

## PRESENTATION AND MANAGEMENT OF HEPATIC TRAUMA AT MAYO HOSPITAL

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*Hepatic injury is one of the most challenging problems for a trauma surgeon. We collected a data of all hepatic trauma received at our center for two years. We found that young males living in cities are maximally prone to this kind of injury. The patients presented to us late. And most of them were in hypovolemic shock. We treated 10.5% conservatively with success. The more extensive the procedure attempted, the higher was the mortality. We contained our mortality to 18% despite inadequate facilities. However we recommend a more conservative approach as we had encouraging results with it.*

**Key Words:**

*Hepatic Trauma, Liver, Injury, abdominal trauma*

### INTRODUCTION

Liver is the most frequent intra abdominal organ to be injured in abdominal trauma<sup>1</sup>. Morbidity and mortality are increased significantly due to concomitant injuries to other organs, uncontrolled hemorrhage from liver and septic complication<sup>2</sup>. From a World War 1 mortality of 66% it has come down to the current 10 to 20 percent, mainly due to safer anesthesia and better surgical practices and materials, along with a more accurate critical care<sup>3</sup>. However it still remains one of the most challenging problems for the trauma surgeon.

We present the presentation and management of traumatized liver in Mayo Hospital, Lahore where we have achieved a relatively low mortality rate of 18% in view of the rather unsatisfactory operating conditions and with erratic postoperative care.

### MATERIALS AND METHODS

57 cases of hepatic trauma were selected from among 579 admissions for penetrating or blunt abdominal trauma in our unit during two years from January 1996 to December 1998 and comprise the study group. This represents approximately a quarter of all such cases since the admissions are divided equally between four general surgical units in our center.

Data regarding the age, sex, urban or rural origin, time delay from injury to presentation, type and pattern of injury, hemodynamic status at presentation, resuscitation requirements, intra-operative findings and associated injuries was collected. A routine statistical analysis of the data was performed. A follow up of a minimum of six months was done, initially once fortnightly for three months and then monthly for three months.

A standardized protocol was followed in patients suspected to have hepatic trauma from mechanism of injury and clinical evaluation. Initial resuscitation was done with two wide bore IV cannulas and Ringer's Lactate, the volume administered being determined according to the estimated blood loss<sup>4</sup>. Colloids were used only when there was poor response to crystalloids. Due to scanty availability of blood, it was usually transfused only after preoperative hemorrhage control. A policy of conservative resuscitation was followed with the systolic blood pressure maintained in the range of 100 mm Hg. A nasogastric tube and a Foley's catheter were passed. An empiric antibiotic regimen of Ampicillin 500 mg iv, Gentamycin 80 mg iv and Metronidazole 500 mg iv was initiated in all patients along with Tetanus prophylaxis. Routine investigations including Liver Function Tests and grouping/cross matching were done and where

time permitted CXR and plain abdominal film both erect and supine were taken along with other investigations necessitated by other concomitant injuries.

A diagnosis of hepatic trauma was suspected when patient had blunt abdominal or lower thoracic trauma especially with abrasions or bruised on the right side and penetrating injuries in the epigastrium and right hypochondrium. Clinical evidence of circulatory shock (cold clammy skin,

tachycardia, hypotension, restlessness and oliguria), abdominal signs like tenderness, guarding, distention and dullness to percussion were taken as strong pointers to a hepatic injury. Radiological evidence included fracture of right lower ribs and ground glass appearance on the right side.

Hepatic Trauma was classified according to the grades devised by American Association for the Surgery of Trauma (AAST) (**Table 1**).

**Table 1:** Grades of Hepatic Trauma.

Grades	Injury	Description
1.	Hematoma	S/C* non expanding; < 10% of surface area
	Laceration	Capsular tear, non bleeding < 1 cm deep parenchymal disruption
2.	Hematoma	S/C non expanding ; 10 – 50% of surface area; Intraparenchymal, non expanding, < 2 cm in diameter
	Laceration	1 – 3 cm parenchymal depth; < 10 cm in length
3.	Hematoma	S/C, > 50% surface area or expanding; Ruptured subcapsular hematoma actively bleeding. Intraparenchymal hematoma > 2 cm or expanding
	Laceration	> 3 cm parenchymal depth
4.	Hematoma/ Laceration	Ruptured intraparenchymal hematoma with active bleeding Parenchymal disruption involving 20 – 50 % of hepatic lobe
5.	Laceration/ Vascular	Parenchymal disruption involving > 50% of hepatic lobe Juxtahepatic venous injury: major hepatic veins / retrohepatic vena cava
6.	Vascular	Hepatic Avulsion

\*S/C: Subcapsular

## RESULTS

**Table2:** Patient Characteristics n = 57

Males	50	87%
Females	7	13%
Age Range	12 – 62 years	
Mean Age	28 years	
Urban	52	91.3%
Rural	5	8.7%

An overwhelming majority of the patients were males of urban origin. Most were in the

young adult age group. Blunt (50.8%) and penetrating (49.2%) trauma were almost equally distributed. Roadside accidents (66.8%) accounted for the most frequent cause of hepatic trauma, most of them high velocity collisions with collision speeds of more than 35 km/hr. Firearms (31.5%) and Stabs (1.7%) comprised the rest of the etiology.

None of the patients reached us within one hour of injury and most frequently it took them 4 to 6 hours to reach the definitive care center. Upon arrival a very large fraction of patients was in shock, with signs of advanced hypovolemic shock apparent.

All patients had abdominal tenderness and guarding at presentation. Bowel sounds were absent in 14 patients. 59.6% were diagnosed on clinical grounds while a positive four-quadrant tap was needed to establish the diagnosis in 5 patients.

Fracture of the right lower ribs was seen in 6 patients. Emergency ultrasonography, nuclear scan or CT was not available at our center at the time of the study.

**Table 4:** *Time Interval.*

Time Interval (Hours)	No. of Patients	Percentage
<01	0	0
01 - 04	07	12.3%
04 - 06	22	38.5%
06 - 08	16	28.2%
> 08	12	21%

**Table 5:** *Grades of Injury Peroperatively.*

Grades of Injury	No. of Patients	Percentage
1	17	30 %
2	10	18 %
3	17	30 %
4	9	15 %
5	4	7 %

Top five associated injuries in order of decreasing frequency were small gut perforation,

**Table 6:** *Management and Associated Mortality.*

Mode of Treatment	No. of Patients	Percentage	Mortality	Percentage
Conservative	6	10.5%	1	16.25%
Simple Suture of the rent	12	21%	1	8.33%
Mattress Suture over Spongston	16	28.5%	3	19%
Suture over Line Omental Patch	6	10.6%	0	0
Left Lobectomy	4	7%	0	0
Right Lobectomy	1	1.8%	1	100%
Simple Polyfax Gauze Packing	12	21%	4	33.3%

Note: All patients undergoing operative intervention underwent exploratory laparotomy through a full midline incision.

diaphragmatic tear, chest injuries, renal injury and retroperitoneal hematoma. Spleen was damaged in 5.2% patients only, while gall bladder injuries were seen in 1.7%.

43 (75.5%) patients were in obvious shock at presentation, over half of them without any recordable pulse or blood pressure. About 24.5% were hemodynamically stable at presentation, most of these were the patients who had presented more than 4 hours post trauma.

A minimum of 03 and a maximum of 28 blood transfusions were needed in these patients with an overall average of 09 pints. The transfusion requirements were judged by the peroperative losses and serial blood counts coupled with clinical judgement.

Of the 6 patients treated conservatively, 2 reached the hospital within 4 hours and the rest within 6 hours. All suffered blunt trauma and on arrival had a pulse rate of <100/min and systolic blood pressure of >80 mm Hg. They were admitted to ICU with hourly monitoring and two hourly clinical evaluations. Serial ultra sonograms were done to assess the size of the hematoma/laceration. All remained stable and were discharged on 10<sup>th</sup> to 14<sup>h</sup> post admission day.

Our complications were as follows:

We had a mortality rate of 18% including all types of liver trauma patients. The mortality ratio among blunt and penetrating trauma was similar, however not all patients died of injuries of the liver; other concomitant injuries were also responsible for the mortality.

**Table 7: Complications.**

Complications	No. of Patients
<b>Early</b>	
Hemorrhage	08
Hypothermia	02
Hypoglycemia	06
<b>Delayed</b>	
Respiratory Complications	03
Intra abdominal Sepsis	06
Wound Infection	04
Wound Dehiscence	04
Jaundice	06
Biliary Fistula	03
<b>Remote</b>	
Bile Peritonitis	01
Liver ABCs	02

## DISCUSSION

Most patients reached us after about 4 to 8 hours post-trauma while none reached the trauma center in less than an hour. This shows the lack of

an efficient pre-hospital retrieval system for the patients resulting in a postulated death of many severely injured patients. Thus an urgent need exists for developing and installing such a system. We received no patient with Grade 6 injury probably because of the long transport time. 78% patients had equal to or less than Grade 3 liver injury.

Due to this late arrival with no systematic pre-hospital resuscitation being done, we need to make a prompt diagnosis and start early definitive treatment. This being only possible if the attending emergency doctor recognizes the signs and symptoms. Focal assessment by sonographic technique (FAST) is the ideal investigation to assess the situation<sup>19</sup>, and time permitting CT scan are the most sensitive and specific diagnostic aids. Four quadrant abdominal tap and Diagnostic Peritoneal Lavage are other useful investigations. One series has found an absolute correlation between Revised Trauma Score and Injury Severity Score, classes of severity of lesion and subsequent surgical survey suggest that scoring system could be adopted in the first triage of traumatic lesions of the liver<sup>16</sup>.

**Table 8: Comparative Data.**

	M	F	Mean Age	Blunt Trauma	Penetrating Trauma	Conser-vative	Suture & Drainage	Resection/ Pack	Mortality
N=37 <sup>5</sup>	84%	16%	22 yr	62%	38%		49%	16%	19%
N=64 <sup>6</sup>	61%	39%	7.6 yr			72%	17.8%	4.7%	4.7%
N=120 <sup>7</sup>									14%
N=102 <sup>8</sup>				88%	12%				22.4%
N=63 <sup>9</sup>				83%	17%				19%
N=43 <sup>10</sup>				88%	12%	14%			
N=135 <sup>11</sup>									24.4%
N=48 <sup>12</sup>	71%	29%	28.5 yrs	48%	52%	29%			
N=482 <sup>13</sup>									
N=110 <sup>14</sup>				78%	22%	5%	72%	25%	18%
N=45 <sup>15</sup>				83%	17%	22.2%	77.8%		
N=26 <sup>16</sup>				88.5%	11.5%	19%	81%		
N=73 <sup>17</sup>				60.2%	39.8%	9.5%	69.8%	20.5%	
N=230 <sup>18</sup>				67%	33%	8%	66%	26%	19%

Young males from urban origin figured predominantly in our series. The proportion of males has been shown to range from 61% to 84% in various series with an average of 72%, which is lower than our figure of 87%. Age ranges from 7.6 years to 28.5 years with an average of 19.3 years, a figure again showing the propensity of younger patients to be involved in major hepatic trauma. This reflects the increased accident-prone atmosphere in cities and a general ignoring of proper precautionary measures against accidents amongst young people.

From the literature review, we found that blunt trauma ranged from 48% to 88.5% as the mechanism of injury with an average of 74.5%, a figure much higher than our value of 50.8%, with roadside accidents accounting for about two third of our cases. Since our comparative data comes from all over the world with only one study from Oakland, USA<sup>12</sup> matching our figure, we may postulate that the pattern of the mechanism of injury in our setting has been consistently related to accident rather than crimes of violence like firearms and stabs. We have however no data available to match the socioeconomic conditions in Oakland and the rural hinterland of Lahore, to compare the results on the basis of more solid factual evidence.

Our operative approach to such patients was through a midline incision, which gives the best exposure to all areas of the abdomen. However a right paramedian incision may be made provided that the condition of the patient allows sufficient time to allow imaging studies and hence to reach the diagnosis of isolated hepatic trauma. The advantage being a robust closure leading to a stronger scar<sup>20</sup>.

Conservative treatment of hepatic injuries is gaining support in the current management of hepatic trauma. The major requirements are hemodynamic stability, availability of serial CT scan with IV contrast, isolated hepatic trauma, adequate surveillance facilities and operative capability available at all times to deal with late hemorrhage<sup>10</sup>. Some studies also recommend the availability of an angiography suite<sup>21</sup>. CT is an operator dependant investigation, but with iv contrast and an experienced operator it allows precise evaluation of liver injuries, both initially and for follow up<sup>21</sup>. The decision to treat conservatively is not taken according to the grade

of injury but on the hemodynamic stability<sup>15</sup>. We treated 10.5% patients conservatively, while the range of comparable figures is from 8% to 72%, the average being 22.3%. Our low figure can be attributed to lack of prompt diagnostic aids and improper and unreliable intensive care facilities leading to apprehensions about early detection of failure of the conservative approach.

89.5% were treated operatively. The immediate priority is to control hemorrhage which is achieved by Pringle's Manoeuvre, manual compression of liver, aortic compression above the Coelic Trunk and packing the right upper quadrant. The main cause of death in isolated hepatic trauma is shock secondary to hypovolemia<sup>22</sup>, hence newer techniques like laser and plasma radiation should be employed for the achieving hemostasis. 60.1% had suturing and drainage done, and 29.8% had resections and/or packing done because of the high grade of injury. We agree with the widely held view that segmentectomy and limited resections were less associated with mortality than standard hepatic resections<sup>23</sup>. Most of our cases were direct arrivals with little secondary referrals, usually with a previous laparotomy done and perihepatic packing in place. Due to financial constraints we could not use any innovative technology, but things like Fibrin Glue<sup>24</sup> and Polyglycolic Acid fabric<sup>25</sup> were considered.

In two separate series from India the commonest complications were: intraabdominal abscesses; coagulopathy; prolonged biliary leak; late hemorrhage and hepatic necrosis<sup>14,18</sup>. The rate of abscess formation in relation to various types of packing and drainage was found to be<sup>13</sup>.

	Abscess Rate
<b>Omental packing</b>	8%
<b>Gauze Packing</b>	30%
<b>No drain</b>	6.7%
<b>Closed suction</b>	3.5%
<b>Sump drainage</b>	13%

Hence the ideal procedure to suggest itself would be omental packing with closed suction drainage. Coagulopathy is directly related with the

blood transfusion requirements<sup>26</sup>, hypothermia and length of surgery<sup>11</sup>. Hence we recommend that liver surgery for trauma should be quick, with minimal blood loss. Bile leak occurs in almost all the patients initially, but stops quickly. Prolonged biliary leaks can lead to bilomas, biliary fistulas, hemobilia and even bile ascites<sup>27,28</sup>. CT guided aspiration is the treatment, and all fistulas closed spontaneously within a mean time period of 44 days<sup>27,28</sup>.

Mortality in our series was 18% for all types of injuries. For procedures involving hepatorrhaphy and packing with drainage, it was 10.9%, while it was 66.5% when resections and packing were done. In comparable series mortality ranged from 4.7% to 24.4% with a mean of 17.5%. These figures correlate with our study where mortality was higher if the procedure done was more extensive. Most of these deaths were from concomitant injuries<sup>7,8</sup>.

To conclude, hepatic trauma was present in 14% of all abdominal trauma to be treated in our center. Although patients most frequently presented late i.e. 4-8 hours post-injury, and with poor in-hospital logistic support, we have managed to contain the mortality to 18% which is comparable to other centers. Since our experience with conservative management had been encouraging, we recommend that where facilities are available, a conservative approach should be taken with the most important criterion being hemodynamic stability.

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