

Research Article**Frequency and grading of liver and spleen injuries
following blunt trauma abdomen****Talha Zaffar, Mehvish Iqbal
and Shehzad Aslam**¹House Officer, Nishter Hospital, Multan²Woman Medical Officer, BHU 79/10 R, Khanewal³Medical Officer, Government Filter Clinic 2-C1-Township Lahore**ABSTRACT****OBJECTIVE:** To determine the frequency and grades of liver and spleen injuries on exploratory laparotomy following blunt abdominal trauma.**STUDY DESIGN:** Cross sectional study**SETTINGS and duration:** Department of Surgery, Nishter Hospital, Multan from July 2015-January 2016.**RESULTS:** A total of 183 patients of blunt abdominal trauma were included in this study. Mean age of the patients was 31.05 ± 9.25 years. Out of 183 patients, 136 (74.3%) were male and 47 (25.7%) were female. Liver and spleen injuries were found in 96 (52.5%) patients and 121 (66.1%) patients respectively. Out of 96 patients with liver injuries, grades of liver were as grade I in 38 (20.8%), grade II 29 (15.8%), grade III 24 (13.1%), grade IV 3 (1.6%) and grade V 2 (1.1%) patients. Out of 121 patients with spleen injuries, grade I in 40 (21.9%), grade II in 24 (13.1%), grade III in 27 (14.8%), grade IV in 24 (13.1%) and grade V in 6 (3.3%) patients.**CONCLUSION:** Blunt trauma was the commonest type of abdominal injury. Male are more victims as compare to female and younger age group was the most affected age group. Spleen was found to be the most common organ injured among patients with blunt trauma as compare to liver and most of splenic injuries were grade I and III.**KEY WORDS:** Blunt abdominal trauma; Focused assessment with sonography for trauma; Diagnostic peritoneal lavage; Computed tomography; Mortality.**INTRODUCTION**

Trauma is defined as damage to the body by exchange with environmental energy that is beyond body's resilience.¹ Trauma deaths continue to burden society despite the advancement of strategies to affect a decrease. Worldwide trauma is a major cause of morbidity and accounts for 10% of mortality especially in people younger than 50 years of age.² Injury accounts for 14% of all disability-adjusted life years (DALY's), especially because the trauma population consists of young people without pre-existent morbidity, making trauma an important source of health-related costs.² Abdomen is among the commonly injured regions of the body due to large surface

area.⁴The liver and spleen were the most common organs involved in patients with blunt abdominal trauma with haemoperitoneum, especially in 2nd & 3rd decades of life.¹⁰ Liver injuries were found in 47.9% and spleen injuries in 61.7% patients of blunt abdominal trauma undergoing laparotomy.³ Most of the liver injuries fell under grade I (42.8%) followed by grade II (28.35%) and grade III (22.85%).⁴ Grade I splenic injuries were found in 31.34% patients followed by grade II in 19.40%, grade III in 23.88%, grade IV in 20.90% and grade V in 4.48% patients.¹³ Mortality after blunt liver and splenic injury was high (12%).⁴

The liver is the largest solid abdominal organ in the body, weighing approximately 1500 grams. It sits in the right upper abdominal cavity beneath the diaphragm, protected by the rib cage.⁵The majority of injuries to the liver occur as a result of blunt injury. As liver is solid, compressive forces can easily burst its substance when compressed between the force and the rib cage or vertebral column.⁶

The spleen lies between the fundus of the stomach and the diaphragm, under cover of the 9th, 10th and the 11th ribs, its long axis being in the line of the 10th rib.⁷ Splenic injury occurs from direct blunt trauma; the spleen is often injured by direct energy applied to the overlying ribs (9th to 11th ribs).⁶

Liver injury is the most common intra-abdominal solid organ injury associated with rib fracture (40%), followed by spleen injury (23%).⁸ The number of intra-abdominal solid organ injuries requiring emergency operations is significantly higher in patients with more than 6 rib fractures,⁸ reaching up to 51%.⁹

In our surgical unit, trauma constitutes one of the most common reasons for emergency hospital admission. Due to mechanization leading to increase in number of road side accidents caused by 2-wheelers on roads, the figure of victims of blunt trauma abdomen has increased in our setup. Most of the locally published literature regarding blunt trauma abdomen consists of retrospective studies which contain small and inadequate sample sizes.⁴ Therefore, a cross-sectional study with adequate sample size is proposed to determine the frequency and grading of liver & spleen following blunt trauma abdomen presenting to a tertiary care hospital.

OPERATIONAL DEFINITIONS:

Liver injury: Liver injury was labeled when on exploratory laparotomy bleeding, hematoma or wound is seen on the surface of liver. It was further graded according to classification devised by Organ Injury Scaling Committee of the American Association for the Surgery of Trauma.^{1,4}

Spleen injury: Spleen injury was labeled when on exploratory laparotomy bleeding, hematoma or

wound is seen on the surface of spleen. It was further graded according to classification devised by Organ Injury Scaling Committee of the American Association for the Surgery of Trauma.^{1,4}

MATERIAL AND METHODS:

STUDY DESIGN:

This was a cross sectional study.

STUDY SETTING and duration:

Department of Surgery, Nishter Hospital, Multan from July 2015-January 2016.

Inclusion criteria:

1. Patients presenting with history of blunt trauma abdomen with hemodynamic instability (Pulse > 100 beats/min, SBP < 90 mmHg) and/or intra-abdominal hemorrhage (seen on abdominal sonography) and undergoing exploratory laparotomy.
2. Patients of both genders.
3. Patients of age above 16 and below 50 years.

Exclusion criteria:

1. Patients managed non-operatively.
2. Patients suffering any kind of penetrating abdominal injury, natural disaster injuries and stampede injuries.
3. Moribund patients who are ASA-4 and above.
4. Patients not giving informed consent.

DATA COLLECTION:

Study was started after approval of synopsis and permission from ethical committee of Hospital. All the patients admitted to Department of Surgery with history of blunt trauma abdomen fulfilling the inclusion criteria were entered in the study after taking informed consent. Findings of each case upon exploratory laparotomy were entered on a pre-designed proforma (Annexure 1) attached to the patient's file during the operative procedure. Case sheets of the admitted patients were screened for various variables such as age and gender of the patients and operative findings. Injuries involving liver and spleen were noted on that proforma as according to the operational definitions. The scale devised by the Organ Injury Scaling Committee of the American Association for the Surgery of Trauma (Annexure II) was used to grade injuries to

various organs. Grading of injuries was verified by attending consultant.

DATA ANALYSIS:

The data was analyzed by computer software SPSS version 18. Mean and standard deviations were calculated for quantitative variables like age. Frequencies and percentages were calculated for qualitative variables like gender, injuries of liver and spleen and grades of injuries of liver and spleen. Results were presented as tables and figures for age, gender, frequency and grades of injury.

Effect modifiers was controlled by stratification of data with reference to age and gender. Chi-square test was applied to see the effect of these on outcome variables. P-value ≤0.05 was taken as significant.

RESULTS:

A total of 183 patients fulfilling the inclusion/exclusion criteria were enrolled to study the frequency and grades of liver and spleen injuries on exploratory laparotomy following blunt abdominal trauma. Mean age of the patients was 31.05 ± 9.25 years.

Gender distribution of the patients was done which showed that 136 (74.3%) were male and 47 (25.7%) were female. (Table No.1)

Age distribution of trauma patients was done. Age group 1 (17-33 years) and age group 2 (34-49 years) were made. Age group 1 consisted on 113 (61.7%) patients and age group 2 consisted on 70 (38.7%) patients. (Table No.2).

Out of 183 patients of blunt trauma, liver injuries were found in 96 (52.5%) patients. (Table No.3)

In which Grade-I injury was found in 38 (20.8%) patients, Grade-II injury in 29 (15.8%) patients, Grade-III injury 24 (13.1%) patients Grade-IV injury in 3 (1.6%) patients and Grade-V injury was found in 2 (1.1%) patients. (Figure No.1)

Stratification for age was done for patients with liver injury and group was made age group 1 consisted on patients having age from 17-33 years and age group 2 consisted on patients having age from 34-49 years. In age group 1, there were 113 (61.7%) patients and liver injury was found in 61 (54%) patients. In age group 2, there were 70 (38.3%) patients and liver injury was found in 35 (50%) patients. No association was found between liver injury and age groups. P value 0.64. (Table No.4)

Gender stratification was done for patients with liver injury. Out of 136 (74.3%) male patients, liver injury was found in 73 (53.7%) patients and out of 47 (25.7%) female patients, liver injury was found only in 23 (49%) patients. No association was found between liver injury and gender. (Table No.5)

Out of 183 patients, spleen injures was found in 121 (66.1%) patients. (Table No.6)

In which Grade-I spleen injury was found in 40 (21.9%) patients, Grade-II injury in 24 (13.1%) patients, Grade-III injury in 27 (14.8%) patients, Grade-IV injury in 24 (13.1%) patients and Grade-V injury was found in 6 (3.3%) patients. (Figure No.2)

Stratification for age was done for spleen injury. In Age group 1, out 113 (61.7%) patients, spleen injury was found in 76 (67.3%) patients. In age group 2, spleen injury was found in 45 (64.3%) cases out of 70 (38.3%) patients. No association was found between spleen injury and age groups. (Table No.7)

Stratification for gender was done for spleen injury. There were 136 (74.3%) male and spleen injury was found in 93 (68.4%) patients. Out of 47 (25.7%) female, spleen injury was found in 28 (60%) patients. No association was found between spleen injury and gender. (Table No.8)

Table No.1: Gender Distribution of patients of blunt trauma

Gender	Frequency	Percentage
Male	136	74.3
Female	47	25.7
Total	183	100.0

Table No.2: Age distribution of patients of blunt trauma

Frequency and grading of liver and spleen injuries following blunt trauma abdomen

Age Group (in years)	Frequency	Percentage
17-33 Age Group 1	113	61.7
34-49 Age Group 2	70	38.3
Total	183	100.0

Table No.3: Frequency of Liver Injury

Injury of Liver	Frequency	Percentage
Yes	96	52.5
No	87	47.5
Total	183	100.0

Figure No.1

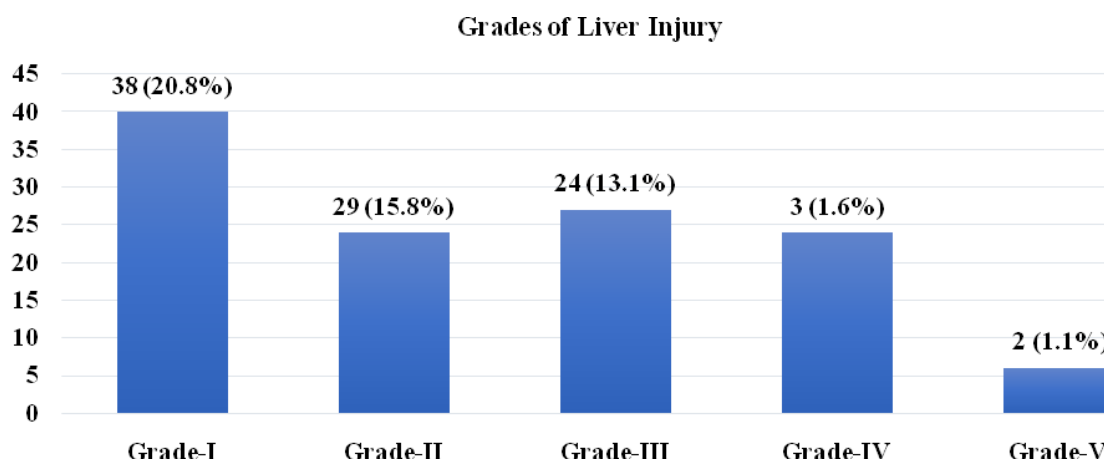


Table No.4: Stratification of Age for liver injury

Age Group	Liver Injury		Total	P. value
	Yes (%)	No (%)		
17-33 Age Group 1	61 (54)	52 (46)	113 (61.7)	0.64
34-49 Age Group 2	35 (50)	35 (50)	70 (38.3)	
Total	96 (52.5)	87 (47.5)	183	

Table No.5: Stratification of Gender for liver injury

Gender	Liver Injury		Total	P. value
	Yes	No		
Male	73 (53.7)	63 (46.3)	136 (74.3)	0.61
Female	23 (49)	24 (51)	47 (25.7)	
Total	96 (52.5)	87 (47.5)	183	

Tale No.6: Frequency of Spleen Injury

Spleen Injury	Frequency	Percentage
Yes	121	66.1
No	62	33.9
Total	183	100.0

Figure No.2

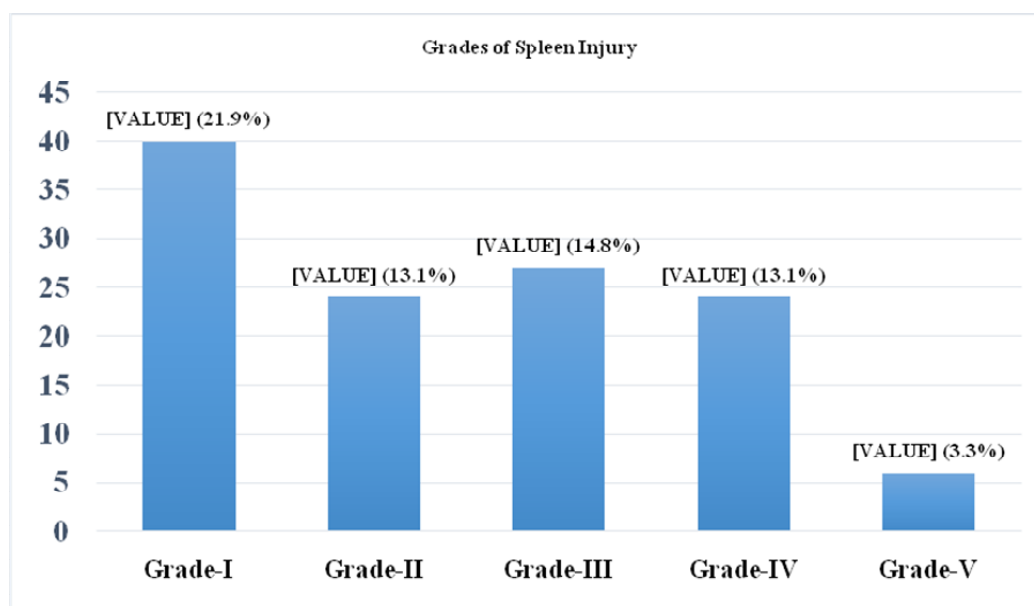


Table No.7: Stratification of Age for spleen injury

Age Groups	Spleen Injury		Total	P. value
	Yes	No		
17-33 Age Group 1	76 (67.3)	37 (32.7)	113 (61.7)	0.74
34-49 Age Group 2	45 (64.3)	25 (35.7)	70 (38.3)	
Total	121 (66.12)	62 (33.88)	183	

Table No.8: Stratification of Gender for spleen injury

Gender	Spleen Injury		Total	P. value
	Yes	No		
Male	93 (68.4)	43 (31.6)	136 (74.3)	0.28
Female	28 (60)	19 (40)	47 (25.7)	
Total	121 (66.12)	62 (33.88)	183	

DISCUSSION:

Blunt abdominal trauma is a leading cause of morbidity and mortality among all age groups.¹⁰ Identification of serious intra-abdominal pathology is often challenging. Many injuries may not manifest during the initial assessment and treatment period. Mechanisms of injury often result in other associated injuries that may direct the physician’s attention from potentially life threatening intra-abdominal pathology.¹¹ Blunt trauma secondary to motor vehicle accident, motor cycle accidents, falls, assaults and pedestrians struck remain the most frequent mechanisms of abdominal injury.⁷⁰

The clinical evaluation of abdomen by means of physical examination is inadequate to identify intra-abdominal injuries. So several diagnostic modalities evolved during the past three decades, including diagnostic peritoneal lavage, ultrasound, CT and laparoscopy all of them with advantages, disadvantages and limitations. Approximately 25% of all trauma victims will require an abdominal exploration.¹² In our study, male are more common (74.3%) victims of blunt trauma abdomen as compare to female, which correlates with the study of Gad MA et al.¹³ In our study, minimum age was 17 years and maximum age was 49 years. Maximum incidence was observed in the age group 1 (17-33 years) followed by age group 2 (34 to 49 years) of

age. The mean age was 34.8 yrs. In the study by Frick EJ Jr et al, maximum incidence was observed in the age group of 20-29 yrs.¹⁴ Another study by Mufti TS et al mean age of patients of blunt trauma was 27 years which is in contrast with this study.¹⁵

In our study liver injuries was found in 52.5% patients which is comparable with the study by Mohamed AA et al which was reported liver injuries in blunt trauma as 47.9%.³ In one study by Memon et al reported liver injury in patients of blunt trauma as 53.12% which is in agreement with my study.¹⁶ In a study by Raza M et al, out of trauma patients liver injury was found in (13.2%), most of the patients (58.8%) had grade III liver injuries. These findings were not comparable with my study.¹⁷ In one study by Aman Z et al, the incidence of liver injury was 28.57% which is in contrast with this study.¹⁸

In our study grades of liver injury were 20.8%, 15.8%, 13.1%, 1.6% and 1.1% respectively as grade I, II, III, IV and grade V. In one study by Saaq M et al grades of liver injury were as grade I 32.7%, grade II 36.2%, grade III 25.6% and grade IV injury was 6.1%.¹⁹

Our study showed liver blunt trauma was common 61.7% in age group 17-33 years. In one study by M Swarnkar et al, out of 826 patients of blunt abdomen trauma, Most of the injuries were seen in 11-40 year age group (64.06%). These findings were comparable with my study.²⁰

Although protected under the bony ribcage, the spleen remains amongst the vulnerable organ sustaining injury from amongst the abdominal trauma patients in all age groups. It is a friable and highly vascular organ holding 25% of the body's lymphoid tissue and has both haematological and immunological functions.¹⁵

In our study blunt spleen injury was found in 66.1% patients. Raza M et al observed spleen injury in 29.8% patients.¹⁷ These findings were not comparable without study.

In other studies like Najfi et al and Ghazanfar et al, splenic injuries were 18.5% and 23% respectively.^{21, 22} It is possible that their results

differ from my study because their studies included less number of patients.

In present study grades of spleen injury were grade I 21.9%, grade II 13.1%, grade III 14.8, grade IV 13.8% and grade V 3.3%. In study of Renzulli P, grades of spleen injury were grade 1 in 20.9%, grade 2 in 25.2%, grade 3 in 29.1%, grade 4 in 20.4% and grade 5 in 4.4%.²³ These results were not similar with my study due to many reasons. Most important one is the patient number and different age group of victims.

Conclusions:

Blunt trauma was the commonest type of abdominal injury. Male are more victims as compare to female and younger age group was the most affected age group. Spleen was found to be the most common organ injured among patients with blunt trauma as compare to liver and most of splenic injuries were grade I and III.

REFERENCES:

1. Macleod JBA, Cohn SM, Johnson EW, McKinney MG. Trauma deaths in the first hour: are they all unsalvageable injuries? *Am J Surg.* 2007;193:195-9.
2. Saltzherr TP. Optimizing the initial evaluation and management of severe trauma patients [Dissertation]. Amsterdam: University of Amsterdam; 2011.
3. Mohamed AA, Mahran KM, Zaazou MM. Blunt abdominal trauma requiring laparotomy in poly-traumatized patients. *Saudi Med J.* 2010 Jan;31(1):43-8.
4. Khan JS, Iqbal N, Gardezi JR. Pattern of visceral injuries following blunt abdominal trauma in motor vehicular accidents. *J Coll Physicians Surg Pak.* 2006;16:645-7.
5. Brunicaudi CF, Andersen KD, Billiar RT, Dunn LD, Hunter GJ, Mathews BJ, et al. *Schwartz's Principals of Surgery.* 9thed. New York: McGraw Hill; 2010.

6. Williams SN, Bulstrode KJC, O'Connell RP. Bailey & Love's Short Practice of Surgery. 25th ed. London: Hodder Arnold; 2008.
7. Farquharson M, Moran B. Farquharson's Textbook of Operative General Surgery. 9th ed. London: Hodder Arnold; 2005.
8. Park S. Clinical Analysis for the Correlation of Intra-abdominal Organ Injury in the Patients with Rib Fracture. *Korean J ThoracCardiovasc Surg.* 2012 Aug;45(4):246–250.
9. Al-Hassani A, Abdulrahman H, Afifi I, Almadani A, Al-Den A, Al-Kuwari A, et al. Rib fracture patterns predict thoracic chest wall and abdominal solid organ injury. *Am Surg.* 2010 Aug;76(8):888-91.
10. Mukhopadhyay. Intestinal Injury from Blunt Abdominal Trauma: A Study of 47 Cases. *Oman Medical Journal* [Internet]. 2009 [cited 2014 Jun 9]; Available from: http://www.omjournal.org/OriginalArticles/FullText/200910/FT_IntestinalInjuryfromBlunAbdominalTraumaAStudy.html.
11. Nyongole OV, Akoko LO, Njile IE, Mwanga AH, Lema LE. The Pattern of Abdominal Trauma as Seen at Muhimbili National Hospital Dar es Salaam, Tanzania. *East and Central African Journal of Surgery.* 2013;18(1):40–7.
12. *Journal of Emergencies, Trauma, and Shock* [Internet]. [cited 2014 Jun 9]. Available from: <http://www.linkedin.com/today/post/article/20140419140926-36789366-journal-of-emergencies-trauma-and-shock>.
13. Gad MA, Saber A, Farrag S, Shams ME, Ellabban GM. Incidence, Patterns, and Factors Predicting Mortality of Abdominal Injuries in Trauma Patients. *N Am J Med Sci.* 2012 Mar;4(3):129–34.
14. Frick EJ Jr, Pasquale MD, Cipolle MD. Small-bowel and mesentery injuries in blunt trauma. *J Trauma.* 1999 May;46(5):920–6.
15. Mufti TS, Akbar I, Ahmed S. EXPERIENCE WITH SPLENIC TRAUMA IN AYUB TEACHING HOSPITAL, ABBOTTABAD. *J Ayub Med Coll Abbottabad* [Internet]. 2007 [cited 2014 Jun 6];19(3). Available from: <http://www.ayubmed.edu.pk/JAMC/PAST/19-3/01%20Tariq%20Mufti.pdf>.
16. Memon MR, Sanghi AG, Abbasi SA, Memon AA. Role of laparoscopy in blunt abdominal trauma. *Rawal Medical Journal.* 2013;38(1):40–3.
17. Raza M, Abbas Y, Devi V, Prasad KV, Rizk KN, Nair PP. Non operative management of abdominal trauma-a 10 years review. *World J Emerg Surg.* 2013;8(1):14.
18. Aman Z, Ikramullah AH, Iqbal Z, Aslam R, Aman AWZ, Wahab A. FREQUENCY OF HEPATIC TRAUMA IN PATIENTS WITH ABDOMINAL FIREARM INJURIES. *KJMS.* 2011;3(2):77.
19. Saaq M, Niaz-ud-Din MZ, Shah SA. Presentation and outcome of surgically managed liver trauma: experience at a tertiary care teaching hospital. *JPMA The Journal of the Pakistan Medical Association.* 2013;63(4):436–9.
20. M Swarnkar, P Singh, S Dwivedi. Pattern Of Trauma In Central India: An Epidemiological Study With Special Reference To Mode Of Injury. *The Internet Journal of Epidemiology.* 2009 Volume 9 Number 1.
21. Najfi S M, Khan A F A, Gondal K M. Spectrum of injuries in blunt abdominal trauma at Mayo Hospital, Lahore. *Biomedica,* 1995; 11: 18-22.
22. Ghazanfar A, Chaudhary Z A, Zubair M, Nasir S M, Khan S A, Ahmad W. Abdominal solid visceral injuries in blunt abdominal trauma. An experience in busy surgical unit of Mayo Hospital, Lahore. *Annals KEMC* 2001; 7: 85-7.
23. Renzulli P, Gross T, Schnüriger B, Schoepfer AM, Inderbitzin D, Exadaktylos AK, et al. Management of blunt injuries to the spleen. *Br J Surg.* 2010 Nov;97(11):1696–703.