

# Frequency & Grading of Liver and Spleen Injuries following Blunt Trauma Abdomen

SUMMERA SIDDIQUE, ASGHAR ALI, UMAIR AHMAD

## ABSTRACT

**Aim:** To determine the frequency and grades of liver and spleen injuries on exploratory laparotomy following blunt abdominal trauma.

**Study design:** Cross sectional study

**Duration & place of study:** Dept. of Surgery, B V Hospital, Bahawalpur from Dec. 2013 to June 2014.

**Methods:** Total 183 patients with blunt trauma was included in this study. Findings of each case upon exploratory laparotomy were entered on a pre-designed proforma.

**Results:** This study consisted of 183 cases of blunt abdominal trauma with mean age as 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 injury 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:** In cases with abdominal injury, most common type of trauma was blunt trauma. Male are more victims as compare to female and younger age group was the most affected age group. Among the cases of blunt trauma, the common injured organ was spleen as compare to liver and most of the cases was with grad I and grade III spleen injury.

**Keywords:** Blunt abdominal trauma; focused assessment with sonography for trauma;.

---

## INTRODUCTION

Trauma is defined as injury to the body by interchange with energy of environment that is beyond body's resilience<sup>1</sup>. Trauma deaths continue to burden society regardless of the progress in strategies to affect a decrease. All over the world trauma is a main reason for morbidity of the patients and is responsible for 10% mortality specially in people under the age of 50 years<sup>2</sup>. Injury is responsible for 14% of all the disability-adjusted life years (DALY's), especially due to the population of trauma comprise of young people without any pre-existing morbidity, making the trauma as valuable source of costs related to health<sup>2</sup>.

Abdomen is among the commonly injured regions of the body due to large surface area<sup>3</sup>. The spleen and liver were the most frequent organs involved in cases of blunt abdominal trauma with haemoperitoneum, especially in 2<sup>nd</sup> & 3<sup>rd</sup> decades of life<sup>4</sup>. Liver injuries were found in 47.9% and spleen injuries in 61.7% patients of blunt abdominal trauma undergoing laparotomy<sup>5</sup>. Among the injuries of liver mostly were grade I as 42.8% followed by grade II as 28.35% and grade III as 22.85%<sup>3</sup>. 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.<sup>6</sup> Mortality after blunt liver and splenic injury was high (12%)<sup>3</sup>.

The liver is the largest solid abdominal organ in the body, weighing approximately 1500 grams. It sits in the upper right abdominal cavity below the diaphragm, shielded by the rib cage<sup>7</sup>. The 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<sup>8</sup>.

Spleen is present in the left hypochondrium of abdomen between stomach and the diaphragm under the lower ribs with its long axis with the 10th rib.<sup>9</sup> Splenic injury occurs from direct blunt trauma; the spleen is often injured by direct energy applied to the overlying ribs (9<sup>th</sup> to 11<sup>th</sup> ribs)<sup>8</sup>.

Injury of liver is the common most intra-abdominal solid organ injury correlated with rib fracture (40%), followed by spleen injury (23%).<sup>8</sup> The number of intra-abdominal solid organ injuries needs emergency operations is markedly higher in cases with fractures of more than 6 rib,<sup>10</sup> reaching up to 51%<sup>11</sup>.

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-

---

Department of Surgery, B V Hospital, Bahawalpur  
Correspondence to Dr. Summera Siddique, Registrar, E. mail:  
summerasiddique@yahoo.com

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<sup>4</sup>. 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.

**MATERIAL AND METHODS**

This cross sectional study was conducted at the Department of Surgery Bahawal Victoria Hospital, Bahawalpur from December 2013 to June 2014. Permission was taken from institutional review committee and an informed written consent was taken from every patient. Total 183 patients age range from 16 years to 50 years, both male or female presenting with history of blunt trauma abdomen with hemodynamic instability (Pulse >100 beats/min, SBP <90mmHg) and/or intra-abdominal hemorrhage (seen on abdominal sonography) and undergoing exploratory laparotomy were included in this study.

Patients managed non-operatively, Patients suffering any kind of penetrating abdominal injury, natural disaster injuries and stampede injuries and moribund patients who are ASA-4 and above were excluded from the study. Findings of each case upon exploratory laparotomy were entered on a pre-designed proforma 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. Liver and spleen injuries were labeled when on exploratory laparotomy bleeding, hematoma or wound is seen on the surface of liver or spleen. It was further graded according to classification devised by Organ Injury Scaling Committee of the American Association for the Surgery of Trauma.

All the data were entered in SPSS version 16 and analyzed. Mean and standard deviations were calculated for quantitative variables and frequencies and percentages were calculated for categorical data. Effect modifiers were 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**

Total 183 cases 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. 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%) pts and age group 2 consisted on 70(38.7%) pts (Table 1).

Table 1: Frequencies for age and gender (n=183)

Age group	n	Gender	n
17-33	113(61.7)	Male	136(74.3)
34-49	70(38.3)	Female	47(25.7)

Out of 183 patients of blunt trauma, liver and spleen injuries were found in 96(52.5%) and 121(66.1%) patients respectively (Table 2). Grading of liver injury was done, Grade-I injury was found in 38(20.8%) patients, Grade-II injury in 29(15.8%) pts, Grade-III injury 24(13.1%) pts Grade-IV injury in 3(1.6%) pts and Grade-V injury was found in 2(1.1%) patients.

Table 2: Frequency of injury of liver and spleen (n=183)

Injury of organ	Liver injury	Spleen injury
Yes	96(52.5%)	121(66.1%)
No	87(47.5%)	62(33.9%)

Grading for spleen injury was also done and 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 (Fig. 1 & 2).

Fig. 1: Grades of liver injury

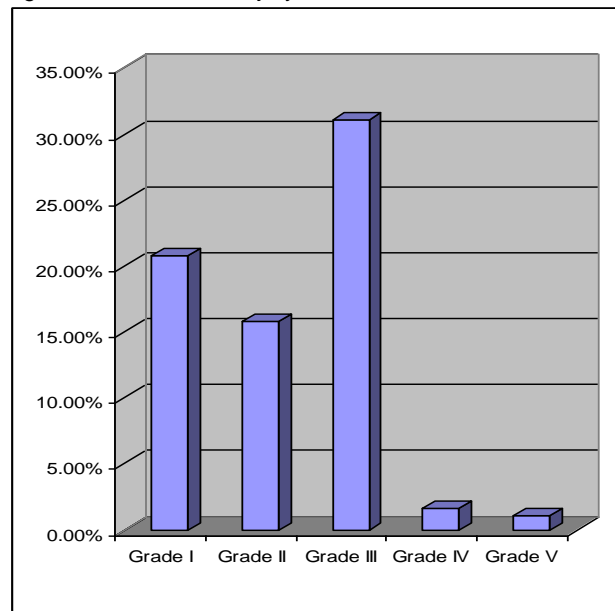
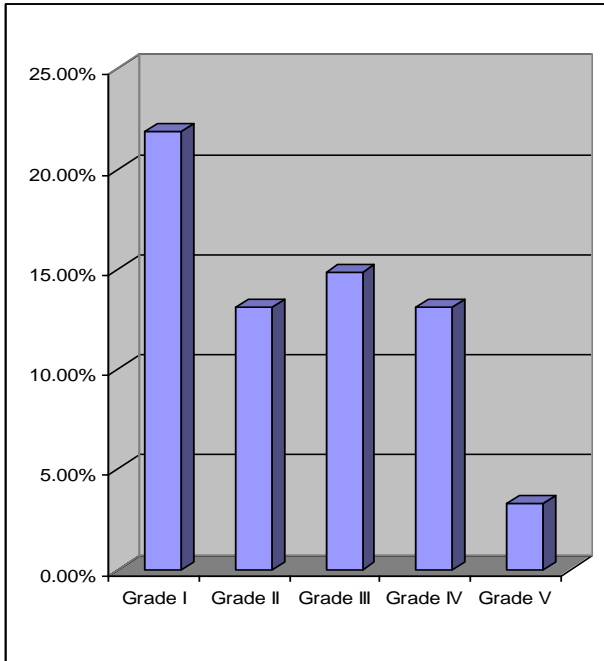


Fig. 2



136(74.3%) male patients, liver injury was found in 73(53.7%) patients and spleen was found in 93(68.4%). Out of 47(25.7%) female patients, liver injury was found in 23(49%) patients and spleen injury was found in 28(60%). Insignificant association of gender with organ injury (liver and spleen) was found. P value 0.61 and 0.28.

Stratification for age was done for patients with liver and spleen injury and two 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 and spleen injury was found in 61(54%) patients and 76(67.3%) patients respectively. In age group 2, there were 70(38.3%) patients and liver injury was found in 35 (50%) patients spleen injury was found in 45(64.3%). Insignificant association of age was found organ injury (liver and spleen) P value 0.64 and 0.74. (Table 4)

Stratification for gender was done for the patients with liver and spleen injury. Out of Table 3: Stratification of Gender for liver and spleen injury

Gender	Liver injury		Total	Spleen injury		Total
	Yes	No.		Yes	No	
Male	73(53.7%)	63(46.3%)	136 (74.3%)	93(68.4%)	43(31.6%)	136(74.3%)
Female	23(49%)	24 (51%)	47(25.7%)	28(60%)	19(40%)	47(25.7%)
Total	96(52.5%)	87(47.5%)	183	121(66.12%)	62(33.88%)	183
P value	0.61			0.28		

Table 4: Stratification of age for liver and spleen injury

Age group	Liver injury		Total	Spleen injury		Total
	Yes	No.		Yes	No	
17-33 Years Age Group 1	61(54%)	52(46%)	113(61.7%)	76(67.3%)	37(32.7%)	113(61.7%)
34-49 Years Age Group 2	35(50%)	35(50%)	70(38.3%)	45(64.3%)	25(35.7%)	70(38.3%)
Total	96(52.5%)	87(47.5%)	183	121(66.12%)	62(33.88%)	183
P value	0.64			0.74		

## DISCUSSION

Blunt abdominal trauma is a well-known cause of mortality and morbidity in people of any age<sup>12</sup>. Evaluating the intra-abdominal injury pathology is not a simple job as many of them remain concealed during initial period. Most of the time associated injuries particularly of limbs and head and neck potentially to be taken as first to look and attaining the treating physician or surgeon attention<sup>13</sup>.

Blunt trauma secondary to motor vehicle accident, motor cycle accidents, falls, assaults and pedestrians struck remain the most frequent mechanisms of abdominal injury<sup>14</sup>.

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<sup>15</sup>.

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.<sup>16</sup> 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<sup>17</sup>. Another study by Mufti TS et al mean age of patients of blunt trauma was 27 years which is in contrast with this study<sup>18</sup>.

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%<sup>3,5</sup>. 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.<sup>19</sup> 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<sup>20</sup>. In one study by Aman Z et al, the incidence of liver injury was 28.57% which is in contrast with this study<sup>21</sup>.

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 Saaiq 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%<sup>22</sup>.

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<sup>23</sup>.

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.<sup>18</sup>

In our study blunt spleen injury was found in 66.1% patients. Raza M et al observed spleen injury in 29.8% patients.<sup>20</sup> 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.<sup>24, 25</sup> 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%<sup>26</sup>. 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. *Nederlands Tijdschrift voor Traumatologie [Internet]. Springer Science + Business Media; 2011 Nov 30;19(5):147–147.* Available from: <http://dx.doi.org/10.1007/s12506-011-0042-3>.
3. 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.
4. Feliciano DV. Diagnostic modalities in abdominal trauma. Peritoneal lavage, ultrasonography, computed tomography scanning, and arteriography. *Surg Clin North Am.* 1991 Apr;71(2):241–56.
5. Mohamed AA, Mahran KM, Zaazou MM. Blunt abdominal trauma requiring laparotomy in poly-traumatized patients. *Saudi Med J.* 2010 Jan;31(1):43-8.
6. Hamilton Bailey's Emergency surgery: 13th edition: 2000: p446-471.
7. Brunnicardi CF, Andersen KD, Billiar RT, Dunn LD, Hunter GJ, Mathews BJ, et al. *Schwartz's Principals of Surgery.* 9<sup>th</sup> ed. New York: Mc Graw Hill; 2010.
8. Williams SN, Bulstrode KJC, O'Connell RP. *Bailey & Love's Short Practice of Surgery.* 25<sup>th</sup> ed. London: Hodder Arnold; 2008.
9. Farquharson M, Moran B. *Farquharson's Textbook of Operative General Surgery.* 9<sup>th</sup> ed. London: Hodder Arnold; 2005.
10. Park S. Clinical Analysis for the Correlation of Intra-abdominal Organ Injury in the Patients with Rib Fracture. *Korean J Thorac Cardiovasc Surg.* 2012 Aug;45(4):246–250.
11. 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.
12. Mukhopadhyay. Intestinal Injury from Blunt Abdominal Trauma: A Study of 47 Cases. *Oman Medical Journal [Internet]. Oman Medical Journal; 2009;* Available from: <http://dx.doi.org/10.5001/omj.2009.52>.
13. Nyongole OV, Akoko LO, Njile IE, Mwangi 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.
14. *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>.

15. Streck CJ, Jewett BM, Wahlquist AH, Gutierrez PS, Russell WS. Evaluation for intra-abdominal injury in children following blunt torso trauma. Can we reduce unnecessary abdominal CT by utilizing a clinical prediction model? *J Trauma Acute Care Surg* [Internet]. 2012 Aug [cited 2014 Jun 9];73(2). Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3855542/>
16. 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.
17. Frick EJ Jr, Pasquale MD, Cipolle MD. Small-bowel and mesentery injuries in blunt trauma. *J Trauma*. 1999 May;46(5):920–6.
18. Memon MR, Sanghi AG, Abbasi SA, Memon AA. Role of laparoscopy in blunt abdominal trauma. *Rawal Medical Journal*. 2013;38(1):40–3.
19. 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:
20. 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.
21. Aman Z, Ikramullah AH, Iqbal Z, Aslam R, Aman AWZ, Wahab A. frequency of hep frequency of hepatic trauma in patients with tients with abdominal firearm injuries. *KJMS*. 2011;3(2):77.
22. Saaiq 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.
23. 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.
24. 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.
25. 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.
26. 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.