ORIGINAL ARTICLE

Presentation and outcome of surgically managed liver trauma: experience at a tertiary care teaching hospital

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Abstract

Objective: To document and analyse the presentation and outcome of surgical management of liver trauma.

Methods: The study was a retrospective review of records of all surgeries carried out at the Department of General Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad, from January 2003 to December 2010. The study included all adult patients of either gender who presented with liver trauma and underwent operative management. Convenience sampling technique was employed. The study excluded patients who were managed conservatively. The data were collected through a proforma and analysed through SPSS 10.

Results: Out of 113 cases of liver trauma, 91 (80.5%) were males and 22 (19.4%) were females. The mean age was 34.8±9.7 years. Road traffic accidents were the leading cause (n=75; 66.3%) of injuries. There were 37 (32.7%) patients with grade I injury; 41 (36.2%) with grade II injury; 29 (25.6%) with grade III injury; and 7 (6.1%) patients with grade IV injury. Besides, 62 (54.8%) patients had associated extra-hepatic injuries. Majority of the patients presented with haemodynamic compromise (n= 97; 85.8%).

Perihepatic packing was the commonest operative procedure instituted (n=43;38%). The in-hospital mortality was 9.7% (n=11).

Conclusion: Liver trauma constitutes an important cause of emergency hospitalisation, morbidity and in-hospital mortality in our population. It predominantly affects the younger males and road traffic accidents are the leading cause. Majority of the patients are successfully managed with perihepatic packing.

Keywords: Liver trauma, Perihepatic packing, Damage control surgery. (JPMA 63: 436; 2013)

Introduction

Liver trauma represents an important aspect of trauma which both in isolation as well as part of poly-trauma carries significant morbidity and mortality.[1-3] It may be caused by a variety of blunt and penetrating mechanisms.[1,4-6] Over the years, the outcome has improved owing to better critical care, damage control strategies, antibiotics, blood transfusions and imaging interventions.[1,2,7]

The present study was conducted to document and analyse the various causes, clinical presentation, morbidity and mortality of surgically-managed liver trauma with the aim of generating evidence that could prompt measures to address the issue more efficiently.

Patients and Methods

A retrospective review of surgical cases was carried out at the Department of General Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad, from January 2003 to December 2010. The study included all adult patients of either gender who presented with liver trauma and underwent operative management. Convenience sampling technique was employed. The study excluded those patients of liver trauma who were managed conservatively. As the study was an observational one and did not involve any fresh intervention, it was conducted in accordance with the Declaration of Helsinki of 1975, as revised in 1983, and the anonymity of the participants was ensured.

Initial assessment and diagnosis was made by history, physical examination and ancillary investigations, including ultrasound abdomen, computed tomography (CT) scan abdomen, and diagnostic peritoneal lavage where indicated.

The proforma employed encompassed variables such as socio-demographic profile of the patient, mechanism/cause of injury, haemodynamic status at emergency presentation, grade of liver injury on operative assessment, associated extra-hepatic injuries, surgical procedure instituted, post-operative complications encountered, need for care in the intensive care unit (ICU), length of hospital stay, and mortality. The liver injury was graded according to the liver injury scale of the American Association for the Surgery of Trauma-Organ Injury Scale (AAST=OIS)[7] (Table-1).

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Patients were resuscitated and arrangements were made for emergency exploratory laparotomy wherein the needful surgical procedures were undertaken to address the liver injury. Transfusions of whole blood and fresh frozen plasma (FFPs) were undertaken to optimise the haematological parameters. The specific armamentarium employed for liver injuries included topical haemostatic agents (i.e. oxidised cellulose/gelatin), suture hepatorrhaphy, perihepatic packing with temporary abdominal closure, and right hepatic artery ligation. The principles of damage control surgery were followed particularly in cases of moderate to high grade injuries and care was taken to ensure prevention of hypothermia, acidosis and coagulopathy. The patients with perihepatic packing and temporary closure of abdominal incision were shifted to ICU for correction of metabolic derangements and correction of hypothermia. Removal of perihepatic packs and definitive procedure, if needed, were undertaken after 48-72 hours. Associated injuries were managed according to standard protocols. A drain was left in the liver bed to effect any drainage and monitor any bleeding/biliary leak.

The data collected was analysed through SPSS version 10 and various descriptive statistics were used to calculate frequencies, percentages, means and standard deviation. The numerical data such as age, hospitalisation, and duration of hospital stay were expressed as mean ± standard deviation. The categorical data such as gender distribution and surgical procedures instituted were expressed as frequencies and percentages.

Results

Out of 113 patients, 91 (80.53%) were males and 22 (19.46%) were females. The male:female ratio was 4.13:1. The age of the patients ranged between 14-60 years with a mean of 34.85±9.75 years.

The causes included RTAs (n= 75; 66.37%), firearm injuries (n= 15; 13.27%), falls (n= 13; 11.50%), stabs (n= 7; 6.19%) and blast injuries (n= 3; 2.65%).

Time lapse between sustaining injury and hospital presentation was 0-4 hours in 23 (20.35%) patients, and 4-8 hours in 66 (58.40%), while 24 (21.23%) patients presented after 8 hours of the injury. Ninety-seven (85.84%) patients presented with haemodynamic compromise.

There were 37 (32.74%) patients with grade I injury, 41 (36.28%) with grade II injury, 29 (25.66%) with grade III injury, and 7 (6.19%) with grade IV injury. There were no patients with grade V or VI injury.

Overall, 62 (54.86%) patients had associated injuries, which included small gut (n=20; 17.69%), colon/rectum (n=9; 7.96%), spleen (n=7; 6.19%), diaphragm (n=4; 3.53%), kidney/urinary bladder (n=4; 3.53%) and stomach (n=3; 2.65%). The associated extra-abdominal injuries included thoracic injuries (n=6; 5.30%), long bone fractures (n=4; 3.53%) and head injury (n=5; 4.42%).

Five operative procedures (Table-2) were undertaken, and complications were encountered in 27 (23.89%) cases (Table-3).

Transfusions of whole blood (number of units) instituted among the patients were 2.29±0.83 (range 1-4 units). One-unit transfusion was done in 15 (13.27%) patients, two units were transfused in 62 (54.86%) patients, three units were transfused in 24 (21.23%) patients, while 12 (10.61%) patients needed transfusion of 4 units. FFPs transfused were 4.1±1.22 (range 3-6 units).

The hospital stay ranged from 7-28 days with a mean of 13.1±4.58 days. Besides, 51 (45.13%) patients were managed in the ICU. The ICU stay was 7-23 days with a mean of 16.50±3.15 days. The in-hospital mortality in our

Table-1: Liver injury grading by the American Association for the Surgery of Trauma.[7]

Grade	Injury description	
I	Haematoma	Subcapsular, non-expanding, <10% of surface area.
	Laceration	Capsular tear, non-bleeding, with < 1 cm deep parenchymal disruption.
II	Haematoma	Subcapsular, non-expanding, 10-50% of surface area, intra-parenchymal, non-expanding, < 2 cm in diameter.
	Laceration	< 3 cm deep parenchymal disruption, < 10 cm in length
III	Haematoma	Subcapsular, >50% of surface area or expanding, ruptured Subcapsular haematoma with active bleeding, intra-parenchymal haematoma > 2 cm.
	Laceration	>3 cm deep parenchymal disruption, > 10 cm in length
IV	Haematoma	Ruptured central haematoma.
	Laceration	Parenchymal disruption, < 75% of hepatic lobe
V	Laceration	Parenchymal disruption, >75% of hepatic lobe
	Vascular	Juxta-hepatic venous injuries (retro-hepatic cava/major hepatic veins)
VI	Vascular	Hepatic avulsion

Table-2: Liver injury-specific surgical procedures (n=113).

Operative procedure	Frequency (%)
Perihepatic packing with temporary abdominal closure	43 (38.05)
Suture hepatorrhaphy with topical haemostatic agents (oxidised cellulose/gelatin)	39 (34.51)
Suture hepatorrhaphy alone	17 (15.04)
Suture hepatorrhaphy and perihepatic packing	8 (7.07)
Right hepatic artery ligation	6 (5.30)

Table-3: Post-operative complications (n=27).

Complications	Frequency (%)
Abscess formation in abdominal cavity	11 (9.73)
Septicaemia	7 (6.19)
Bile leak	5 (4.42)
Wound dehiscence	2 (1.76)
Haemorrhage	1 (0.88)
Gut herniation through temporarily closed abdomen	1 (0.88)

series was 9.73% (n=11).

Discussion

Liver is the largest solid intra-abdominal organ. Though it lies in a relatively protected anatomic location, its large size makes it an inescapable victim of injury when the abdomen encounters some traumatic insult. Owing to lack of trauma registry in our country, the exact incidence of liver injury is difficult to estimate. However, it is certainly high among our population as indicated by our study as well as other published local studies from different parts of the country.[5,8-10]

The current study observed predominant involvement of males. More frequent involvement of males has also been reported in published literature in the context of trauma in general as well as liver injuries.[5,9-11] As males are more involved in driving, travel and other outdoor and high-risk activities, they are more prone to injuries. Males are also more frequent victims of assaults such as firearm injuries and stabs resulting from fights and brawls.

Our study found more frequent involvement of the younger population. This is in line with the observations of several other studies.[5,9,10] Predominant involvement of younger males further amplifies the socio-economic implications of such injuries.

In our study the predominant mechanism of liver injury was blunt, particularly RTAs. Studies in Russia and Peshawar have reported firearm injuries as the predominant mechanism of injury.[3,10]

In our study majority of the patients presented with hemodynamic compromise and underwent resuscitation and emergency exploratory laparotomy. Most of the published local literature has also reported similar observations on the mode of presentation of these patients.[5,10]

Not surprisingly, none of patients had grade V or grade VI liver injury. These injuries have not been reported in other local studies either.[8,10] The possible explanation for this is that we lack proper system for adequate on-scene management of RTA victims on our highways. No proper systems of on-site medical care or transportation to tertiary care health facilities exist. Owing to unacceptable delay in transportation, patients with life-threatening injuries of higher grade mostly die on the scene or en route to hospital.[11]

Perihepatic packing and suture hepatorrhaphy constituted our most frequently performed procedures. This conforms to other reported studies.[2,9,10,12,13] In fact, perihepatic packing has been of proven efficacy in liver trauma, particularly in patients with no tolerance for blood-loss or those requiring massive transfusion. This damage control strategy helps to avert the lethal triad of hypothermia, metabolic acidosis and coagulopathy.[1-3,12,14,15] We followed the policy of putting no more than six abdominal sponges around the liver in order to avert the possibility of iatrogenic abdominal compartment syndrome.

Ligation of right hepatic artery was selectively employed in six of our patients and did not result in any complication specific to arterial ligation. Other workers have also safely employed this surgical option in selected patients.[3,13] A variety of other haemostatic measures have been employed for liver injury by various workers with variable success rates. For instance, application of topical haemostatic agents, hepato-omentorrhaphy (a viable omental pedicle is packed into the hepatic wound and sutured to the edges of Glisson's capsule superficially), tractotomy with finger fracture (i.e. digitoclasia), extensive hepatorrhaphy, resectional debridement with selective vascular ligation, intrahepatic balloon, angioembolisation, venovenous bypass, and hepatic transplant etc.[1,2,16,17] The choice of haemostatic measure instituted depends on a variety of factors such as the grade of liver injury, expertise of the surgeon, preference of individual surgeon and institutional practices. Hence, standardisation as well as comparison of the surgical procedures undertaken by different researchers is difficult to make. Damage control surgery was preferred in the current study.

The complications noted were relatively fewer. A Croatian study reported much higher rate of post-operative complications in liver injuries, which included septic

complications and haemorrhage. They mainly employed debridement of injured liver with ligation of severed vessels and bile ducts.

Our in-hospital mortality was 9.73%. Studies from Greece,[4] China,[13] Thailand,[12] and Croatia[18] reported liver injury related mortality as 5.8%, 11.8%, 14.7% and 28.5% respectively.

Contrary to our series, which included only those patients who were managed operatively, there is a growing trend in the developed world towards selective non-operative management of both penetrating as well as blunt liver injury. The conservative management has been time-tested for haemodynamically stable cases of blunt liver injuries. However, in penetrating injuries, particularly in victims of firearm injuries, exploratory laparotomy has remained the standard of care for many decades.[19] This strategy has been challenged in recent studies that support selective non-operative management in haemodynamically stable patients without concomitant abdominal injuries. Patients with penetrating injuries who are haemodynamically stable and have no signs of peritonitis, are recommended to undergo a contrast-enhanced CT scan of the abdomen. If there are radiological signs of hollow viscous perforation or evolving haemodynamic instability/peritonitis, exploratory laparotomy is opted for. The grade of the liver injury itself is not considered as a contraindication for non-operative management.[19,20]

Given the evidence base, we should evolve regulations and measures to prevent RTAs, thereby reducing the frequency of liver trauma. As majority of our patients have haemodynamic compromise and present late, improved pre-hospital care can help to reduce the resultant morbidity and mortality. Public awareness on the issue is imperative.

Conclusion

Liver trauma constitutes an important cause of emergency hospitalisation, morbidity and in-hospital mortality in our population. It predominantly affects the younger males and RTAs are the leading cause. Majority of the patients are successfully managed with perihepatic packing.

References

1. Ahmed N, Vernick JJ. Management of liver trauma in adults. J Emerg Trauma Shock 2011; 4: 114-9.
2. Badger SA, Barclay R, Campbell P, Mole DJ, Diamond T. Management of liver trauma. World J Surg 2009; 33: 2522-37.
3. Urman MG, Subbotin AV. Surgical strategy for the liver injury and developed abdominal complications. Vestn Khir Im I I Grek 2009; 168: 72-5.
4. Gouriotis S, Vougas V, Germanos S, Dimopoulos N, Bolanis I, Drakopoulos S, et al. Operative and nonoperative management of blunt hepatic trauma in adults: A single-center report. J Hepatobiliary Pancreat Surg 2007; 14: 387-91.
5. Butt HA, Zahur S, Haq AU. Hepatic trauma: effects of delay in presentation. Ann King Edward Med Uni 2006; 12: 293-5.
6. Gonullu D, Koksoy FN, Ilun S, Demiray O, Yucel O, Yucel T. Treatment of penetrating hepatic injuries: a retrospective analysis of 50 patients. Eur Surg Res 2009; 42: 174-80.
7. Tinkoff G, Esposito TJ, Reed J, Kilgo P, Fildes J, Pasquale M, et al. American Association for the Surgery of Trauma Organ Injury Scale I: Spleen, liver, and kidney, validation based on the National Trauma Data Bank. J Am Coll Surg 2008; 207: 646-55.
8. Muizuddin M, Rehman A, Alam SN, Manzar S. Intra-abdominal visceral injuries in blunt abdominal trauma. Pak J Surg 2009; 25: 29-32.
9. 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.
10. Ali U, Noor A, Shah MM, Alam W. Trauma management in a tertiary care hospital in Peshawar, Pakistan. J Ayub Med Coll Abbottabad 2008; 20: 112-6.
11. Saaiq M, Shah SA. Thoracic trauma: Presentation and management outcome. J Coll Physicians Surg Pak 2008; 18: 230-3.
12. Vatanaprasan T. Operative treatment of hepatic trauma in Vachira Phuket hospital. J Med Assoc Thai 2005; 88: 318-28.
13. 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.
14. Hsu JM, Pham TN. Damage control in the injured patient. Int J Crit Illness and injury Sci 2011; 1: 66-72.
15. 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 2005; 71: 595–7.
16. Mohr AM, Lavery RF, Barone A, Bahrampour P, Magnotti LJ, Osband AJ, et al. Angiographic embolization for liver injuries: low mortality, high morbidity. J Trauma 2003; 55: 1077-81.
17. Delis SG, Bakoyiannis A, Selvaggi G, Weppler D, Levi D, Tzakis AG. Liver transplantation for severe hepatic trauma: Experience from a single center. World J Gastroenterol 2009; 15: 1641-4.
18. Milotic 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.
19. Navsaria PH, Nicol AJ, Krige JE, Edu S. Selective nonoperative management of liver gunshot injuries. Ann Surg 2009; 249: 653-6.
20. Schnüriger B, Talving P, Barbarino R, Barmparas G, Inaba K, Demetriades D. Current practice and the role of the CT in the management of penetrating liver injuries at a Level I trauma center. J Emerg Trauma Shock 2011; 4: 53-7.