15.6%) patients showed Contrast Blush on CT scan, and all had unsuccessful NOM. Our study concluded that, all patients with Contrast Blush on CT Scan findings, had unsuccessful non-operative management of splenic trauma. The results of our study are comparable to study conducted by Leung et al. in 2007, who concluded that the presence of vascular blush on CT scan should indicate the need for intervention.¹⁶ Vascular blushing refers to an active bleeding (due to contrast extravasation) within a solid organ, and is associated with severe injuries necessitating aggressive monitoring and possible surgical intervention. Lutz et al in 2004¹ confirmed the significance of blush sign on CT scan, in that all had a grade III or above splenic injury and require either angio-embolization or splenectomy. As angio-embolization is not available in our set up, all patient showing blush sign on CT Scan undergoes splenectomy and hence unsuccessful non operative management of splenic trauma (Table 8).¹⁸

Hemoperitoneum

Our study showed that, hemoperitoneum is a significant predictor for outcome of the study with p value<0.001. In

our study, all patients of splenic trauma had hemoperitoneum at presentation. Out of 45 patients, 16 (35.6%) patients had mild hemoperitoneum, and 22 (48.9%) patients had moderate hemoperitoneum and all of them had successful outcome. 7 (15.6%) patients presented with massive hemoperitoneum and all of them undergo splenectomy later on. The results of our study are comparable to the study conducted by Bradburn et al in 2010 who concluded that NOM was ultimately successful for 80.1% of patients with a small amount of blood versus only 27.4% with a large HP.¹⁹ Gonzales and associates in 2008 reported the failure of NOM based on the quantity of HP to be 10%, 22%, and 48% for small, moderate, and large amounts of fluid, respectively.²⁰ Similar conclusions were drawn by Sharma and colleagues in their patient populations with large HP. Singh et al in his study gave multislice computed tomography grading of hemoperitoneum (Table 6).²¹

Age

In our study, out of 45 patients of splenic trauma, 6 patients fall in age group (0-9) years, 9 patients in age group (10-19) years and (20-29) years each, 6 patients in age group (30-39) years, 13 patients in age group (40-49) years, 1 patient in age group (50-59) years and (60-69) years each (Table 3). In our study, out of above age groups, (0-9) years, (50-59) years, and (60-69) years group had all successful NOMSI, indicating that age had no statistical significance. Result of our study are comparable to study conducted by Notash et al in their study suggested that age alone is not a contraindication to non-operative management of splenic injury and there is no significant difference in the failure rate between patients younger and older.²² Myers et al in 2000²³ in their study reported a success rate of 94% in patients older than 55 years undergoing non-operative management following splenic injury and showed that there was no significant difference in the failure rate between patients younger and older than 55 years.

Table 11: MSCT grading of haemoperitoneum

Description	Estimates	Approximate amount
Fluid in only one space	Small	100-200 ml
Fluid in two or more spaces.	Moderate	250-500 ml
Fluid in all spaces or pelvic fluid anterior / superior to urinary bladder.	Large	>500 ml

Mode of injury

In our study, out of 45 patients of splenic trauma, mode of injury in 26 (57.8%) patients are fall from height and RTA (Road traffic accidents) corresponds to 19 (42.2%) patients. The result contradict the results of study conducted by Fernandes et al in 2013, where causes of

injury were distributed as follows: four (15.37%) patients were involved in motor vehicle crashes, nine (34.61%) in motorcycle collisions and one (3.85%) in a bicycle accident.

Three (11.56%) were pedestrians hit by cars, three (11.56%) were victims of assault and six patients (23.07%) were involved in other types of blunt trauma.²⁴ In this study, RTA (15.37%) has highest percentage as mode of injury but; In our study, fall from height (57.8%) has highest percentage as mode of injury. The reason for this is that Kashmir is a valley surrounded by mountains where people used to go for arable farming and animals grazing, therefore the incidence of fall from height is higher than road traffic accidents (Table 4).

Gender

In our study, out of 45 patients, 13 (28.89%) are females, of which 10 (22.2%) showed successful NOM and 32 (71.12%) are males, of which 28 (62.2%) showed successful NOM. Our study showed that gender had no statistical significance with p value 0.394 (Table 2).

Successful outcome

In our study, out of 45 patients, 38(84.44%) patients had successful NOM of splenic trauma and 7(15.56%) patients had unsuccessful NOM. The results of our study are comparable to study conducted by Beuran et al in 2012 concluding that non-operative management (NOM) of blunt injury to the spleen in adults has become the standard of care in hemodynamically stable patients.²⁵ This modality of treatment in paediatric patients is also highly successful with overall success rates of 69-98%. Ciocchi et al in 2014 done a study showing comparable results, concluding that NOM success rate was 85.7%, which is similar to the past literature, in study done by Tan et al in 2010²⁶, which quotes successful NOM rates around 80% (Table 10).^{12,26}

Limitations

In haemodynamically stable patients of splenic trauma, with contrast blush on CT scan and pseudo-aneurysm, angio-embolization is well accepted adjuvant. Because of non-availability of angio-embolization in our setup, all the patients with major vascular bleed and vascular injury undergo surgical intervention (splenectomy).

CONCLUSION

Non-operative management (NOM) of blunt injury to the spleen in adults has become the standard of care in hemodynamically stable patients. This modality of treatment in paediatric patients is also highly successful and is standard treatment of choice in both adults and children. Grade of splenic injury, grade of Hemoperitoneum and contrast blush on CT scan are important parameters which shows statistical significance

with P value<0.001 and are predictors for successful NOM of isolated splenic injury. Success of NOM of isolated splenic injury depends on multiple factors such as availability of ICUs, high dependency units for strict monitoring, blood banks and availability of multidisciplinary team efforts encompassing anesthetics, trauma surgeons, radiologists, for successful outcome. Every patient of splenic trauma who is considered for NOM, should be properly counselled about emergency signs and should be advised to report to emergency if any of emergency signs were present. Follow up of patient should be done as per protocol, and counselling of patient should be done about time to resume light activities and sports activities.

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