

# A study of Non-operative Management of Liver Trauma in hemodynamically Stable Patients.

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## ABSTRACT

**Background:** Nonoperative management is presently considered the treatment modality of choice for hemodynamically stable patients sustaining blunt liver trauma. **Methods:** This study describes the outcome of nonoperative management decided for fifty one (51) patients who sustained liver injury. Those patients were admitted to the Emergency Department of Jawahar Lal Nehru medical college Aligarh between November 2011 and November 2013. **Results:** Males 42 (82%) and 9 females (18%), aged 14- 70 years (average age 32.5years), sustained liver trauma due to different accident mechanisms but mostly (70%) due to road traffic accidents. According to the American Association for the Surgery of Trauma – computerised axial tomography grading of liver injury, there were 21 cases of grade I (41%), 18 cases of grade II (35%), 11 cases of grade III (22%), and 1 cases of grade IV injuries (2%). Blood transfusion units needed ranged between 0 – 7units with an average of 2.2 units/ patient. Length of hospital stay was 2-24 days with an average of 8 days. No mortality in our series and two cases (4%) required operative intervention within the first 24 hours of admission for associated abdominal injuries. Nonoperative management of blunt liver trauma is safe, effective, and is clearly the treatment modality of choice in hemodynamically stable patients. **Conclusion:** Failure of nonoperative management in our series was due to associated other injuries and not the liver.

**Keywords:** Liver Trauma, Trauma.

## INTRODUCTION

Operative therapy has been the standard of care for liver injuries from the beginning of this century until the 1990s. This has been based on the dual rationale of hemostasis and bile drainage. Since the early 1980s, sporadic reports of adult patients with blunt hepatic trauma treated non-operatively appeared in the literature (Farnell MB et al,<sup>[1]</sup> Brasel KJ et al).<sup>[2]</sup> However, surgical literature confirms that as many as 86% of liver injuries have stopped bleeding by the time surgical exploration is performed, and 67% of operations performed for blunt abdominal trauma are non-therapeutic. Imaging techniques, particularly CT scanning, have made a great impact on the treatment of patients with liver trauma, and use of these techniques has resulted in marked reduction in the number of patients requiring surgery and non-therapeutic operations (Nawaz Khan A et al.)<sup>[3]</sup> Nonoperative management is presently considered the treatment modality of choice for

haemodynamically stable patients sustaining liver trauma.

Non-operative management of hepatic injuries is the treatment modality of choice in hemodynamically stable patient, irrespective of the grade of injury.<sup>[4,5]</sup> It is associated with a low overall morbidity and mortality and does not result in increase in length of hospital stay, need of blood transfusions, bleeding complications, or visceral associated hollow viscus injuries as compared to operative management.<sup>[5,6]</sup> Non-surgical treatment has become the standard of care in haemodynamically stable patients with liver trauma.

Nonoperative Management of hepatic injury, the Following criteria must be met:

- 1) Hemodynamic Stability
- 2) No Demonstrable Peritoneal Signs On Abdominal Examination
- 3) The absence of any intraperitoneal or retroperitoneal injuries on computer computerized Axial tomography scans requiring operative intervention.

## MATERIALS AND METHODS

This work entitled “A study of Non-operative Management of Liver Trauma in Hemodynamically Stable Patients” was conducted in the Department of Surgery and Department of Radiodiagnosis

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Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh from November 2011 to November 2013. A total of 150 patients of abdominal trauma reported in the emergency department during this period. A total of 53 patients of liver trauma were included in our study and evaluated prospectively. The patients were thoroughly examined, investigated and initially managed in the emergency department and then transferred to Intensive Care Unit or ward as required. Regardless of grade of liver injury, patients who were normotensive (Systolic BP >90 mmhg) were treated conservatively. All the patients were periodically assessed for the signs of peritonitis (diffuse tenderness/rebound tenderness, guarding, rigidity) and hemodynamic instability (vital signs, serial hemoglobin level, abdominal girth). Patients who were initially managed conservatively but after certain time had to undergo laparotomy because of hemodynamic instability and/or suspected intra abdominal hollow viscus injury were considered as a failure of non-operative management. Data on demographic characteristics, mode of injury, grade of injury, degree of hemoperitoneum, associated injuries, no of blood transfusion, no of days in hospital, complications and outcome were collected. Degree of hemoperitoneum was classified according to Knudson criteria based on CT scan in which < 250 cc was considered small degree of hemoperitoneum, <500 cc was moderate degree of hemoperitoneum and >500cc was taken as large degree of hemoperitoneum.

**Inclusion Criteria**

All patients of liver trauma of >14 yrs of age with stable hemodynamic status or who have become stable after resuscitation were taken in our study.

**Exclusion Criteria**

1. All patients of liver trauma <14 yrs of age.
2. Haemodynamically compromised patients.
3. All patients who underwent laparotomy for non-hepatic injuries.

Investigations were done on all patients :Haemogram –(serial haemoglobin and hematocrit levels measured 6 hourly for initial 24-48 hr.), X-Ray chest and other relevant X-rays, and USG abdomen was performed by the radiology resident on emergency call.

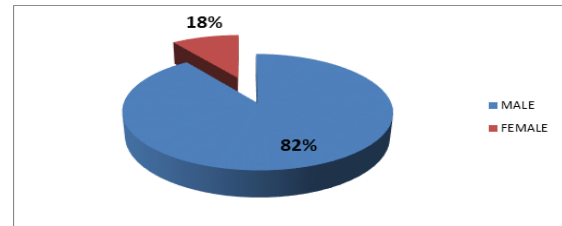
CECT Abdomen- Contrast enhanced CT scan of whole abdomen was done with in 24 hours of admission. Uroscan (60-100ml) was used as intravenous contrast. Siemens single slice CT scan model SOMATOM balance was used for scanning . 5-10 mm slice was taken depending upon specific organ injured.

**RESULTS**

Two patients were initially managed conservatively but within 24 hour these patients underwent laparotomy because of biliary peritonitis and suspected bowel injury excluded from the study. A total no. of 51 adult patients of liver trauma was studied and following observation made.

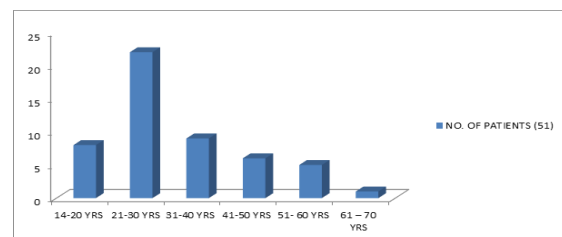
**Sex Distribution**

S.No	Sex	No. Of Patients (51)	Percentage
1.	Male	42	82%
2.	Female	9	18%



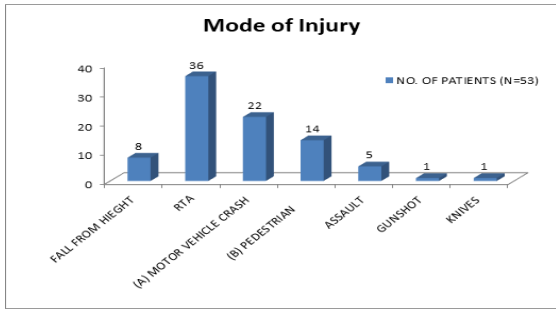
**Age Distribution**

S.No	Age	No. Of Patients (51)	Percentage
1.	14-20 YRS	9	18%
2.	21-30 YRS	21	41%
3.	31-40 YRS	9	18%
4.	41-50 YRS	6	12%
5.	51- 60 YRS	4	8%
6.	61 – 70 YRS	2	4%
Total		51	100%
	MEAN	32.5	
	SD	14.04	
	RANGE	14-70	



**Mode Of Liver Injury**

S.No	Mode Of Injury	No. Of Patients (N=51)	Percentage
1.	Fall From Hieght	8	16%
2.	Rta	36	70%
	(A) Motor Vehicle Crash	22(43%)	
	(B) Pedestrian	14(27%)	
3.	Assault	5	10%
4.	Gunshot	1	2%
5.	Knives	1	2%
	Total	51	100%

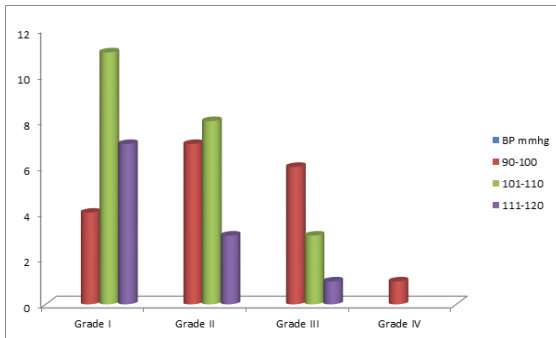


**Systolic BP at the time of admission**

S. No	Systolic BP Mm Hg	No Of Patients
1	90-100	25
2	101-110	19
3	111-120	7
	Mean	103.3
	SD	6.16
	Range	94-118

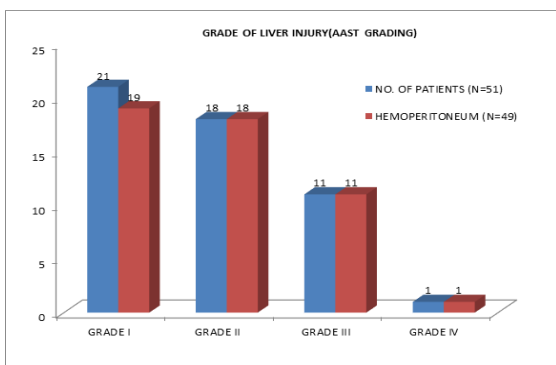
**Systolic BP at the time of admission in different Grades Of Liver Injury**

S.no	Systolic BP mmhg	Grade I	Grade II	Grade III	Grade IV
1.	90-100	8	9	7	1
2.	101-110	10	6	3	
3.	111-120	3	3	1	



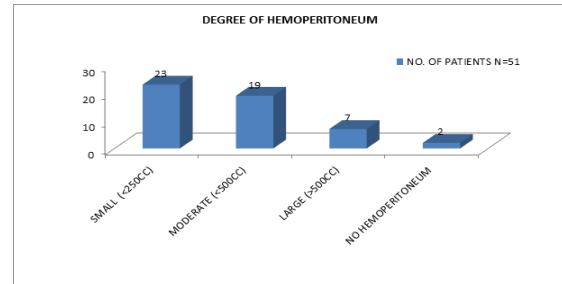
**Grade of liver injury (aast grading)**

S.No	Grade	No. Of Patients (N=51)	Percentage
1.	GRADE I	21	41%
2.	GRADE II	18	35%
3.	GRADE III	11	22%
4.	GRADE IV	1	2%
	TOTAL	51	100%



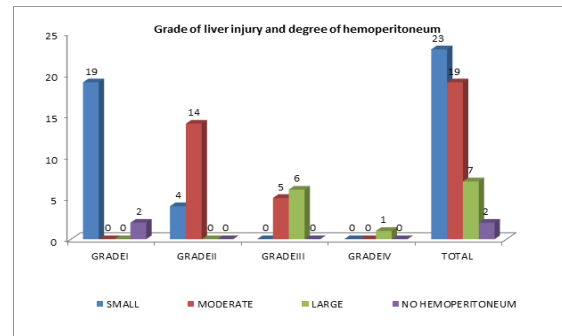
**Degree of Hemoperitoneum (Knudson Classification CT Based)**

S.No	Degree Of Hemoperitoneum	No. Of Patients N=51	Percentage
1.	Small (<250cc)	23	45%
2.	Moderate (<500cc)	19	37%
3.	Large (>500cc)	7	14%
4.	No Hemoperitoneum	2	4%
	Total	51	100%



**Grade of Liver Injury and Degree of Hemoperitoneum**

S. No	Degree Of Hemoperitoneum	Grade I	Grade II	Grade III	Grade IV	Total
1.	Small	19	4	0	0	23
2.	Moderate	0	14	5	0	19
3.	Large	0	0	6	1	7
4.	No Hemoperitoneum	2	0	0	0	2
	Total	21	18	11	1	51

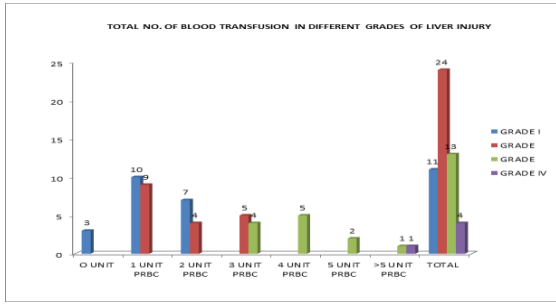


**Associated injuries**

S.No	Associated Injuries	No. Of Patients N=51	Percentage
1.	Head Injury	9	18%
2.	Ribs Fracture With Haemopneumothorax	33	65%
3.	Pelvic Fracture	4	8%
4.	Upper Limb , Lower Limb and clavicle fracture	14	27%
5.	Kidney Injury	3 (2 GRADE IV & 1 GRADE III)	6%
6.	Splenic Injury	1 (GRADE I)	2%
7.	Bladder And Urethra Injury	2	4%
8.	Hepatobiliary Tract	3	6%
9.	Pancreas	2	4%
10.	Bowel	1	2%
11.	None	1	2%

**Total no. Of blood transfusion in different grades of liver injury**

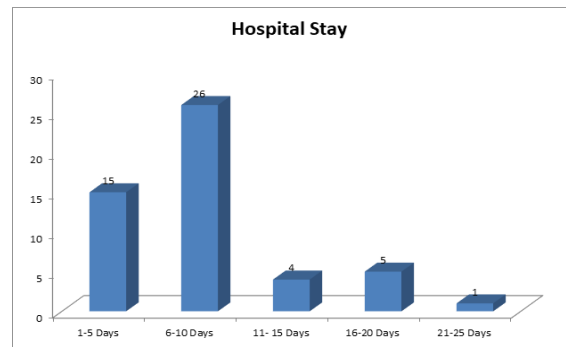
S.No	No. Of Transfusion	Grade I No Of Patients	Grade II No Of Patients	Grade Iii No Of Patients	Grade Iv No Of Patients	Total
1.	0 Unit	3				3
2.	1 Unit Prbc	11	9			20
3.	2 Unit Prbc	6	4			10
4.	3 Unit Prbc	1	5	3		9
5.	4 Unit Prbc			5		5
6.	5 Unit Prbc			2		2
7.	>5 Unit Prbc			1	1	2
	Total	11	24	13	4	51



4.	16-20 Days	6	12%
5.	21-25 Days	1	2%
	MEAN	8.29	
	SD	4.78	
	RANGE	2-24 DAYS	

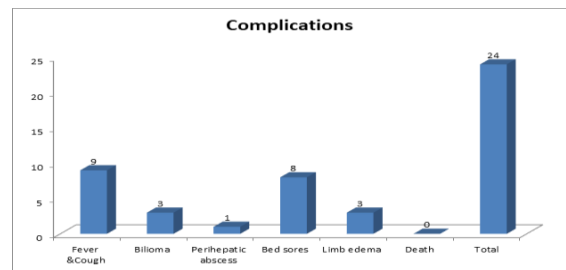
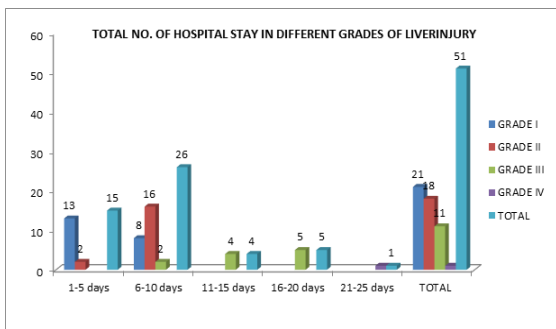
**Length Of Hospital Stay**

S.No	No Of Days In Hospital	No.Of Patients N=51	Percentage
1.	1-5 Days	14	27%
2.	6-10 Days	25	49%
3.	11- 15 Days	5	10%



**Total No. Of Hospital Stay In Different Grades Of Liverinjury**

S.No	No. Of Days Hospital	Grade I No Of Patients	Grade Ii No Of Patients	Grade Iii No Of Patients	Grade Iv No Of Patients	Total No. Of Patients
1	1-5	11	3			14
2	6-10	10	15			25
3	11-15			5		5
4	16-20			6		6
5	21-25				1	1
	Total	21	18	11	1	51

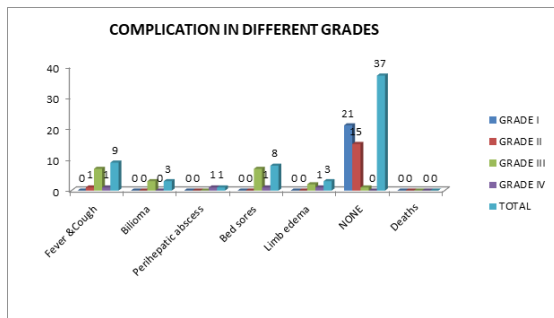


**Complications**

S.No	Complication	No. Of Patients N=51	Percentage
1.	Fever & Cough	8	18%
2.	Bilioma	1	2%
3.	Perihepatic Abscess	0	0%
4.	Bed Sores	7	15%
5.	Limb Edema	2	4%
6.	Death	0	0%
7.	Total	16	39%

**Complication In Different Grades**

S.No	Complication	Grade I	Grade II	Grade Iii	Grade Iv	Total
1.	Fever & Cough	-	1	6	1	8
2.	Bilioma	-	-	1	-	1
3.	Perihepatic Abscess	-	-	-	-	0
4.	Bed Sores	-	-	6	1	7
5.	Limb Edema	-	-	2	-	2
6.	None	21	17	2	-	40
7.	Deaths	-	-	-	-	0



## DISCUSSION

Both blunt and penetrating liver injuries are more common in males. Most liver trauma occurs in adults who drive motor vehicles or engage in fighting. Zargar M et al conducted study on 84 liver trauma patients. They noticed that males were more vulnerable for liver trauma than Females. Martin A.Croce et al 7 performed study on 136 blunt trauma abdomen cases and found that mean age group in non operative group was 33years age. In our study males were dominant 82%. The most common age group suffering from liver injury was (21-30 years) 41 %. The least common age group was (61-70years) 4% .Mean age group was 32.5 years. The overall incidence rate of liver trauma was higher in the male patients with younger age group.

The most common cause of liver injury is blunt abdominal trauma, which is secondary to motor vehicle crashes (Nawaz Khan A et al),<sup>[3]</sup> Thiago M.Z. et al conducted study on 748 liver trauma patients in which blunt trauma occurred in 287 patients(38.4%)<sup>[8]</sup>; motor vehicle crashes (MVCs – 128 cases; 17.1%).In our study the most common mode of injury was RTA (70%) : motor vehicle crashes (43%) while penetrating injuries were less(4%). Non operative treatment of penetrating injuries has been controversial. Demetriades and associates reported 36 patients with gunshot wounds of the liver,<sup>[16]</sup> of which 16 were initially treated without operation. The use of CT scanning potentially permits the tract to be outlined, and if the tract is confined to the liver and the patient is stable, operation may be avoided. Clearly, this must be used with great caution in highly selected patients.

In the study of Meyer AA criteria for selective non operative management was associated with hemodynamic stability .In our study the criteria for hemodynamic stability was systolic BP>90 mm of Hg. Feliciano et al proposed conservative treatment for any lesion regardless of the magnitude as long as the patient remained hemodynamically stable and with hemoperitoneum of less than 500 ml as estimated by CT scan.<sup>[9]</sup> In the study of Federico JA et al amount of fluid did not predict failure of conservative treatment and in our study even large hemoperitoneum (14%) was successfully managed conservatively.<sup>[11]</sup> Neither the grade of liver injury nor the degree of hemoperitoneum is indicator of surgery.

In the study conducted by Zargar M et al splenic trauma was the most common associated injury with liver 46 (54.8%) patients. Other associated injuries were thorax 21(25%), pelvis 9(10.7%), head injury 8(9.5%) and lower extremity 8(9.5%). Isolated hepatic injuries were in 18 (21.4%) cases. In our study the most common associated injury was chest injury (65%), pelvic injuries (8%), head injuries (18%), while splenic injury was less common (2%) and isolated liver injury was (4%). Poly trauma patients were usually associated with hemodynamic instability. In the study of Croce MA et al the average blood transfusion in non-operative group versus operative group was lower (1.9 vs 4.0 units; p<0.04) and in our study the average transfusion was 2.2 units.<sup>[7]</sup> The higher grade of liver injuries and polytrauma patients required large number of blood transfusions. Croce MA et al conducted study on 136 patients of liver trauma and there was no significant difference in the average length of hospital stay between non operative and operative group (16 vs. 17 days) and in our study the average length of hospital stay was 8.29 days with the range of 2-24 days, the length of hospital stay was higher in higher grade of injury. In the study of Croce et al there were fewer intraabdominal complication like bilioma and perihepatic abscess in non operative group (3%) similarly in our study intra abdominal complications 1 case (2%) had bilioma. There were no deaths in our study.

In the study by Velmahos et al , the risk for failure of nonoperative management approached 96% in the presence of (1) a splenic or renal injury with a positive FAST result, (2) an estimated amount of free fluid on CT of greater than 300 mL, and (3) the requirement for blood transfusion. If all of these factors are absent, the risk for nonoperative management failure is only 2%. In the study by Croce et al (1995), of the 112 patients, 12 (11%) failed conservative treatment and underwent laparotomy .Out of these 12 patients, 5 were liver related failures and 7 were non liver related failure. Liver related failure rates for CT grades I to V were 20%, 3%, 3%, 0%, and 12%, respectively, and failure rates according to hemoperitoneum were 2% for minimal, 6% for moderate, and 7% for large hemoperitoneum. In our study 2(4%) patients failed conservative management and underwent laparotomy due to non-liver related injuries. First case had gall bladder perforation and developed biliary peritonitis after 16 hours of initial presentation. The second case had jejunal perforation and developed peritonitis with free gas under diaphragm after 12 hours of initial presentation. No patient failed conservative management because of liver related injury. Non operative management was successful in 96% of haemodynamically stable patients irrespective of grade of liver injury and degree of hemoperitoneum. Soham N,Sweed Y12(1999) determined the results of conservative



approach in the treatment of 95 blunt abdominal traumas. 87% patients were treated conservatively. Delius RE et al 1989<sup>14</sup>, Olham KT, Guice KS et al 1986<sup>15</sup> all advocated conservative management of solid organ injuries. From above study we conclude that non operative management of liver trauma in haemodynamically stable patients is safe and effective and there were fewer complications.

### Summary

1. Majority of liver trauma if hemodynamically stable, can be managed conservatively.
2. 96% of liver trauma patients were managed conservatively.
3. Majority of liver trauma was common in third decade of life (21-30 yrs).
4. Males were more vulnerable to liver trauma (82%).
5. Neither degree of hemoperitoneum (knudson classification)<sup>118</sup> nor the grade of liver injury(AAST grading) predicts the outcome of non operative management.
6. Hemodynamic stability is the only criteria for the success of non operative management.
7. There were no cases of grade V and grade VI in our study, grade I-IV injuries were managed conservatively.
8. Chest injuries (65%) was the most common associated injury whereas splenic injuries were less common (2%).
9. The average blood transfusion was 2.2 units PRBC( range 0-7 units )and higher in grade IV.
10. The average length of hospital stay was 8.3 days. ( Range 2-24 days)
11. Failure of non operative management was due to other associated injuries.
12. Non operative management requires regular vital signs monitoring and repeated physical examinations.

### CONCLUSION

51 patients of liver trauma was managed conservatively at our centre from November 2011 to November 2013. The following conclusions can be drawn from this study.

1. The incidence of liver trauma was more common in male gender with majority of patients lying in 20-30 years of age.
2. Both blunt and penetrating liver injuries were managed conservatively. Road traffic accident was the most common cause of liver injury.
3. Grade I to Grade IV of liver injuries with small to large degree of hemoperitoneum were managed successfully. Large degree of hemoperitoneum were seen in higher grade of liver injury and polytrauma patients.

4. Chest injury was the most common associated injury. While other intraabdominal injuries were seen in higher grade of liver injury.
5. The amount of blood transfusions and length of hospital stay were more in grade III and grade IV of liver injury and polytrauma patients.
6. Non operative management of liver trauma was associated with less no. of intraabdominal complications such as bilioma was seen in grade III of liver injury.
7. Failure of non operative management was due to associated injuries(bowel injury and gall bladder injury).
8. Non operative management of liver trauma is safe and effective treatment modality of choice in haemodynamically stable patients irrespective of grade of injury and degree of hemoperitoneum.

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