TRAUMA MANAGEMENT IN A TERTIARY CARE HOSPITAL IN PESHAWAR, PAKISTAN

Usman Ali, Ashab Noor, Mian Mujahid Shah*, Waqar Alam
Department of Surgery, Postgraduate Medical Institute, Lady Reading Hospital, Peshawar
***Department of Forensic Medicine, Women Medical College Abbottabad**

Background: With an increasing incidence of road traffic accidents and weapon injuries there is increasing need for improvement in trauma management. Liver being a highly vascular organ and strategically located is difficult to manage. **Methods:** Study was conducted in Surgical 'A' Unit, Lady Reading Hospital, Peshawar from August 2003 to September 2005. It was a descriptive study and all patients were operated in emergency department. All relevant data of patients were recorded from the emergency and admission protocols. **Results:** A total of 364 trauma patients were received and among those 48 patients had liver trauma, 75% of patients had penetrating and 25% had blunt trauma. Most of the patients had grade III liver injuries. There were no grade V and VI injury. Repair with perihepatic packing for liver injuries remains the most frequently performed procedure (41% of patients). **Conclusion:** In a stable patient blunt trauma liver can be managed conservatively by serial examinations and investigations with emergency laparotomy facilities at hand. Perihepatic packing and damage control surgery is the valuable procedure at hand. Increasing grades of liver injuries leads to increasing morbidity and mortality. The same is the case with multiple organ injuries.
Keywords: Hepatic trauma; liver injuries; laparotomy; grading system; management.

INTRODUCTION

Liver is the largest solid organ in the abdominal cavity.[1] Liver can be injured by blunt and sharp trauma. Blunt trauma usually causes fracturing of liver but may result in vascular avulsion injury; it may also cause sharp injury by fracturing the ribs and drawing them into the liver. Sharp weapons can cause deep penetrating wounds. Drivers occupying the right side of vehicle are more liable to liver trauma.[1]

Liver is the most frequently injured organ in penetrating abdominal trauma. Liver fractures caused by blunt injury are of two main types: Liver fracture with tear in capsule resulting in hemoperitoneum, and fracture without injury to the capsule resulting in haematoma (subcapsular). A severe trauma will result in a central fracture with multiple peripheral radiations. With increasing incidence of trauma patients there is increasing stress on trauma management. Trauma scoring system has been devised and liver trauma management is being standardized.

Table-1: Injury scale by American Association for the Surgery of Trauma

Grade	Criteria
I.	Subcapsular hematoma less than 1 cm in maximal thickness, capsular avulsion, superficial parenchymal laceration less than 1 cm deep, and isolated periportal blood tracking
II.	Parenchymal laceration 1–3 cm deep and parenchymal/ subcapsular hematomas 1–3 cm thick
III.	Parenchymal laceration more than 3 cm deep and parenchymal or subcapsular hematoma more than 3 cm in diameter
IV.	Parenchymal/subcapsular hematoma more than 10 cm in diameter, lobar destruction, or devascularization
V.	Global destruction or devascularization of the liver
VI.	Hepatic avulsion

The present study was undertaken to know how the patients were managed surgically in different grades of liver injury and also about prognosis of different grade injuries.

PATIENTS AND METHODS

The study was conducted in Surgical 'A' Unit of PGMI, LRH, Peshawar from August 2003 to September 2005. This was a descriptive study. All the patients presented to our casualty. They were examined and resuscitated at the same time. A brief history regarding the type of injury and various co-morbid states was taken. All the patients were properly exposed and examined from head to toe. The investigations done routinely were:

- HBsAg and HCV status
- Urea, creatinine and RBS.
- X-ray erect abdomen/ lateral position. (X-ray chest also in some cases)
- Ultrasound abdomen.
- Peritoneal aspiration
- CT scan in stable patients only.

Decision regarding laparotomy was taken after examination and investigation. Another indication for laparotomy was persistent low blood pressure after adequate infusions. Laparotomy was done using midline incision; findings were noted during laparotomy and grading of liver injury was done. Stable patients were put on conservative management. They were diagnosed and subsequently graded on ultrasound and C.T. abdomen. Patients having a collection of around 500 ml were also considered for conservative management. The criteria for conservative management were:

1. Blunt trauma abdomen patients without history of loss of consciousness.
2. Haemodynamicaly stable patient.
3. Achievement of haemodynamic stability with modest amount of i/v fluids.
4. No additional injury or signs of peritoneal irritation.

Conservative management is not for centres having any CT/ultrasound or emergency laparotomy facilities. Such patients were closely monitored for blood pressure, pulse, abdominal tenderness, abdominal girth, hourly urine and serial haemoglobin estimations. During Laparotomy the following procedures were done:

1. Perihepatic packing.
2. Ligation of hepatic bleeding.
3. Debridement only with packing of lacerated liver.
4. Haemostatic suturing of liver parenchyma in clear cut injuries.
5. Lobectomy
6. Right hepatectomy

RESULTS

We received a total of 364 trauma patients in casualty department during 2 years period. Among 364 patients, 48 (13.2%) had liver injury. Male were 40 while female were 8 (M:F ratio 5:1). Age range was from 20 to 60 years with mean of 35 years.

In our unit firearm injuries tops the list of trauma patients consisting of 75% of total patients. 25% of patients were having blunt trauma injury. 10 patients (20.8%) had isolated liver injuries while 41% had two organ system involvement and 37.5% had 3 organ systems involved. 10% patients were treated conservatively while in rest of patients laparotomy was performed (Table-2).

Table-2: Distribution of liver injury in trauma (blunt/ firearm/penetrating)

Variables	No. of cases	%
Total cases of trauma	364	100
Liver injuries [total]	(48)	(13.2)
Liver injuries only	10	20.8
Liver +gut [two organ system involvement]	20	41.6
Liver +gut+urological system [three organs system involvement]	18	37.5

Most of the patients (58.8%) had grade III liver injuries (Figure-1) with 12 patients (8%) having associated gut injuries and 6 patients had trauma to urological system, while 12.5% of patients had associated chest injuries and diaphragmatic injuries requiring chest intubation. Out of the total, 12.5% of patients were having thoracoabdominal injury having very high mortality, 21.6% of patients were having grade IV injuries with associated gut injuries (20.5%) and chest injuries (4.1%). There were no vascular injuries of grade V and VI. Most of such patients (grade V and VI) usually die before reaching hospitals (Table-3).

Table-3: Distribution of clinical details of liver injury

Variables	No. of cases	%
Grade of liver injury		
I	2	5.0
II	8	16.66
III	28	58.8
IV	10	21.6
V	0	-
VI	0	-
Time since injury		
One hour	2	4.0
Two hours	20	42.50
Four hours	26	44.0
Condition at arrival		
Stable	8	16.66
Shock responding rapidly	16	33.30
Shock slow responding	24	50.0
Treatment		
Conservative	5	10.0
Active	43	90.0

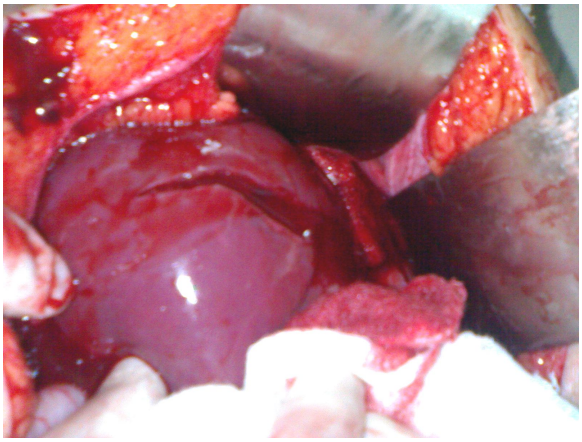

Figure-1: Photograph of a female having penetrating injury to the liver with active bleeding after being stabbed in chest, receiving a thoraco-abdominal injury. She was discharged without any complications on 5th postoperative day

Among the organ systems injury two organs system injury was on top of the list with 41.6% of patients presenting as both hepatobiliary system and gastrointestinal system involvement.

Majority of patients came to our emergency unit after more than 4 hours. 16.6% of patients were received in stable condition.50% of patients presenting late and had complication (Table-4).

In majority of cases (Table-5) perihepatic packing was performed and it was successful when packs were removed 24 hours later (58.8% of patients). In associated gut injuries haemostasis and

suturing of perforation remains the most frequently performed procedure.

Among the complications (Table-6), residual abscess was the most frequent one in patients (25%). In 4 patients ultrasound guided aspiration was done which was successful, while in 2 laparotomy was performed for multiple abscess. Second most frequent complication was bile leak (16%). They were managed conservatively.

Table-4: Complications in relation to delay in treatment

ARRIVAL GROUPS	No. of complications	%
Group A (n=2) (reaching in 1 hour)	0	-
Group B (n=20) (reaching from 1–2 hours)	3	15.0
Group C (n=26) (reaching from 2–4 hours)	22	85.0

Table-5: Procedures performed in liver trauma

Procedures prformed	No. of cases	%
Perihepatic packing+drainage	28	58.83
Debridement/drainage	8	16.66
Haemostatic suturing hepatorrhaphy	6	12.5
Suture ligation of bleeders	4	8.3
Right hemi-hepatorrhaphy	1	2.5
Left lobectomy	1	2.5
Segmental resection	-	-

Table-6: Various postoperative complications

COMPLICATIONS	No. of cases	%
Abscess	12	24
Bile leaks	8	2
Wound dehiscence	8	16
Jaundice	4	8
Renal failure	4	8
Bleeding	4	8
Coagulopathy	2	4
Sepsis	2	4
Diaphragmatic injury	2	4
Pleural effusion	1	2
Pneumonia	1	2
Haematoma	0	-

DISCUSSION

Liver is highly vascular and vital organ.[1] It is situated in the upper abdomen (thoracic part) protected by ribs. This protective cage and strategic position leads to exposure problems during laparotomy for liver injuries. Sometimes the incision has to be extended to thorax to get gross exposure. Difficulties encountered during management of bleeding liver and other unstable patients led to the advent of damage control surgery.

Patients having liver injuries can be managed conservatively. The criteria for conservative management include CT scanning with I/V contrast. There should be no free contrast around liver. Any collection/bile leaks can be looked after by ultrasound guided aspiration. Any free contrast and massive necrotic regions in liver is an indication for surgery.[2] Patients with free flowing contrast on CT but stable clinically can be managed by successful by embolization.[3]

Carrillo[4] has termed angio-embolization to be life-saving in patients persistently bleeding after perihepatic packing. Mohr *et al*[5] has termed angio-embolization as safe and effective procedure. But at the same time he also stressed early embolization as angio-embolization is also associated with complication like liver necrosis and abscess.[5] Sriussadaporn[3] reported that 3% of conservatively managed patients heeded angio-embolization. Hagimora[6] concluded that absorbable material should not be used for angioembolisation as it leads to pseudoaneurysm formation.

We received 75% of patients with penetrating abdominal trauma (firearm injuries). Asensio *et al*[7] reported that 79% of patients with liver injuries were having penetrating abdominal trauma while a number of authors[3, 8-11] reported that blunt trauma is the most frequent cause of liver injury. Gurs[12] reported high mortality in blunt abdominal trauma. Most of the authors reported high incidence of blunt trauma liver as the leading cause but in our series it is the penetrating (firearm) injury as the most frequent cause of liver injury; reflecting Pukhtoon culture. Pukhtoons are traditionally equipped with firearms.

In 20% of cases, patients were having isolated liver injuries while in 80% of cases it was multiple organ system injuries. 20 patients (41.6%) were having two system involvement while 37.5% of patients were having 3 organ system injuries.

Milotie *et al*[13] reported 90% of cases injured in Croatia conflict were having liver and multi organ system involvement. Liver injuries in his study were of grade III and IV in 75% of cases. His survival rate was 50% with high rate of septic complications. His conclusion was that injuries having multi system involvement has very high mortality. 10% of our patients were treated conservatively while 90% were managed actively (by laparotomy). Bonaviol *et al*[14] treated conservatively 25% of patients and his results were successful managed in 88.5% of cases. Brammor RD[9] treated conservatively 50% of patients with blunt trauma and concluded that most of the patients with liver injuries can be managed conservatively. Trunkey[15] said that he believed that some of the authors are over enthusiastic about conservative management and surgeons should keep every armamentarium in their hand.

In our study we received most of the patients in grade II, III, IV while there were no grades V and VI injuries. It may be due to fact that such patients do not reach hospital.

All the patients were operated in casualty Operation Theatre and principles of damage control laparotomy were applied. After giving midline incision the abdominal cavity was packed the patient was resuscitated, until well stable. After the stability was achieved haemostasis was secured and a search was made for injuries and various operative procedures were performed.

The operative procedure most commonly done was perihepatic packing and drainage. Such packs were removed after 24 hours with no bleeding. Perihepatic packing 58.83% was done, followed by debridement/drainage (16.6%). Haemostatic suturing, hepatorrhaphy (12.5%) and suture ligation of bleeders (8.3%) were the most frequent procedures. Although suture ligation of bleeders in injured liver is the most definitive management in controlling haemostasis, usually it is not possible because of the unstable condition of patient or multiple vessel injury retracting into the liver parenchyma or hepatic venous injury which can not be controlled by clamping hepatic artery. Hepatic venous injuries can only be managed definitively by taking control of i.v.c. (by passing i.v.c. above and below the liver).

Gur[12] reported that primary suturing was done in more than 80% of cases of I, II, III grade injuries. In less than 20% of cases re-sectional debridement was done in grade I, II, III. While in grade IV, V and VI most of the patients had re-sectional debridement. Gur[12] reported high mortality in IV, V and VI grades. Our series showed only 20% cases in grade IV. There were no grade V and VI injuries.

Milotie *et al*[13] managed his 75% of cases by debridement, ligation of bleeders and bile ducts. Buddhaboriwan[8] reported that most of the cases in his series were grade II and hepatorrhaphy, suture ligation of bleeders and drainage of liver was performed in majority of cases. Gao[16] reported success rate of 80% in retrohepatic caval injury with packing and 82% in patients without such injury. Sariussadoponn[3] reported performing perihepatic packing in 21% of patients with liver injury. Two patients needed subsequent angio-embolization. He termed perihepatic packing as life saving. Richardson *et al*[11] termed packing and embolization effective methods of haemorrhage control.

Fengjun[17] reported management of 197 patients along the lines of damage control surgery. He reported success in pancreatic duodenal injury by doing damage control surgery. He concluded that major surgery is not possible without damage control. Chino[18] reported successfully treated 2 patients with juxta-hepatic venous injury with perihepatic packing and recombinant factor VII. Vatanaprasan[19] termed perihepatic packing to be useful procedure when termination of operation was considered necessary. Perihepatic packing was used in 73% of patients with high-grade injuries and yielded success rate of 65.5%. 25% of patients of high grade injuries died.

In our series abscess formation in 25%, bile leak in 13% and wound dehiscence in 13% of cases and there were the frequent tabulated complications. Overall mortality was as high as 12% in our series. The causes of death were haemorrhage, sepsis, coagulopathy and renal failure.

Nicholas *et al*[20] reported intraabdominal abscess in 18% of cases and 42% of patients had sepsis. Mohr *et al*[5] reported death rate of 45% in arterial embolization procedure, the cause being necrosis, biliary leaks and abscess. Milotie *et al*[13] reported 50% complications in liver injuries, which consisted of sepsis complications, haemorrhage and abscess. Gao and associates[16] reported on overall mortality of 11.8% and high mortality in grade IV and V. Buddhaboriwan[8] reported 76.6% survival rate. Bonariol *et al*[14] reported a mortality rate of 15%. Vatanaprasan[19] reported a mortality of 12.1%.

In our series liver trauma was observed in 13% of trauma cases. 75% of patients had penetrating liver injuries. Majority of the liver injuries were of grade III/IV 28/10 respectively. 10% of patients were managed conservatively, 43 patients were operated. Perihepatic packing was most frequently performed procedure. Abscess formation and bile leak was most frequent postoperative complication.

CONCLUSIONS

1. Early transportation to hospital has improved survival rate in cases of trauma in general and hepatic injuries in particular.
2. During transportation of patient circulatory support is lacking and paramedics must be trained in ABC of trauma. It will further improve survival rate.
3. Most of the grade I, II, III injuries can be managed by debridement, suture ligation of bleeders and hepatorrhaphy.
4. High-grade injuries need damage control surgery i.e. perihepatic packing resuscitation followed again by laparotomy.
5. Angio-embolization is an invaluable addition to the management. It can be used in association with perihepatic packing {if still bleeding} or in isolated cases of conservative management.
6. Operating surgeon should be well versed with principles of damage control and anatomy of liver. In well-established trauma centres the surgeon is liver transplant surgeon.

RECOMMENDATIONS

1. Transportation to hospital needs to improve further.
2. Paramedics need to be trained in the basics of trauma management.

3. Trauma centres need to be developed.
4. Angio-embolization (intervention radiology) needs to be developed.
5. Liver transplant surgeon must be a member of trauma team (currently composed of general surgeon, cardiac, vascular, thoracic surgeon, urologist).
6. I.C.U. facility must be available for the patient who can go into a number of complications.

REFERENCES

1. Strong RW. The management of blunt liver injuries. In: Johnson TCD, editor. Recent advances in surgery. 24th ed. Edinburgh: Churchill Livingstone; 2001.p125–37.
2. Hoyt DB. Trauma specific injuries. In: Cuschieri A, Steele RJC, Moossa AR, editors. Essential Surgical Practice. 4th ed. Oxford: Butterworth-Heinemann; 2000.1–42.
3. Sriussadaporn S. Pakart R, Thararej C, Sirichindakul B, Chiamananthapong S. A multidisciplinary approach in the management of hepatic injuries. Injury 2002;33:309–15.
4. Carrillo EH, Richardson JD. The current management of hepatic trauma. Adv Surg 2001;35:39–59.
5. Mohr AM, Lavery RF, Barone A, Bahrampour P, Magnotti IJ, Osband AJ, *et al*. Angiographic embolization for liver injuries: low mortality, high morbidity. J Trauma 2003;55:1077–81.
6. Hagiwara A, Taral T, Murata A, Matsada T, Yamaguti Y, Shimazoki S. Relationship between pseudoaneurysm. J Trauma 2005;59:49–53.
7. Asensio JA, Roldan G, Petrone P, Rojo E, Tillou A, Kuncir E, *et al*. Operative management and out comes in 103 AAST-OIS grades IV and V complex hepatic injuries: trauma surgeons still need to operate, but angio-embolization helps. J Trauma 2003;54:647–53.
8. Buddhaboriwan T. Management of liver injuries in Pahalpolpay Uhasena hospital. J Med Assoc Thai 2003;86:103–10.
9. Brammer RD, Bramhall SR, Mirza DF, Mayer AD, McMaster P, Buckels JA. A 10 years experience of complex liver trauma. Br J Surg 2002;89:1532–7.
10. Claridge JA, Young JS. A successful multimodality strategy for management of liver injuries. Am Surg 2000;66:920–5.
11. Richardson D, Franklin GA, Lukan JK, Carrillo EH, Spain DA, Miller FB, *et al*. Evolution in the management of hepatic trauma: a 25-year perspective. Ann Surg 2000;232:324–30.
12. Gur S, Orsel A, Atahan K, Hokmez A, Tarcan E. Surgical treatment of liver trauma (analysis of 244 patients). Hepatogastroenterology 2003;50:2109–11.
13. Milotie F, Uravic M, Raguz K, Depolo A, Rahelic V, Bacic G, *et al*. Penetrating liver war injury a report on 172 cases. Mil Med 2003;168:419–21.
14. Bonariol L, Massani M, Carztozozolo E, Recordare A, Callegari P, Antoniutti M, *et al*. Selection criteria for non-surgical treatment of liver injury in adult poly traumatized patients. Chir Ital 2002;54:621–8.
15. Trunkey DD. Hepatic trauma: contemporary management. Surg Clin North Am 2004;84:437–50.
16. Gao JM, Du DY, Zhao XJ, Liu GL, Yang J, Zhao SH, *et al*. Liver trauma: experience in 348 cases. World J Surg 2003;27:703–8.
17. Fengjun L, Mteta KA, Xuting Z, Nanhai S. Complex therapy for hepatic trauma. East Afr Med J 2005;82:28–33.
18. Chino J, Paolini D, Tran A, Mathew P, Howdieshell TR. Recombinant activated factor VII as an adjunct to packing for liver injury with hepatic venous disruption. Am Surg 2005l;71:595–7.
19. Vatanaprasan T. Operative treatment of hepatic trauma in Vachira Phuket hospital. J Med Assoc Thai 2005;88:318–28.
20. Nicholas JM, Rix EP, Easley KA, Feliciano DV, Cava RA, Ingram WL, *et al*. Changing pattern in the management of penetrating abdominal trauma: the more things change, the more they stay the same. J Trauma 2003;55:1095–108.

Address for Correspondence:

Dr. Usman Ali, Senior Registrar, Surgical Unit, KGN Hospital, Bannu, Pakistan
Email: usalikhan60@yahoo.com