

Proportion of Cases Managed Non-Operatively and Its Predictors for Failure in Splenic Injury – A Cross Sectional Study from VSSIMSAR, Odisha

Harekrishna Majhi¹, Abinasha Mohapatra², Sachin Paul James³, Ashok Kumar Nayak⁴

^{1, 2, 3, 4} Department of General Surgery, Veer Surendra Sai Institute of Medical Science and Research (VIMSAR), Burla, Sambalpur, Odisha, India.

ABSTRACT

BACKGROUND

The primary objective in the management of splenic injury earlier was to achieve early haemostasis which resulted in splenectomy as the treatment of choice. But after recognising the role of spleen in immune and haematopoietic functions, non-operative management (NOM) was started. In order to practice non-operative management safely a better way to assess the severity of splenic injury was necessary. Eventually it became possible with the advent of computed tomography. Along with clinical assessment, it enabled us in the selection of appropriate patients for non-operative management. Now this modality is considered as the gold standard for patients who are hemodynamically stable or readily stabilisable. It decreases the duration of hospital stay and prevents post-operative morbidity. We wanted to find out the proportion of cases and predictors for failure of non-operative management among splenic injury patients in VIMSAR, Burla.

METHODS

This cross-sectional study was done among 35 patients with splenic injury who were hemodynamically stable from November 2018 to October 2020.

RESULTS

Age, sex, systolic blood pressure, diastolic blood pressure, mechanism of injury, Glasgow Coma Score (GCS), associated injury (if hemodynamically stable) were not found to be significant predictors in deciding the failure of non-operative management.

CONCLUSIONS

Most important predictor for failure of non-operative management was development of haemodynamic instability. Tachycardia, low mean arterial pressure (MAP), drop in haemoglobin (Hb) and haematocrit were significant parameters in our study and all these parameters ultimately point towards hemodynamic instability.

KEYWORDS

Non-Operative Management (Successful), Non-Operative Management (Failure), Hemodynamically Stable, Blunt Trauma Abdomen

Corresponding Author:

*Dr. Ashok Kumar Nayak,
Associate professor,
Department of General Surgery,
VIMSAR, Burla, Sambalpur - 768017,
Odisha, India.*

E-mail: drnayak1970@gmail.com

DOI: 10.18410/jebmh/2021/216

How to Cite This Article:

*Majhi H, Mohapatra A, James SP, et al.
Proportion of cases managed non-
operatively and its predictors for failure
in splenic injury – a cross sectional study
from VSSIMSAR, Odisha. J Evid Based
Med Healthc 2021;8(17):1116-1121.
DOI: 10.18410/jebmh/2021/216*

Submission 27-07-2020,

Peer Review 07-01-2021,

Acceptance 04-03-2021,

Published 26-04-2021.

Copyright © 2021 Harekrishna Majhi et al. This is an open access article distributed under Creative Commons Attribution License [Attribution 4.0 International (CC BY 4.0)]

BACKGROUND

Blunt trauma abdomen is a major source of morbidity and mortality worldwide and solid organs are particularly vulnerable due to their size and vascularity. Even though it is protected by the costal grid, spleen is the most common organ injured in blunt abdominal trauma which accounts for about 40 %.¹ Since spleen receives 5 % of the cardiac output, severe spleen injury can result in haemorrhagic shock.

For many years, the main focus after splenic injury was to achieve haemostasis as early as possible, and for that splenectomy was done regardless of the type of injury. But after recognizing the important role of spleen in the immune and hematopoietic system, non-operative management was started initially in children mainly to prevent overwhelming post splenectomy sepsis (OPSS) from encapsulated organisms. The first reported movement for non-operative management was pioneered by Wan borough at the sick children's hospital Toronto in 1940s.²

In order for non-operative management to be widely practiced, a better way to assess the severity of splenic injury was required. Now with improvement in hospital conditions, early availability of trauma care support and computed tomography, non-operative management is considered as the gold standard method in patients with splenic injury who are hemodynamically stable.^{3,4,5}

This treatment modality is associated with decreased hospital expenses, fewer non-therapeutic laparotomy, a decreased rate of intra-abdominal complications, lower rate of blood transfusion and above all decrease in mortality and morbidity.

Objectives

1. To find out the proportion of cases successfully managed by non-operative management among splenic injury patients in VIMSAR, Burla.
2. To find out the predictors for failure of non-operative management in splenic injury patients.

METHODS

This is a hospital based cross sectional study conducted in the Department of General Surgery VIMSAR, Burla, Sambalpur, from November 2018 to October 2020 among 35 patients (male-32, female-3) with splenic injury due to blunt trauma of abdomen. Institutional ethical committee was obtained before conducting the study.

Inclusion Criteria

1. Hemodynamically stable patients irrespective of sex (interventions planned - nil).
2. Age more than 14 years and less than 75 years.
3. Patients having splenic injury with associated other injuries, who do not require any urgent operative interventions.

Exclusion Criteria

1. Patients who died in casualty before completion of diagnostic workup.
2. Pregnant females.
3. Patients with severe pre-existing co morbidities like cardiovascular, respiratory and haematological disorders.

Data Collection

Baseline demographic details, clinical examination, lab reports, CT scan reports, of the patient were noted. If patient was hemodynamically unstable in the first 6 hours, nonoperative management was abandoned and laparotomy was undertaken. If patient was stable after 6 hours non-operative management by 6 hourly vitals monitoring was continued. Patients were divided into two groups according to the outcome of non-operative management.

1. NOM-S (successful) i.e. 28 cases (80 %) out of total 35 cases. Any patient who was managed successfully with non-operative management.
2. NOM-F (failure) i.e. 7 cases (20 %) out of total 35 cases. Any patient who underwent laparotomy within 6 hours or patient was on non-operative management.

Both groups were followed up till discharge.

Statistical Analysis

Recording, categorisation and computing was done with the help of Microsoft Excel. All the data was analysed with SPSS. The outcome was analysed in terms of incidence, prevalence, percentage, frequency, mean, chi square test. P-value < 0.05 was considered significant.

RESULTS

Bivariable Analysis

Our study shows 32 (91.4 %) patients were males and 3 (8.6 %) patients were females. 81.3 % of male and 66.7 % of female patients were managed successful. Non-operative management was found to be successful in 80 % cases. Mean age of the study subjects was found to be 36.3 (SD = 14.53). Minimum and maximum age was found to be 15 and 75 years. 48.6 % of patients belonged to the age group of 26 - 49 years.

Baseline Investigations	Management	N	Mean	Std. Deviation	P-Value
PR on admission	NOM failure	7	108.57	5.855	< 0.001
	NOM successful	28	88.21	11.396	
GCS on admission	NOM failure	7	13.71	1.604	0.538
	NOM successful	28	14.14	1.508	
SBP	NOM failure	7	96.00	7.303	0.018
	NOM successful	28	108.79	13.000	
DBP	NOM failure	7	60.00	5.774	0.013
	NOM successful	28	67.50	7.005	
Mean arterial pressure	NOM failure	7	72.0000	5.96285	0.005
	NOM successful	28	81.2619	7.69873	

Table 1. Baseline Investigations

Table 1 shows mean systolic blood pressure (BP) of the two groups (96 vs. 108) and mean diastolic BP (60 vs. 67.5). In both groups MAP was above normal, it was significantly

towards low normal side in patients who failed successful non-operative management with P-value = 0.005. Mean pulse rate between the two groups were (108.57 vs. 88.21), P-value - < 0.001.

GCS on Admission

In our study GCS score was found minimum at 10 (single case) and patient was managed successfully with non-operative management. Among patients with GCS 15 / 15, 20 patients were managed successfully and 4 patients had failure of non-operative management.

Subsequent Hemodynamic Instability		Management NOM Successful	NOM Failure	Total
Absent	Count	28	0	28 (80 %)
	% within subsequent haemodynamic instability	100.0 %	0.0 %	100.0 %
Present	Count	0	7	7 (20 %)
	% within subsequent haemodynamic instability	0.0 %	100.0 %	100.0 %
Total	Count	28	7	35 (100 %)
	% within subsequent haemodynamic instability	80.0 %	20.0 %	100.0 %

Table 2 Subsequent Hemodynamic Instability * Management
Chi-square = 35.00, P-value < 0.001

Table 2 shows subsequent haemodynamic instability which was found in 7 (20 %) cases, out of 35 cases.

Table 3 shows out of 35 cases, all developed left hypochondrial tenderness and 3 (8.6 %) cases developed features of generalised peritonitis later on.

Gen. Peritonitis		Management NOM Successful	NOM Failure	Total
Absent	Count	28	4	32 (91.4 %)
	% within gen. peritonitis	87.5 %	12.5 %	100.0 %
Developed later on	Count	0	3	3 (8.6 %)
	% within gen. peritonitis	0.0 %	100.0 %	100.0 %
Total	Count	28	7	35 (100 %)
	% within gen. peritonitis	80.0 %	20.0 %	100.0 %

Table 3. Gen. Peritonitis * Management
Chi-square = 13.125, P-value < 0.001

Associated Injuries		Management NOM Successful	NOM Failure	Total
No associated injuries	Count	9	2	11
	% within asso. injuries	81.8 %	18.2 %	100.0 %
Head injury	Count	8	3	11
	% within asso. injuries	72.7 %	27.3 %	100.0 %
Blunt trauma chest	Count	6	2	8
	% within asso. injuries	75.0 %	25.0 %	100.0 %
Long bone fracture	Count	3	0	3
	% within asso. injuries	100.0 %	0.0 %	100.0 %
Renal contusion	Count	2	0	2
	% within asso. injuries	100.0 %	0.0 %	100.0 %
Total	Count	28	7	35
	% within asso. injuries	80.0 %	20.0 %	100.0 %

Table 4. Associated Injuries * Management
Chi-square = 1.761, P-value = 0.780

Table 4 shows head injury was found to be the most common associated injury, seen in 11 (31.4 %) cases. Among head injuries 8 (out of 11), among blunt trauma chest 6 (out of 8), all patients with long bone fracture and renal contusion were managed successfully with non-operative management.

Subsequent Hemoglobina & HCT Fall Subsequently		Management NOM Successful	NOM Failure	Total
Absent	Count	26	2	28 (80 %)
	% within HB & amp; HCT fall subsequently	92.9 %	7.1 %	100.0 %
Present	Count	2	5	7 (20 %)
	% within HB & amp; HCT fall subsequently	28.6 %	71.4 %	100.0 %
Total	Count	28	7	35 (100 %)
	% within HB & amp; HCT fall subsequently	80.0 %	20.0 %	100.0 %

Table 5. Subsequent Haemoglobin & HCT Fall * Management
Chi-square = 14.464, P-value < 0.001, Odds ratio (95 % CI) = 32.5 (3.67 – 287.84)

Table 5 shows Hb and haematocrit fall in 7 (20 %) cases.

Blood Transfusions		Management NOM Successful	NOM Failure	Total
0	Count	13	0	13 (37.1 %)
	% within blood transfusions	100.0 %	0.0 %	100.0 %
1	Count	8	0	8 (22.9 %)
	% within blood transfusions	100.0 %	0.0 %	100.0 %
2	Count	4	3	7 (20 %)
	% within blood transfusions	57.1 %	42.9 %	100.0 %
3	Count	3	1	4 (11.4 %)
	% within blood transfusions	75.0 %	25.0 %	100.0 %
4	Count	0	2	2 (5.7 %)
	% within blood transfusions	0.0 %	100.0 %	100.0 %
5	Count	0	1	1 (2.9 %)
	% within blood transfusions	0.0 %	100.0 %	100.0 %
Total	Count	28	7	35 (100 %)
	% within blood transfusions	80.0 %	20.0 %	100.0 %

Table 6. Blood Transfusions * Management
Chi-square = 19.598, P-value = 0.001

Table 6 shows mean blood transfusion as 1.34. Highest number of blood transfusion given was 5 (2.9 %) cases.

Grade of Spleen Injury (CT)		Management NOM Successful	NOM Failure	Total
1	Count	8	0	8 (22.9 %)
	% within grade of spleen injury (CT)	100.0 %	0.0 %	100.0 %
2	Count	12	0	12 (34.3 %)
	% within grade of spleen injury (CT)	100.0 %	0.0 %	100.0 %
3	Count	7	2	9 (25.7 %)
	% within grade of spleen injury (CT)	77.8 %	22.2 %	100.0 %
4	Count	1	5	6 (17.1 %)
	% within grade of spleen injury (CT)	16.7 %	83.3 %	100.0 %
Total	Count	28	7	35 (100 %)
	% within grade of spleen injury (CT)	80.0 %	20.0 %	100.0 %

Table 7. Grade of Spleen Injury (CT) * Management
Chi-square = 20.069, P-value < 0.001

Table 7 shows grade 2 (12 cases) splenic injury which was most commonly found, followed by grade 3 (9 cases). Grade I spleen injury (22.9 %), grade II spleen injury (34.3 %), grade III spleen injury (25.7 %) and grade IV (17.1 %). grade V spleen injury cases were not seen during the study period.

Post-OP Complications

In our study mortality was 0 % among study subjects. Most common complications encountered were surgical site infection (5.7 %), followed by atelectasis in 2.9 % cases. No complications were found in rest 91.4 % cases.

DISCUSSION

In our study younger patients were managed more successfully compared to older patients. We had 33 patients below 55 years out of which 27 patients were managed successfully and we had 2 patients above 55 years and only 1 patient was managed successfully by non-operative management. But age of the patients was not found to be a significant predictor in deciding the failure of non-operative management probably due to low sample size.

According to a study conducted by Michael Paul Johan Teuben et al., higher age was significantly associated with increased likelihood of failure. According to Longo et al. patients with 50 years or above age did not represent a contraindication but a risk for successful non-operative management.⁶ As per the study of Sartorelli et al. Barone et al. Myers et al. and Brasel et al. successful non-operative management was performed in 83.3 % of all patients more than 55 years.^{7,8,9,10}

In recent study, 32 patients were males and 3 patients were females. 81.3 % of male and 66.7 % of female patients were managed successfully but sex of the patient was not found to be a significant parameter in predicting the outcome of non-operative management.

In recent study, all the patients with a failure of non-operative management had a significantly higher pulse rate at the time of admission compared to those who were managed successfully. The mean pulse rate between the two groups were (108.57 vs. 88.21), P-value = < 0.001 (Table 1).

In a study by Vishal G Shelat et al. tachycardia more than or equal to 100 / min was found in 53.5 % of patients who underwent operative management where as it was found only in 35.6 % patients who were managed successfully non-operatively.¹¹ But in this study tachycardia on admission came out to be a significant predictor for failure of non-operative management (P-value < 0.001), which is statistically significant. In a similar study by Mayur R Dalai et al. 63.63 % of patients who had pulse rate > 100 / min had splenectomy.¹²

Mean systolic BP and diastolic BP were both low at the time of admission in patients who had failure of non-operative management compared to patients who were managed successfully. Mean systolic BP of the two groups were (96 vs. 108) and mean diastolic BP (60 vs. 67.5). In our study, systolic BP at the time of admission was not found only in a single patient and that patient underwent operative intervention. In the study by Mayur R Dalai et al. systolic BP less than 90 mmHg was found to be a significant factor in predicting the outcome of non-operative management.¹²

The MAP was found to be lower in patients of non-operative failure group (72) compared to patients who underwent successful non-operative management (81.2). According to Vishal G Shelat et al. MAP less than 70 was considered as an indicator of shock.¹¹ But here, even though in both groups MAP is above normal, it was significantly towards low normal side in patients who failed successful non-operative management with P-value = 0.005. So, in our study even though systolic BP and diastolic BP individually was not found to be a significant predictor for failure of non-

operative management, MAP [DBP + 1 / 3 (SBP-DBP)] was found to be a significant predictor.

The most common mechanism of injury was road traffic accidents (RTA) which accounts for 91.4 % cases followed by fall from height 5.7 %. We did not find mechanism of injury as a significant predictor for failure of non-operative management. Similar study was conducted by Vishal G Shelat et al.¹¹

Patients with low GCS had a prolonged duration of hospital stay compared to patients with normal GCS with head injury. In study by Michael Tuben et al. they tried non-operative management of spleen injury where presence of neurological impairment was significantly associated with prolonged ICU stay and hospitalization.¹³ In our study we did not find it as statistically significant may be due to low sample size.

During non-operative management, any evidence of hemodynamic instability is defined as tachycardia > 130 / min, systolic BP < 90 mmHg after fluid loading of up to 2 litres of IV fluids, according to Atish N Bansod et al.¹⁴ We found that all the patients with subsequent haemodynamic instability underwent splenectomy and it was found to be a significant predictor of failure of non-operative management (P-value < 0.001). Patients with hemodynamic instability at the time of admission were traditionally considered as a contraindication for non-operative management. From our experience we also understood that even though systolic BP and diastolic BP at the time of admission was not found to be significant predictor, the subsequent fall in blood pressure and rising tachycardia that indicates an ongoing blood loss is a significant predictor for failure of non-operative management (Table 2). As per Atish N Bansod et al. study group, non-operative management is a successful strategy in those who are hemodynamically stable.¹⁴ According to Velmahos GC et al. and Cocanourcs et al, the only absolute indication for emergency laparotomy is hemodynamic instability.^{15,16}

Features of generalised peritonitis was taken as a criteria of exclusion at the time of admission, but out of 35 patients studied, 3 patients developed generalised peritonitis later on (all the three patients had failure of non-operative management and it was found to be statistically significant, P-value < 0.001) and one patient among the three had sudden drop in haemoglobin so it may be due to continued bleeding and progressive haemoperitoneum (Table 3).

Associated injuries do not predict the failure of non-operative management if the patient is hemodynamically stable (Table 4). But in our study this observation is not statistically significant, may be due to low sample size. In a study by Michael Paul Johan Teuben et al concluded that non-operative management for hemodynamically stable patients with spleen injury is feasible and safe even in the presence of concurrent (non-hollow organ) injuries. But presence of femur fracture is a significant predictor for failure of non-operative management in this study.¹³

Mean haemoglobin and haematocrit on admission were 10.45 and 33.23. Haemoglobin and haematocrit fall were seen in 7 (20 %) patients, out of which 5 (71.4 %) had failure of non-operative management, and it was found to be statistically significant with P-value < 0.001 (Table 5). As per

the studies of Haan JM et al. Peitzman AB et al. Cogbill TH et al. hemodynamic instability is considered as an absolute contraindication for non-operative management.⁴

All those who had blood transfusions more than or equal to 4 units had a failure of non-operative management and it was found to be statistically significant with a P-value < 0.001 (Table 6). In study by Sartorelli et al. Peitzman et al. Gomez et al concluded that early failure of non-operative management seen who required more than 4 units of blood transfusions.^{5,7,17} Among all the patients having grade I and II were managed successfully with non-operative management. Among grade III patients, 77.8 % were managed successfully and 22.2 % had failure of non-operative management. Among grade IV patients, 16.7 % were managed successfully and 83.3 % had failure of non-operative management. These findings were found to be statistically significant with P-value < 0.001 (Table 7). Out of 35 patients, 28 (80 %) were managed successfully in our study. According to study by Roberto Cirocchi et al. and Pietzman et al. non-operative management is the treatment of choice for grade I and II spleen injuries. According to studies by Mattox K L et al. Moore FA et al. and Stassen NA et al. non-operative management has been of choice in hemodynamically stable patients, regardless of the degree of injury.^{3,4,18}

Mean duration of hospitalisation was 7.43 days with minimum of 5 days and maximum of 14 days. Low grade spleen injuries, hemodynamically stable and who do not have associated injuries were discharged on day 5. Presence of associated injuries and failure of non-operative management had increased the duration of hospitalisation.

CONCLUSIONS

The most important predictor for failure of non-operative management was development of haemodynamic instability. Tachycardia, low mean arterial pressure, drop in haemoglobin and haematocrit were significant parameters in our study and all these parameters ultimately point towards hemodynamic instability.

Limitations of the Study

(1) Inadequate sample size, (2) Lack of designated trauma care centre with adequate ICU bed facilities and imaging modality for serial monitoring.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

REFERENCES

- [1] Crandall M, Shapiro MB, West MA. Does splenectomy protect against immune-mediated complications in blunt trauma patients? *Mol Med* 2009;15(7-8):263-267.
- [2] Sherman R. Prospectives in management of trauma to the spleen: 1979 presidential address, American Association for the Surgery of Trauma. *J Trauma* 1980;20(1):1-13.
- [3] Mattox KL, Moore EE, Feliciano DV. *Trauma*. 8th edn. Newyork: McGraw-Hill 2013.
- [4] Moore FA, Davis JW, Moore EE Jr, et al. Western Trauma Association (WTA) critical decisions in trauma: management of adult blunt splenic trauma. *J Trauma* 2008;65(5):1007-1011.
- [5] Peitzman AB, Heil B, Rivera L. Blunt splenic injury in adults: multi-institutional study of the Eastern Association for the Surgery of Trauma. *J Trauma* 2000;49(2):177-187.
- [6] Longo WE, Baker CC, McMillen MA, et al. Nonoperative management of adult blunt splenic trauma. Criteria for successful outcome. *Ann Surg* 1989;210(5):626-629.
- [7] Sartorelli KH, Frumiento C, Rogers FB, et al. Nonoperative management of hepatic, splenic and renal injuries in adults with multiple injuries. *J Trauma* 2000;49(1):56-62.
- [8] Barone JE, Burns G, Svehlak SA, et al. Management of blunt splenic trauma in patients older than 55 years. Southern Connecticut regional trauma quality assurance committee. *J Trauma* 1999;46(1):87-90.
- [9] Myers JG, Dent DL, Stewart RM, et al. Blunt splenic injuries: dedicated trauma surgeons can achieve a high rate of nonoperative success in patients of all ages. *J Trauma* 2000;48(5):801-806.
- [10] Brasel KJ, DeLisle CM, Olson CJ, et al. Splenic injury: trends in evaluation and management. *Journal of Trauma and Acute Care Surgery* 1998;44(2):283-286.
- [11] Shelat VG, Khoon TE, Tserng TL, et al. Outcomes of nonoperative management of blunt splenic injury-Asian experience. *International Surgery* 2015;100(9-10):1281-1286.
- [12] Carlotto JRM, Lopes-Filho GDJ, Colleoni-Neto R. Main controversies in the nonoperative management of blunt splenic injuries. *Arq Bras Cir Dig* 2016;29(1):60-64.
- [13] Teuben M, Spijkerman R, Blokhuis T, et al. Non-operative management of splenic injury in closely monitored patients with reduced consciousness is safe and feasible. *Scand J Trauma, Resusc Emerg Med* 2019;27(1):108.
- [14] Bansod AN, Umalkar R, Shyamkumar AT, et al. A study of role of non-operative management in blunt abdominal trauma with solid organ injury. *International Surgery Journal* 2018;5(9):3043-3050.
- [15] Velmahos GC, Chan LS, Kamel E, et al. Nonoperative management of splenic injuries; have we gone too far? *Arch Surg* 2000;135(6):674-689.
- [16] Cocanour CS, Moore FA, Ware DN, et al. Delayed complications of nonoperative management of blunt adult splenic trauma. *Arch Surg* 1998;133(6):619-625.
- [17] Gomez D, Haas B, Al-Ali K, et al. Controversies in the management of splenic trauma. *Injury* 2012;43(1):55-61.

[18] Stassen NA, Bhullar I, Cheng JD, et al. Selective nonoperative management of blunt splenic injury: an Eastern Association for Surgery of Trauma practice

management guideline. J Trauma Acute Care Surg 2012;73(5 Suppl 4):S294-S300.