

PRESENTATION AND MANAGEMENT OF HEPATIC TRAUMA AT MAYO HOSPITAL

Fraz Fahim, Mahmood Ayyaz, Syed Mazhar Abbas

Department of Surgery,
Mayo Hospital,
Lahore.

ABSTRACT

Objective: To find out the pattern, severity and outcome of hepatic trauma in our population.

Material and Methods: This study comprised of 57 cases of hepatic trauma admitted to south surgical unit, Mayo Hospital Lahore from January 1996 to December 1998. After initial assessment and proper evaluation, patients were properly investigated and offered management accordingly. 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, intraoperative 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.

Results: Out of 57 patients, 50 were male and 7 were female. 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 frequently it took them 4 to 6 hours to reach the definitive care center. Forty three (75.5%) patients were in obvious shock at presentation. Out of 57 patients 6 were treated conservatively and the rest were offered surgical intervention. Common complications observed were haemorrhage (8 cases), sepsis (6 cases), jaundice (6 cases) and hypoglycemia (6 cases). Mortality rate was 18%.

Conclusion: Hepatic trauma is not uncommon in abdominal trauma. The delay in the arrival to the hospital is mainly the cause of the worst outcome. Conservative management with haemodynamic stability is an important measure along with surgical intervention in the management of hepatic trauma.

Key Words: Hepatic Trauma, Liver, Injury, Abdominal Trauma

INTRODUCTION

Liver is the most frequent intra abdominal organ to be injured in abdominal trauma.¹ Morbidity and mortality are increased significantly due to concomitant injuries to other organs, uncontrolled hemorrhage from liver and septic complication². 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 care³. However it still remains one of the most challenging problems for the trauma surgeon.

This study was conducted to evaluate the pattern, severity and presentation of hepatic trauma at Mayo Hospital Lahore.

MATERIAL AND METHODS

Fifty-seven 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, intraoperative 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 loss⁴. 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 X-Ray chest 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 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)

RESULTS

Out of 57 patients, 50 patients (87%) were male and 7(13%) were female; with age ranging from 12 to 62 years. Mean age was 28 years. Fifty two patients (91.3%) were from urban region. 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

Grades of Hepatic Trauma

Grades	Injury	Description
1	Hematoma Laceration	S/C* non expanding; < 10% of surface area Capsular tear, non bleeding < 1 cm deep parenchymal disruption
2	Hematoma Laceration	S/C non expanding ; 10 - 50% of surface area; Intraparenchymal, non expanding, < 2 cm in diameter 1 - 3 cm parenchymal depth; < 10 cm in length
3	Hematoma Laceration	S/C, > 50% surface area or expanding; Ruptured subcapsular hematoma actively bleeding. Intraparenchymal hematoma > 2 cm or expanding > 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

Table 1

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 2

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.

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

Forty three (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.

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

Grades of Injury Peroperatively

Time Interval (Hours)	No. of Patients n=57	Percentage
1	17	30 %
2	10	18 %
3	17	30 %
4	9	15 %
5	4	7 %

Table 3

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 10th to 14th post admission day.

Complications observed and presented in table 5.

We had a mortality rate of 18% including all types of liver trauma patients. The mortality ratio among blunt and

Complications

COMPLICATIONS	NO. OF PATIENTS
Early	
Hemorrhage	08
Hypothermia	02
Hypoglycemia	06
Delayed	
Respiratory Complications	03
Intra abdominal Sepsis	06
Wound Infection	04
Wound Dehiscence	04
Jaundice	06
Biliary Fistula	03
Remote	
Bile Peritonitis	01
Liver ABCs	02

Table 5

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 Spongoston	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%

Table 4

penetrating trauma was similar, however not all patients died of injuries of the liver; other concomitant injuries were also responsible for the mortality.

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. Seventy eight percent 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, 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 liver¹⁶.

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, USA¹² 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

Comparative Data

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

Table 6

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 scar¹⁹.

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 hemorrhage¹⁰. Some studies also recommend the availability of an angiography suite²⁰. 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 up²⁰. The decision to treat conservatively is not taken according to the grade of injury but on the hemodynamic stability¹⁵. 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.

In our study 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 hypovolemia²¹, hence newer techniques like laser and plasma radiation should be employed for the achieving hemostasis. In this study 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 resections²². 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 Glue²³ and Polyglycolic

Acid fabric²⁵ were considered.

In two separate series from India the commonest complications were: intraabdominal abscesses; coagulopathy; prolonged biliary leak; late hemorrhage and hepatic necrosis^{14,18}. The rate of abscess formation in relation to various types of packing and drainage was as below¹³.

Time Interval

Abscess Rate	
Omental packing	8%
Gauze Packing	30%
No drain	7%
Closed suction	3.5%
Sump drainage	13%

Table 7

Hence the ideal procedure to suggest itself would be omental packing with closed suction drainage. Coagulopathy is directly related with the blood transfusion requirements²⁵, hypothermia and length of surgery¹¹. 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^{26,27}. CT guided aspiration is the treatment, and all fistulas closed spontaneously within a mean time period of 44 days^{26,27}.

Mortality in our series was 18% for all types of injuries. For procedures involving hepatotomy 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^{7,8}.

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.

REFERENCES

1. Feliciano DV. Surgery for liver trauma. *Surg Clin North Am* 1989; 69:273-84.
2. Beal SL. Fatal hepatic hemorrhage: an unresolved problem in the management of complex liver injuries. *J Trauma* 1990;30:163-9.
3. Krige JE, Bornman PC. Liver trauma in 446 patients. *South Afr J Surg* 1997; 35:10-15.
4. Krantz BE. Advanced trauma life support for doctors. 1997; 93-4.
5. Muhammad I., Mabogunje O. Management of liver injuries in Zaira, Nigeria. *Injury* 1990; 21:174-6.
6. Ringer L. Canadian Association of Paediatric Surgeons: Liver Trauma Study. *J Paediatr Surg* 1989; 24: 1035-40.
7. Schweizer W, Tanner S. Diagnosis and Therapy of Liver Injuries in the Polytraumatized patient. *Helvatica Chirurgica Acta* 1989; 55: 597-612.
8. Eisner L, Ackermann C, Regazzoni P, Harder F. Therapy and prognosis in 102 liver injuries. *Helvatica Chirurgica Acta* 1989; 55:593-6
9. Watson DI, Williams JA. Management of traumatized liver: An appraisal of 63 cases. *Aust N Z J Surg* 1989; 59:137-42
10. Strukmann JR, Pederson IK, Burcharth F. Liver trauma. *Ugeskr Laeger* 1997; 159 (34): 5098-102
11. Chevallier JM, Jost JL, Menegaux F, et al. Hepatic trauma: Experience of 135 consecutive liver injuries (1982-1989) and arguments for conservative surgery. *Langenbecks Archiv fur Chirurgie* 1991; 376:335-40.
12. Smith RS. Non operative management of hepatic trauma. *Milit Med* 1991; 156:472-4.
13. Fabian TC, Croce MA, Stanford GG, et al. Factors affecting morbidity following hepatic trauma. A prospective analysis of 482 injuries. *Ann Surg* 1991; 213: 540-8.
14. Shah PA, Kulkarni SS, Joshi N, et al. Hepatic trauma: Experience of 110 cases. *Injury* 1993; 24: 303-5.
15. Wu J, Liu M, Huang MS, et al. Management of liver trauma in adults: The results of selective non operative management and operative treatment. *Chinese Med J* 1992; 50: 482-8.
16. Cavina E, Goletti O. Clinical evaluation of hepatic lesions: Guidelines for diagnostic protocols and injury severity scores. *Annali Italiani di Chirurgia* 1992; 63: 735-42.
17. John TG, Greig JD, Johnstone AJ, et al. Liver trauma: A 10 year Experience. *Br J Surg* 1992; 79: 1352-6.
18. Shah P, Mohanty S. Hepatic trauma: An Indian experience. *Int Surg* 1995;80: 247-50.
19. Rintoul R.F. Farquharson's Textbook of operative surgery, 8th Edition: 339
20. Schweizer W, Becker C, Tanner S, et al. The significance of CT for conservative treatment of liver trauma. *Helvatica Chirurgica Acta*, 1993; 59: 717-24.
21. Koshelev VN, Chalyk IUV. Ways to decrease lethality in mechanical injuries to the Liver. *Vestnik Khirurgii Imeni i-I-Grekova* 1991; 146: 50-4
22. Sherlock DJ, Bismuth H. Secondary surgery for liver trauma *Br J Surg* 1991; 78 : 1313-7.
23. Oschsner MG, Maniscalco-Theberge ME. Fibrin glue as a hemostatic agent in hepatic and splenic trauma. *J Trauma* 1990; 30: 884-7.
24. Delany HM, Ivatury RR, Blau SA, et al. Use of Biodegradable (PGA) fabric for repair of solid organ injury: A combined institution experience. *Injury* 1993; 24: 585-9.
25. Krige JE, Bornman PC, Terblanche J. Therapeutic perihepatic packing in complex liver injuries. *Br J Surg* 1992; 79: 43-6.
26. Howdieshell TR. Biloma and biliary fistula following hepatorrhaphy for liver trauma *Am Surg* 1995; 61: 165-8.

27. Shahrudin MD, Noori SM. Biloma and biliary fistula associated with hepatorrhaphy for liver injury Hepato-Gastroenterol 1997; 44:519-21.

Address for Correspondence:

Dr Fraz Fahim
South Surgical Ward,
Mayo Hospital, Lahore.
Email: surgeononline@hotmail.com