Hepatic trauma management and outcome; Our experience

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Abstract

Background Injuries to the liver have been reported in 35–45% of patients with significant blunt abdominal trauma. Since the introduction of ultrasonography and computerized tomography in the evaluation of these patients, there has been an increase in number of hepatic injuries diagnosed that previously would not have been apparent.

Aims and objectives The purpose of this study was to determine the epidemiology and pattern of isolated liver injury, significant factors related to management and outcome.

Material and method A retrospective study of 50 cases of isolated Hepatic trauma admitted and managed over span of last three years (June 2006–June 2009) at MGM Medical College, Navi Mumbai.

Observation Out of 50 Patients of isolated liver injury, 36 (72%) were managed conservatively. 14(28%) Patients with refractory hypotension and hemoperitoneum were operated in emergency. The mortality of 3 (6%) cases was related to massive bleeding from liver parenchyma.

Conclusion The line of management of isolated liver trauma is primarily guided by the haemodynamic status of the patient at the time of presentation in emergency department and findings on ultrasonography [FAST] and computerized tomography. There is significant association of line of management with volume of hemoperitoneum and number of blood transfusion.

Keywords Liver injury · Grades of liver injury · Blunt trauma abdomen

Introduction

The liver is the largest intra-abdominal solid organ and is enclosed anteriorly and laterally by the rib cage. The large size of the liver, its friable parenchyma, its thin capsule, and its relatively fixed position in relation to the spine make the liver particularly prone to blunt injury. As a result of its larger size and proximity to the ribs, the right lobe is injured more commonly than the left. Most liver injuries (>85%) involve segments VI, VII, and VIII of the liver. This type of injury is believed to result from simple compression against the fixed ribs, spine, or posterior abdominal wall. The liver is the most common abdominal organ injured by penetrating trauma. Penetrating trauma of the liver may be caused by bullets, shrapnel, knives, and other sharp objects. Complications from liver trauma occur in approximately 20% of patients and include delayed rupture (very rare), hemobilia, arteriovenous fistula, pseudo-aneurysm, and biloma and abscess formation. In the past, most of these injuries were treated surgically. However, surgical literature confirms that as many as 86% of liver injuries have stopped bleeding by the time surgical exploration is performed [2]. Contrast-enhanced is the imaging modality of choice in evaluating hemodynamically stable patients

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with suspected hepatic injury. Hepatic parenchymal injuries can be categorized by CT as contusions, subcapsular and parenchymal hematomas, linear or stellate lacerations, and hepatic fractures. On contrast-enhanced CT, areas of parenchymal injury are often lower in density than normal liver. Lacerations are the most common form of hepatic injury identified on CT, while contusions and subcapsular hematomas are the least common. Despite CT evidence for extensive hepatic parenchyma injury, many hemodynamically stable patients can be managed non-operatively. CT findings which indicate increased morbidity and the need for more aggressive management include laceration of a major hepatic vein, complex perihilar injuries, progression of a hepatic injury on follow-up studies or persistent hemoperitoneum. Ultrasound can also be used in diagnosing post-traumatic complications such as hepatic or perihepatic abscesses or bilomas.

Aims and objectives

The purpose of this study was to determine the incidence, etiology and grades of liver injury, its management and outcome.

Materials and methods

This is retrospective study of 50 cases of isolated Hepatic trauma admitted and managed over span of last three years (June 2006–June 2009) at MGM Medical College, Navi Mumbai. Patients with associated splenic, bladder or bowel injuries were not included in order to eliminate chances of bias in the management plan and outcome. Data were collected on age, sex, mechanism of trauma, grades of liver injury, management and outcome. Liver injuries were graded according to the American Association for

the surgery of Trauma (Table 1). All cases presented to us were resuscitated with 1–2 L of crystalloids (Ringer Lactate or 0.9% Normal Saline) and colloids through wide bore peripheral cannulae. Later central line was accessed in all cases. After primary and secondary evaluation, blood samples were sent for investigations, grouping and cross matching. FAST has been used as first tool to see presence or absence of hemoperitoneum and associated solid organ injury. CECT of abdomen was done in selected group of patients who were haemo-dynamically stable. Those patients with stable blood pressure, adequate urine output, maintained abdominal girth and insignificant changes in laboratory findings were managed conservatively. Patients with refractory hypotension not responding to 40 ml/ kg of fluids during first few hours, in the presence of hemoperitoneum with or without signs of peritonism were operated. Exploratory laparotomies were performed through midline incision. Blood present in the peritoneal cavity were sucked out. Liver was mobilized by cutting triangular ligaments and lesser omental fold containing vessels responsible for vascular inflow was held under vascular clamp intermittently before proceeding for parenchymal repair. Abdominal drains were placed in all cases except three patients in whom haemostasis was not achieved even after suturing liver parenchyma, were left with abdominal packs. A combination of cefotaxime, amikacin and metronidazole were used as antibiotic.

Observations

The total number of patients with liver injury were 50, 44 males (88%) and 6 females (12%). The youngest patient was 5 years old and oldest was of 55 years (Fig. 1). Road traffic accident was the leading cause, seen in 34 patients (68%). 14 patients (28%) had liver injury because fall from height of more than 20 feet and two patients (4%) had stab injury

Table 1 Liver injury scale

Grade	Description
I	Hematoma: Non-expanding, sub capsular, less than 10% of surface area Laceration: Capsular tear, none bleeding, less than 1cm parenchymal depth
II	Hematoma: None-expanding, sub capsular, 10–50% surface area Laceration: Capsular tear, bleeding, 1–3 cm parenchymal depth, less than 10 cm in length
III	Hematoma: Sub capsular, more than 50% surface area, expanding hematoma, ruptured hematoma with active bleeding, intraparenchymal hematoma more than 2 cm or expanding Laceration: more than 3 cm of parenchymal depth, involvement of a segmental vessel
IV	Hematoma: Ruptured intraparenchymal hematoma with active bleeding Laceration: Parenchymal disruption involving 25–50% of hepatic lobe
V	Laceration: Parenchyma disruption more than 50% of hepatic lobe Vascular: Juxta-hepatic venous injuries (major hepatic veins, retro-hepatic vena cava)
VI	Hepatic avulsion.

Fig. 1 Age-wise distribution of patients

[Table 2]. Out of 50 Patients of abdominal trauma with liver injury, 36 (72%) were managed conservatively. On contrast enhanced CT scan (CECT) they were having grade I–III liver injury. 14 (28%) Patients with refractory hypotension and hemoperitoneum were operated in emergency, were having grade III–V injury. The pattern of liver injuries has been mentioned in Table 3. The mortality of 3 (6%) cases was attributed to massive bleeding;

A. The following observations were made in patients managed conservatively;

1. Systolic blood pressure not less than 90 mm of Hg
2. Diastolic blood pressure not less than 60 mm of Hg
3. Central venous pressure not less than 6 mm of Hg
4. Hemoglobin fall less than 2 gm% during first 4 hours
5. Absence of peritoneal signs

Table 2 Demographic profile of the patient with liver injuries

Age	Sex	Mechanism of injury
5–55 years	Male 44	Road traffic accident 34
		Fall from height 14
	Female 06	Penetrating injury 2

Table 3 Pattern of liver injury

Grade	Number	Percentage
I	12	24
II	20	40
III	08	16
IV	06	12
V	04	04
VI	00	00

- 6 Hemoperitoneum on FAST less than one liter (100ml–900ml, mean: 459.72) (Table 5)
 7. Liver Injury grade I–III
 8. Blood transfusion of 1–3 units (Table 4)
 9. Duration of stay was between 5 and 7 days
 10. Post injury no significant complications were noted.
- B. Those patients who got operated were found to have;
1. Refractory hypotension not responding to 40ml/kg of during first few hours and decreasing haematocrit
 2. All laparotomy were performed within first 24 hours Hemoperitoneum: 1200–2500 ml, mean: 1739.29 ml
 3. Liver injury, Grade III–V
 4. Blood transfusion 3–5 units
 5. Liver enzymes were raised during first week of injury
 6. Hepatic vein injury was the possible cause of uncontrolled bleeding and death of 3 patients
 7. Duration of stay 9–15 days
 8. Total operated cases 14, including 3 deaths
 9. Abdominal tube drains were placed, kept for 4 to 6 days
 10. None of them developed abscess or biloma.

Discussion

Hepatic injuries occur in 5% of patients sustaining blunt abdominal trauma. From 1908, with the publication of Pringle's paper, until 1980, the primary focus of trauma surgeons was to find out the most appropriate technique in patients of hepatic injuries [1]. With increasing acceptance of non-operative management in modern times, now the primary focus is selection of appropriate patients for operative and non-operative management. The success of

Table 4 Statistical significance of number of blood transfusion

P value and statistical significance:		
The two-tailed P value is less than 0.0001		
By conventional criteria; this difference is considered to be extremely statistically significant		
Confidence interval:		
The mean of Group One minus Group Two equals 2.0000		
95% confidence interval of this difference: From 1.4607 to 2.5393		
Intermediate values used in calculations:		
t = 7.4562, df = 48		
Standard error of difference = 0.268		
Group	Operated	Conservative
Mean	4.0000	2.0000
SD	0.7700	0.8800
SEM	0.2058	0.1467
N	14	36

non-operative management of hepatic injuries in children in 1980s coupled with repeated observation that 75–85% of hepatic injuries in adults were no longer bleeding at the time of laparotomy, prompted the initiative of non-operative management [2–4]. A number of retrospective studies have been published concerning non-operative management of minor liver injuries, with cumulative success rates greater than 95%. The success of none-operative management of hepatic injuries in properly selected children and adults in the United States remarkably consistent. In a prospective study of 136 patients of blunt hepatic trauma, Croce MA et al. observed that 24 patients required emergency laparotomy. 112 patients were treated conservatively with a subsequent failure rate of 11%. Comparing the non-operative group to the control group, there were no differences in admission hemodynamics or hospital length of stay, but non-operative patients had significantly fewer blood transfusions (1.9 vs. 4.0 units; $p < 0.02$) and fewer abdominal complications (3% vs 11%; $p < 0.04$) [5]. Our study also shows very significant association of blood transfusion (2 vs 4 units; $p < 0.0001$) and volume of intra-peritoneal blood (459.72 vs 1739.29 ml; $p < 0.0001$) with line of management. Those patients who were managed conservatively had hemoperitoneum less than 900 ml and received less than 3 units of blood transfusion. In the multi-center study of Patcher et al., of 404 cases with hepatic injuries treated non-operatively, operative intervention was necessary in six patients (1.5%) because of hemorrhage (3), hepatic abscess (1) and missed enteric injury (2). Only 2 of 27 deaths were related to uncontrolled hemorrhage [6]. In the more recent series by Malhotra et al., liver related failure of none-operative management occurred in 20 of 560 patients (3.8%). Haemodynamic instability was the reason in 16 patients while decreasing haematocrit in other four [7]. The contraindications to none-operative management include

Table 5 Statistical significance of volume of hemoperitoneum

P value and statistical significance:		
The two-tailed P value is less than 0.0001		
By conventional criteria; this difference is considered to be extremely statistically significant.		
Confidence interval:		
The mean of Group One minus Group Two equals 1279.56		
95% confidence interval of this difference: From 1104.93 to 1454.20		
Intermediate values used in calculations:		
t = 14.7322, df = 48,		
Standard error of difference = 86.855		
Group	Operated	Conservative
Mean	1739.29	459.72
SD	418.87	197.78
SEM	111.95	32.96
N	14	36

the extravasation of intravenous contrast agent, expanding haematoma and grade IV and V liver injury. The line of management of isolated liver trauma is primarily guided by the hemo-dynamic status of the patient at the time of presentation in emergency department and response to the initial fluid challenge. Surgery is considered for isolated liver injury if the volume of replacement is more than 40ml/kg during first few hours [8–9]. A surgeon performed ultrasound using a 3.5 MHz transducer is an effective techniques for rapid imaging in hepatic injury [10]. However, actual extent of damage can only be ascertained after surgery. Contrast-enhanced abdominal CT is the imaging modality of choice in evaluating hemodynamically stable patients with suspected hepatic injury. Abdominal CT accurately defines the morphology and extent of the hepatic trauma, identifies associated visceral injuries and depicts the amount of accompanying hemoperitoneum [11]. CT is also helpful in evaluating interval healing or post-operative complications, like sepsis and biloma [12, 13]. The advanced technique used for Grade IV or V injuries include extensive suture hepatorrhaphy, hepatotomy with selective vascular ligation, debridement and selective vascular ligation, absorbable mesh compression, intra-hepatic balloon tamponade, selective hepatic artery ligation and peri-hepatic packing [14–16]. The mean length of hospital stay in different series is 5–7days, which is more in operated cases in our study. Mortality from blunt hepatic trauma is about 5% and is related to uncontrolled hemorrhage, very much similar to our observations.

Conclusion

The incidence of hepatic injury has significantly increased in recent times. Road traffic accidents are the leading cause

of these injuries. Although, age is no bar to such injuries but most of these patients are young males. The line of management of isolated liver trauma is primarily guided by the haemodynamic status of the patient at the time of presentation in emergency department and findings on Ultrasonography [FAST] and Computerized tomography. Ultrasonography does help in identifying hemoperitoneum and intra-abdominal solid organ injury. However, actual extent of damage can only be ascertained after surgery. CECT abdomen is done in selected group of patients, who are haemodynamically stable. Most blunt liver trauma (80% in adults, 97% in children) is currently treated conservatively. The success of non-operative management depends upon proper selection of the patient. The patients, who are managed non-operatively, usually have grade I and II liver injuries, hemoperitoneum less than 900 ml and blood transfusion of less than 3 units. The contraindications to non-operative management include refractory hypotension, significant fall in haematocrit, the extravasations of intravenous contrast agent, expanding haematoma and grade IV and V liver injury on CECT abdomen. The patients of grade III liver injuries need very close observation as they may require surgical intervention during first 24 hours. The failure rate of non-operative management is not more than 5% in most studies. It seems that patients with grade VI injuries rarely reaches to the hospital alive and are not salvageable. Therefore, such injuries are usually documented on autopsy. Mortality from blunt hepatic trauma is about 5% and is related to uncontrolled hemorrhage. The occurrence of abdominal sepsis in hepatic injury is either due to associated bowel injury or penetrating injury. The availability of ultrasonography and computerized tomography has definitely improved the level of management and outcome of blunt abdominal trauma with solid organ injuries.

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