

**Original Article****MANAGEMENT OF SPLENIC INJURY AT B&C MEDICAL COLLEGE, TEACHING HOSPITAL AND RESEARCH CENTRE****\*Bashu Dev Baskota<sup>1</sup>, Deepak Pun<sup>1</sup>, Bimas Payangu<sup>1</sup>, Sachin Bhagat<sup>1</sup>, Amit Kumar Shah<sup>2</sup>, Mukti Devkota<sup>3</sup>**<sup>1</sup>Department of General Surgery, <sup>2</sup>Department of Uro-Surgery, B & C Medical College Teaching Hospital and Research Centre, Birtamode, Jhapa, Nepal, <sup>3</sup>Department of Oncosurgery, Purbanchal Cancer Hospital, Birtamode, Jhapa, Nepal**Submitted: 7<sup>th</sup> – August-2023, Revised: 27<sup>th</sup> – September – 2023, Accepted: 1<sup>st</sup> – October – 2023****DOI: <https://doi.org/10.3126/mjen.v2i02.60780>****ABSTRACT****Background**

In all blunt abdominal injuries splenic injury relates to about 40%. Splenectomy is the preferred treatment choice for blunt splenic injury in hemodynamically unstable patients. The low-grade splenic injuries and stable patients are mostly treated by non-operative management (NOM) at today era. Consensuses have not been yet formulated about the management of high-grade splenic injuries in hemodynamically stable patients. So, this study analyzes the treatment of patients with high-grade splenic injuries in our institution.

**Methods**

This study includes all the patients with splenic injuries presented to our hospital during the 5 years period from 2017 to 2022. The datas regarding primary baseline at emergency, complications and mortality were collected from the patient records at medical record section. Based on splenic injury and the treatment they received, they were grouped accordingly.


**Results**

In a total of 38 cases of spleen injuries, the most common mode of injury was a road traffic accident (RTA) 84% followed by fall injury (10%) spontaneous rupture of the spleen and blast injury 3% each. Sixty-six per cent of the cases underwent operative management out of which 96% cases had a splenectomy and 4% cases had a splenic repair. There was 5% mortality and 95% recovery without residual morbidity.

**Conclusion**

Most of the cases with spleen injury were managed with a favorable outcome. The careful patient selection for non-operative management will result in higher splenic salvage with close monitoring in an intensive care unit.

**Keywords:** Non-Operative Management (NOM), Road Traffic Accident (RTA), Length of Stay (LOS), organ injury scale (OIS), overwhelming post-splenectomy infection (OPSI).

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## INTRODUCTION

Trauma is the fourth cause of death and the first one in individuals below the age of 40 in Western countries these days<sup>1</sup>. Abdominal trauma can be classified as blunt or penetrating as per the causative agent and mechanism of action<sup>2</sup>. The spleen is the most commonly injured intra-abdominal organ in blunt abdominal trauma<sup>3-4</sup>. Splenectomy was the only treatment used until the mid-sixties for blunt splenic injury (BSI)<sup>5-6</sup>. The treatment of spleen injuries has evolved significantly from surgical treatment to an increasingly selective non-surgical approach, assisted by the development of endovascular and cross-sectional imaging studies like computed tomography (CT)<sup>7-8</sup>.

The preservation of the spleen prevents the patient from the overwhelming post-splenectomy infection (OPSI) syndrome with reported high mortality rates of up to 70%<sup>9-10</sup>. However, spleen preservation is not always an option as it can lead to life-threatening haemorrhages<sup>11</sup>. The most important prerequisite for successful Non-Operative Management (NOM) is an appropriate patient selection<sup>12-15</sup>. Therefore, it is very important to choose the right management for the right patient. At present, the only absolute contraindication for NOM is the presence of hemodynamic instability<sup>5, 16</sup>. Close observational management is the standard treatment with low grade splenic injuries (<grade 3)<sup>17</sup>. However, no consensus exists about the management of high-grade splenic injuries (> grade III) in hemodynamically stable patients. Splenectomy is the preferred treatment option in some institutions, while in others these patients are treated with spleen-preserving options and when blush is seen on contrast-enhanced computed tomography (CT) scan, either central or partial angioembolization (AE) is performed preferably and vicryl mesh or splenorrhaphy in absence of other indications for laparotomy if no blush is seen<sup>13-14, 18-20, 22-23</sup>.

Although an increasing body of evidence supports spleen preservation for high-grade injuries in hemodynamically stable patients, as there is limited literature regarding the safety of this approach, we aim to analyze the treatment of high-grade spleen injuries in our hospital<sup>24-25</sup>.

## METHODS

A retrospective observational study was conducted from 2017 to 2022 from hospital

records in the Department of Surgery at B & C Medical College Teaching Hospital, Birtamode, Jhapa, Nepal. The secondary data's were collected from hospital records and data were entered in Performa designed for the study. The data collected were regarding patient demographics (age and sex), trauma characteristics (mechanisms and mode of trauma, type of management – surgical or conservative) and outcome of injury. The American Association for the Surgery of Trauma Organ Injury Scale (OIS) was used for grading splenic injury<sup>4-5, 7, 27</sup>. The patients in each grading category were analyzed for operative rate, hospital length of stay and ICU length of stay. Different modalities of treatment and the treatment outcomes were evaluated. The data were further analyzed for the type of operative interventions adopted for splenic injury. The data was analyzed using Microsoft Office Excel and Statistical Package for Social Science (SPSS 26) with both descriptive and inferential analyses which included frequency, percentage, mean and standard error for descriptive and the Fisher exact test, independent sample t-test and one-way ANOVA for inferential. The output as presented in tables, pie charts and bar diagrams.

## RESULTS

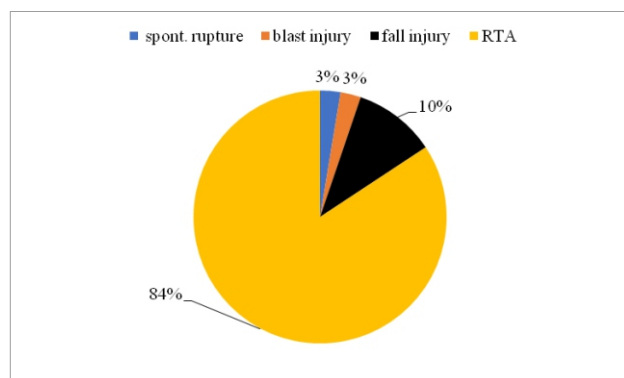
CT scan grading of splenic injury: 10.5% of injuries - grade II, 31.6% - grade III, 10.5% - grade V and grade IV injury was highest of all (47.4%).

**Table 1: CT scan grading of splenic injury**

Frequency	Percentage (%)
Grade II	4(10.5)
Grade III	12(31.6)
Grade IV	18(47.4)
Grade V	4(10.5)

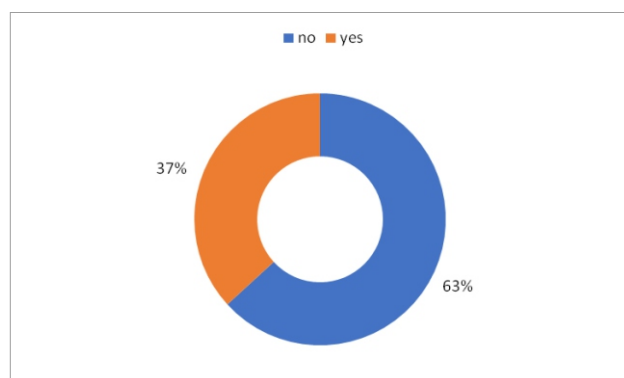
**Table 2: Systolic blood pressure of patients.**

Systolic BP	Percentage (%)
<90	15(39.5)
>90	23(60.5)
38	100.0



**Figure 2: Mode of spleen injury**

84% of injuries, road traffic accident (RTA), then followed fall injury (10%), while blast injury and spontaneous rupture were each 3%.



**Figure 3: Polytrauma with ribs#**

36.8% of cases were observed with polytrauma with ribs# Figure 3.

60.5% of patients had blood pressure more than 90 as shown in (Table 2).

**Table 3: Mean and standard error of age, haemoglobin, platelets and pulse.**

	Mean $\pm$ S.E.
Age	36.03 $\pm$ 2.54
Hb.	11.20 $\pm$ 0.33
Platelet	410.79 $\pm$ 34.53
Pulse	108.26 $\pm$ 3.25
Valid N (listwise)	38

Most of the patients were the age of 36.03 $\pm$ 2.54 years with haemoglobin of 11.20 $\pm$ 0.33, platelets 410.79 $\pm$ 34.53 and pulse 108.26 $\pm$ 3.25.

## Inferential analysis:

**Table 4: Hemoglobin, platelets, ICU stay days, hospital stay days (LoS) and pulse of patients along the CT scan grading of spleen injury**

	HB	Platelets	ICU stay (days)	Hospital stay (days)	Pulse
Grade II	13.57a $\pm$ 1.32	340.00a $\pm$ 32.40	2.00a $\pm$ 0.1	6.75a $\pm$ 2.75	91.50a $\pm$ 5.73
Grade III	12.23ab $\pm$ 1.11	303.67a $\pm$ 54.77	3.00a $\pm$ 0.123	6.83a $\pm$ 2.36	97.00a $\pm$ 4.79
Grade IV	10.10c $\pm$ 1.82	437.44a $\pm$ 37.41	4.7b $\pm$ 0.22	12.17b $\pm$ 5.23	117.22b $\pm$ 3.87
Grade V	10.72bc $\pm$ 1.21	683.00b $\pm$ 176.31	5.00b $\pm$ 1.35	10.75b $\pm$ 6.85	118.50b $\pm$ 13.93
Grand mean	11.205263 $\pm$ 0.32	410.79 $\pm$ 34.53	3.92 $\pm$ 0.24	9.76 $\pm$ 5.03	108.26 $\pm$ 3.25
F value	7.05*	4.37*	11.77***	4.05*	4.93**

\*P= $<$ 0.05, \*\*P= $<$ 0.01 and \*\*\*P= $<$ 0.001

The highest haemoglobin was with grade II of spleen injury which was at par with grade III while significantly higher than grade IV and V. Similarly, platelets count was significantly higher with grade V than other grades of CT scan grading of spleen injury. The ICU stay days were highest with grade V which was at par with grade IV while significantly higher than grade II and III. Hospital stay days were maximum for grade IV being at par with grade V and significantly higher than grade II and III. Pulse was maximum for grade V which was at par with grade IV and significantly higher than grades II and III. The detail is shown in (Table 4).

**Table 5: Hemoglobin, platelets, ICU stay, hospital stay and pulse of patients along with the management of spleen injury.**

	HB	Platelets	ICU stay	Hospital stay	Pulse
Non-Operative Management	12.65a $\pm$ 0.37	265.69a $\pm$ 19.37	2.62a $\pm$ 0.14	6.31a $\pm$ 0.58	92.00a $\pm$ 2.45
Operative Management	10.48b $\pm$ 0.38	472.19b $\pm$ 48.96	5.00b $\pm$ 0.20	12.62b $\pm$ 1.00	113.71b $\pm$ 4.16
Grand mean	11.20 $\pm$ 0.32	410.79 $\pm$ 34.53	3.92 $\pm$ 0.24	9.76 $\pm$ 0.81	108.26 $\pm$ 3.25
F value	6.62**	6.26**	36.69***	12.06***	13.25***

\*\*P= $<$ 0.01 and \*\*\*P= $<$ 0.001

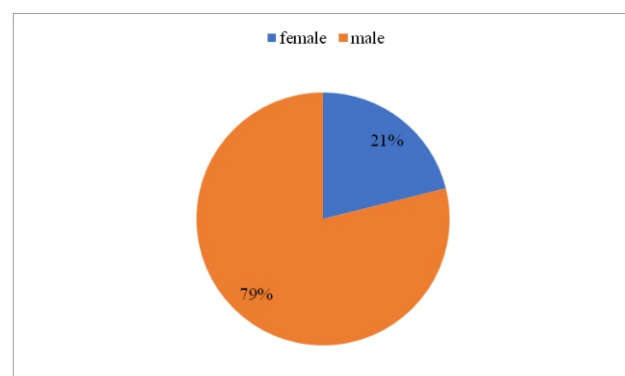
The level of haemoglobin was significantly higher in non-operative management (12.65 $\pm$ 0.37) than in operative management. Platelet count was maximum in operative management and significantly higher than in non-operative management. ICU stays were significantly higher in operative management (5.00 $\pm$ 0.20 days). The same was the case with hospital stay for operative management (12.62 $\pm$ 1.00). The pulse rate was maximum for operative cases (113.71b $\pm$ 4.16) being significantly higher than the non-operative cases. Detail is shown in (Table 5).

Haemoglobin, platelets, ICU stay, hospital stay and pulse of patients along with the gender of patients were not significantly different. Detail is shown in (Table 6).

**Table 6: Hemoglobin, platelets level, ICU stay days, length of hospital stay (days) and pulse of patients along with the gender of patients.**

Gender	Haemoglobin	Platelet level	ICU stay (days)	Hospital stay (days)
Female	10.97±0.77	368.00±44.88	3.25±0.49	8.25±1.53
Male	11.27±0.37	422.20±42.14	4.10±0.26	10.17±0.94
T value	-0.35NS	-0.63NS	-1.46NS	-0.95NS

#### Descriptive statistics of patients



**Figure 1: Gender of patients**

Out of a total 79% of patients were male and 21% were female.

**Table 7: Hemoglobin, platelets level, ICU stay, length of hospital stay and pulse of patients along the patients with polytrauma with ribs#.**

Polytrauma with ribs#	Haemoglobin	Platelet count	ICU Stay (days)	Hospital stay (days)
No	11.25±0.39	387.29±40.20	3.88±0.27	8.50±0.76
Yes	11.12±0.59	451.07±64.13	4.00±0.46	11.93±1.68
T value	0.17NS	-0.88NS	-0.24NS	-0.21*

\*P=<0.05

Hospital stay was significantly higher with polytrauma with ribs# (11.93±1.68). It was 8.50±0.76

days for patients without it. No significant difference was seen for haemoglobin, platelet and ICU stay. Detail is shown in (Table 7).

**Table 8: Polytrauma with ribs# with a grade of CT scan of spleen injury**

	Polytrauma with Ribs#		Total
	No	Yes	
Grade II	3(12.5)	1(7.1)	4(10.5)
Grade III	9(37.5)	3(21.4)	12(31.6)
Grade IV	11(45.8)	7(50)	18(47.4)
Grade V	1(4.2)	3(21.4)	4(10.5)

Polytrauma with ribs# was observed with 7.1% of grade II, 21.4% of grade III, 50% of grade IV and 21.4% of grade V CT scan of spleen injury. Fisher's exact test showed that the association is significantly different at P<0.05. The detail is shown in (Table 8).

#### DISCUSSION

In the present study of 38 patients with blunt trauma abdomen, the splenic injury age group was found to be between 04 to 67 years with the mean age group of 36.03±2.54 yrs. The road traffic accidents were the commonest mode of trauma accounting for 84% of cases followed by fall from heights (10%) and least caused by blast injury and spontaneous rupture of the spleen (3%) each. In our present study, polytrauma with ribs fracture was commonly associated with injuries accounting for 37%. The relative percentage of various Grades of splenic injury is 0% (Grade I), 10.5% (Grade II), 31.6% (Grade III), 47.4% (Grade IV) and 10.5% (Grade V). Federle MP et al [26] reported 99% accuracy of CT scan in 200 patients with blunt abdominal trauma. Sutayak JP et al [27] stated CT scan in 49 patients with 43 splenic injuries correlation surgically with CT findings. In our study, CECT abdomen and pelvis besides diagnosing splenic trauma also diagnosed lung injuries in 37% of cases while most of the splenic injuries were of grade III, grade IV and few grade V. out of which 13 were managed conservatively (34.2%) and 25 patients underwent operative management (65.8%). Among the 13 patients who were selected for non-operative management Grade-II-4 (31%), and Grade-III - 9(69%) with the success rate as 85% and almost all the patients required blood transfusion, with lesser units in low-grade splenic injuries. Two of them failed conservative and had to undergo surgery. Out of all, 25 patients (66%) underwent operative management; splenectomy



was performed in 24 patients (96%) of Grade IV and Grade V injuries and splenorrhaphy in 1 (4%) of Grade III injury. The post-operative complications were seen in 15 patients with wound-related complications the most common and occurred in 7 followed by mechanical ventilation in 3 cases, left-sided pleural effusion in 3 cases and left lower lobe consolidation in 2 cases. All the postoperative patients were immunized with OPSI related vaccines before discharge.

## CONCLUSION

A high degree of success by non-operative management (NOM) and splenorrhaphy for lower grades of splenic injuries can be formulated but the predictor of failure is hemodynamic and clinical instability rather than the severity of organ injury except for Grade V and coexisting bowel injuries. The careful selection of such

patients for non-operative management (NOM) results in higher splenic salvage.

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**Conflict of interest:** None

**Ethical approval:** Yes

## REFERENCES

- Costa, G., et al., The epidemiology and clinical evaluation of abdominal trauma. An analysis of a multidisciplinary trauma registry. 2010. 81(2): p. 95-102.
- Mohamed, M.R.A., et al., Outcome of Management of Splenic Injury In Aswan University Hospital. 2022. 2(2): p. 186-201.
- Cox, E.F.J.A.o.s., Blunt abdominal trauma. A 5-year analysis of 870 patients requiring celiotomy. 1984. 199(4): p. 467.
- Davis, J.J., I. Cohn Jr, and F.C.J.A.o.s. Nance, Diagnosis and management of blunt abdominal trauma. 1976. 183(6): p. 672.
- Leppäniemi, A.J.S.J.o.s., Nonoperative management of solid abdominal organ injuries: From past to present. 2019. 108(2): p. 95-100.
- Knudson, M.M. and K.I.J.S.C. Maull, Nonoperative management of solid organ injuries: past, present, and future. 1999. 79(6): p. 1357-1371.
- Fodor, M., et al., Non-operative management of blunt hepatic and splenic injury: a time-trend and outcome analysis over a period of 17 years. 2019. 14(1): p. 1-12.
- Maclean, W., B. Levy, and T.J.S. Rockall, Trauma laparotomy and damage control surgery. 2019. 37(10): p. 549-557.
- Sinwar, P.D.J.I.j.o.s., Overwhelming post splenectomy infection syndromereview study. 2014. 12(12): p. 1314-1316.
- King, H. and H.B.J.A.o.s. Shumacker Jr, Splenic studies: I. Susceptibility to infection after splenectomy performed in infancy. 1952. 136(2): p. 239.
- McIntyre, L.K., M. Schiff, and G.J.J.A.o.s. Jurkovich, Failure of nonoperative management of splenic injuries: causes and consequences. 2005. 140(6): p. 563-569.
- Spijkerman, R., et al., Non-operative management for penetrating splenic trauma: how far can we go to save splenic function? 2017. 12(1): p. 1-8.
- Teuben, M., et al., Nonoperative management of splenic injury in closely monitored patients with reduced consciousness is safe and feasible. 2019. 27(1): p. 1-7.
- Teuben, M.P.J., et al., Safety of selective nonoperative management for blunt splenic trauma: the impact of concomitant injuries. 2018. 12(1): p. 1-8.
- Teuben, M., et al., Selective non-operative management for penetrating splenic trauma: a systematic review. 2019. 45: p. 979-985.
- Heuer, M., et al., No further incidence of sepsis after splenectomy for severe trauma: a multi-institutional experience of the trauma registry of the DGU with 1,630 patients. 2010. 15: p. 258-265.
- Haan, J.M., et al., Nonoperative management of blunt splenic injury: a 5-year experience. 2005. 58(3): p. 492-498.
- Kiankhooy, A., et al., Angiographic embolization is safe and effective therapy for blunt abdominal solid organ injury in children. 2010. 68(3): p. 526-531.
- Saavedra, M.Z., et al., Management of Splenic Injuries Utilizing a multidisciplinary protocol in 110 consecutive patients at a level II hospital. 2020. 98(3): p. 143-148.
- Schurr, M.J., et al., Management of blunt splenic trauma: computed tomographic contrast blush predicts failure of nonoperative management. 1995. 39(3): p. 507-513.
- Gaarder, C., et al., Nonoperative management of splenic injuries: improved results with angioembolization. 2006. 61(1): p. 192-198.
- Schimmer, J., A. Van Der Steeg, and W.J.I. Zuidema, Splenic function after angioembolization for splenic trauma in children and adults: a systematic review. 2016. 47(3): p. 525-530.
- El-Matbouly, M., et al., Blunt splenic trauma: assessment, management and outcomes. 2016. 14(1): p. 52-58.
- Dent, D., et al., Blunt splenic injuries: high nonoperative management rate can be achieved with selective embolization. 2004. 56(5): p. 1063-1067.
- Ahuja, C., K. Farsad, and M.J.A.J.o.R. Chadha, An overview of splenic embolization. 2015. 205(4): p. 720-725.
- Federle, M., et al., Splenic trauma: evaluation with CT. 1987. 162(1): p. 69-71.
- Sutyak, J., et al., Economic impact and clinical predictors of successful non-operative treatment of adult splenic injury. 1994. 36(1): p. 158.