Original Article **Brunei Int Med J.** 2010; 6 (1): 41-47

Management of liver trauma in RIPAS Hospital

Ahamed Jiffri Ahamed MACKIE and Kenneth Yuh Yen KOK
Department of Surgery, RIPAS Hospital, Brunei Darussalam

ABSTRACT

Introduction: The management of blunt and penetrating liver trauma continues to pose a tremendous challenge to surgeons. This study reviews the pattern of liver trauma and its management, both operative and non-operative, in RIPAS Hospital, the only tertiary referral center in Brunei Darussalam. **Material and Methods**: A retrospective study of patients admitted with liver trauma, with and without other associated injuries between January 2002 and December 2006 to RIPAS Hospital was undertaken. The patients' case records were retrieved. Details on age, sex, mode of injury, pre-operative imaging, severity of liver injury based on the Liver Injury Scale (LIS, grades I to VI), presence of other associated injuries, overall management, complications and outcome were collected and analysed. **Results**: Twenty patients (male, n = 12) with a mean age of 36 years old (range 20 to 75) were treated for liver trauma (median LIS grade of III, range I to V) during the study period. Road traffic accidents accounted for 75% of the injuries. Thirteen (65%) had high grade injuries (≥ LIS grade III). Seventeen (85%) patients underwent surgical procedures for liver and other associated injuries. Four patients (20%) had non-operative management with one failure (5%). This patient subsequently required surgery. There were six post-operative deaths (mortality 30%). There were three major morbidities (15%): right hepatic artery aneurysm, a right hepatic duct bile leak and left hemiplegia secondary to cerebrovascular accident. **Conclusions**: In our local setting, blunt liver trauma is often due to road traffic accidents and is associated with a high mortality rate. A majority was of high grades and required urgent surgical interventions. Non-operative management is an option for those with low grade injuries and who are stable.

Keywords: Abdominal injuries, traffic accidents, treatment outcome

INTRODUCTION

Liver injuries in severe abdominal trauma carry a significantly high mortality ranging from ten to 15%.[1] The management of blunt and penetrating liver trauma continues to pose a tremendous challenge to surgeons. The management of liver trauma depends on the severity of the liver injury, and the presence and severity of other associated injuries. The management of liver injuries has changed dramatically during the past three decades, particularly for blunt trauma. First, it has been recognised that the majority of liver injuries stop bleeding spontaneously.[2-4] Sec-

Correspondence author: A J AHAMED MACKIE
Department of Surgery, RIPAS Hospital,
Bandar Seri Begawan BA 1710,
Brunei Darussalam.
Tel: +673 2242424 Ext 6280 Fax: +673 2449648
E mail: ahmac@brunet.bn

ond, computed tomography (CT) scan has become increasingly available. Thus, there has been a trend towards non-operative management of patients who have sustained significant liver trauma but remain haemodynamically stable.[5] In selected patients who are initially unstable but who respond to the administration of intravenous fluids or blood, this non-operative strategy has also been found to be successful.[6]

MATERIALS AND METHODS

Data were retrospectively collected from patients admitted via the Accident and Emergency Department, RIPAS Hospital between January 2002 and December 2006. The patients' case reports were retrieved. A review of the patients' data, and for those patients who succumbed to their injuries, the post-mortem findings were recorded. Data retrieved included the patients' age, sex, mode of injury, pre-operative imaging, severity of the liver injury, presence of other associated injuries, overall management, complications and outcome. The severity of the liver injuries was documented according to the Liver Injury Scale (LIS) (Table 1).[7]

RESULTS

During the five year study period, 20 cases of liver trauma were identified. The mean age of the patients was 36 (range 20 to 75) years. There were 12 (60%) males and eight (40%) females. Nineteen (95%) patients sustained blunt liver trauma and the remaining one sustained a stab injury. Road traffic accident (RTA) was the leading cause of the blunt liver injuries and was the cause in 15 (75%) patients. The other causes for blunt liver trauma were two(10%) cases of fall from height, one case (five percent) of crush injury from a heavy load and one case (five percent) of a bull gore injury. Eight patients had hypotension (with systolic blood pressure <100 mmHg) on admission. All except two patients had ultrasound (US) scan and/ or CT scan for

Table 1: Description of hepatic injuries using the Liver Injury Scale. [7]

Grade	Injury	Descriptions
I	Contusion	Subcapsular, <10% surface area
	Laceration	Capsular tear, <1 cm parenchymal depth
II	Contusion	Subcapsular, 10% to 50% surface area intraparenchymal, <10 cm in diameter
	Laceration	1 to 3 cm parenchymal depth, <10 cm in length
III	Contusion	Subcapsular, >50% surface area or expanding Ruptured subcapsular or parenchymal hematoma intraparenchymal hematoma >10 cm or expanding
	Laceration	>3 cm parenchymal depth, major duct involvement
IV	Laceration	Parenchymal disruption involving 25% to 75% of hepatic lobe or one to three Couinoud segments within a single lobe or multiple lacerations >3 cm deep
V	Laceration	Parenchymal disruption involving >75% of hepatic lobe or more than three Couinoud segments within a single lobe.
	Vascular	Juxtahepatic venous injuries i.e., retrohepatic cava/central major hepatic veins
VI	Vascular	Hepatic avulsion (total separation of all vascular attachments)

evaluation of the abdominal trauma.

In this study, patients with liver injuries of low (LIS grades I and II) severity (Fig. 1) were less common than those of high (LIS grades III to V) severity (Fig. 2). Overall the frequency of LIS is shown in Table 2.

The associated injuries with the liver trauma were other abdominal, chest, head and limb injuries. The most common other abdominal injury was splenic injury (four cases with two cases requiring splenectomy). There was one diaphragmatic rupture, one gallbladder rupture, one renal contusion and one foetal death. There were also other associated injuries not involving the abdomen; five patients had associated fracture ribs, one rupture of the descending aorta, one lung injury, ten limb injuries, two facial bone fractures and one case each of vertebral fracture and head injury.

Successful non-operative treatment was observed in two cases of low LIS severity one case of high LIS (Grade III i.e. lowest grade of high LIS) blunt liver trauma with no other associated injuries (cases 7, 11 and 19). In another patient with blunt liver trauma who sustained a high LIS severity (case 12), conservative management failed after 24 hours due to haemodynamic instability and falling haemoglobin levels, this patient subsequently required a laparotomy with suturing of liver lacerations.

Operative treatment was carried out in 17 (85%) patients (16 patients with blunt trauma including the patient who had failed non-operative management and one stab injury patients). Laparoscopy and control of bleeding by diathermy was successful in one patient with a low LIS severity liver trauma. Laparotomy was performed in 16 patients. The procedures carried out to control bleeding of the liver included suturing of the liver lacerations, partial hepatectomy, liver segmentectomy and peri-hepatic packing. Non-liver surgery procedures that were performed were splenectomy, repair of diaphragmatic rupture, cholecystectomy and caeserian section. In one patient a thoracotomy was required to

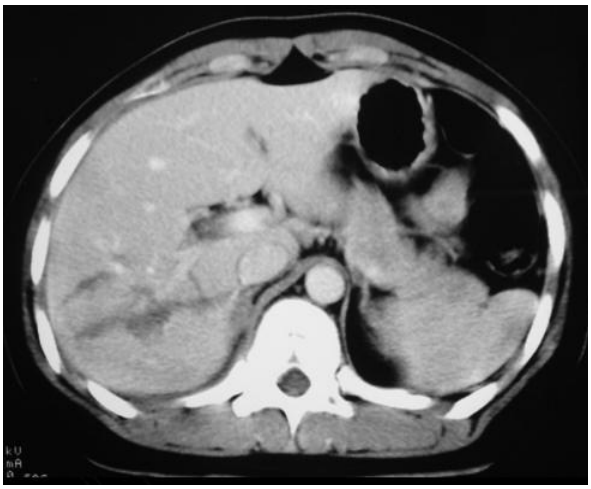

Fig. 1: Axial computed tomography scan showing LIS grade II liver injury secondary to RTA (Case 11) which was successfully managed with conservative non-operative management.

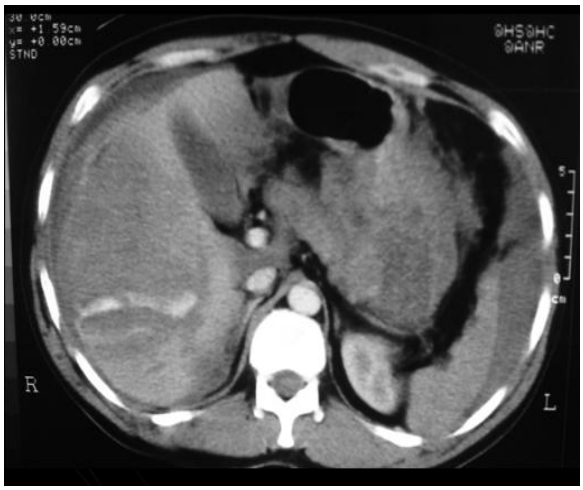

Fig. 2: Axial computed tomography scan showing LIS grade IV liver injury secondary to being gored by a bull (Case 18).

Table 2: Frequency of LIS injury.

Grade	n (%)
I	1 (5)
II	6 (30)
III	4 (20)
IV	6 (30)
V	3 (15)
VI	0 (0)

repair the associated descending aorta rupture and lung injury.

In all the 16 (80%) patients who required urgent laparotomy, the operations were performed within four hours of admission to hospital. There were three patients with LIS grade III, six patients with LIS grade IV, three patients with LIS grade V, one patient with LIS grade I with ruptured spleen and one patient with LIS grade II with diaphragmatic rupture and one patient with LIS grade II with stab injury.

There were three (15%) major post-operative morbidities in this series. One patient developed a pseudo-aneurysm of the right hepatic artery which was successfully treated by arterial embolisation. Another patient had a right hepatic duct bile leak and this was successfully managed by endoscopic stenting. The oldest patient in the series developed a left hemiplegia post-operatively and he was discharged after a prolonged hospital stay.

There were six post-operative deaths (mortality rate 30%) and all of them had liver injury of high LIS severity. One patients had other severe associated injuries (rupture of thoracic to descending aorta and lung injury). Three patients (15%) died within five hours of surgery and the others from septicaemia and multi-organs failure.

Table 3 summarises the clinical characteristics, causes and severity of liver injuries, pre-operative imaging modalities, management and outcome.

DISCUSSION

The management of liver injuries has changed dramatically during the past three decades; particularly for blunt trauma.[8] The LIS grade alone does not determine the need for laparotomy. The haemodynamic status in combination with clinical and other parameters also play a major role.

Our study has shown that non-operative management is successful in selected patients with low LIS severity liver injury who are haemodynamically stable and with no other associated injuries. Previous reports have also outlined the efficacy of non-surgical treatment and its relative safety in haemodynamically stable patients.[9-14] Although the initial attraction to non-surgical treatment is the avoidance of surgery, there is also data to suggest that non-surgical treatment may contribute to a decrease in mortality.[8] With the accuracy of modern CT scan in determining the severity of liver injury and other associated injuries, most blunt liver injuries may be managed without surgery.[8]

Indications for operative treatment in our study included haemodynamic instability, falling haemoglobin levels, a high LIS severity liver trauma and other associated injuries requiring surgery on their own merits even in low LIS severity liver trauma. Repair of liver

Table 3. Characteristics of patients, mode of injuries, imaging and outcomes.

Patient	Age (yrs)	Gender	Mode of injury	Pre-operative imaging	LIS grade	Management	Outcome
1	45	Male	RTA	US	III	Liver suture Cholecystectomy	Died
2	32	Male	Crush injury	CT	V	Liver suture Liver packing	Died
3	36	Female	RTA	US	III	Liver packing	Died
4	44	Female	RTA	None	IV	Liver suture Splenectomy Aortic and lung suture	Died
5	36	Female	RTA	US	III	Liver suture	Alive Hepatic artery aneurysm
6	75	Male	RTA	US	II	Liver suture Splenectomy	Alive Left hemiplegia
7	35	Female	RTA	CT	II	Non-operative	Alive
8	22	Male	RTA	US	II	Laparoscopy Diathermy of laceration	Alive
9	37	Male	RTA	CT	I	Liver suture Left diaphragm repair	Alive
10	36	Female	Stab wound	None	II	Liver suture	Alive
11	20	Female	RTA	CT	II	Non-operative	Alive
12	21	Female	RTA	CT	IV	Failed non-operative Liver suture	Alive
13	22	Male	Fall	CT	IV	Liver suture ERCP stenting	Alive Right hepatic leak
14	23	Male	RTA	US	V	Liver suture	Alive
15	58	Male	RTA	CT	IV	Liver suture	Alive
16	36	Female	RTA	US	IV	Left lateral segmentectomy LSCS	Alive
17	23	Male	RTA	None	II	Liver suture	Alive
18	42	Male	Bull gore	CT	IV	Liver suture Liver packing	Died
19	36	Male	RTA	US/CT	III	Non-operative	Alive
20	41	Female	Fall	US	V	Partial hepatectomy Liver packing	Died

LIS; Liver Injury Scale, RTA; Road traffic accident, US; Ultrasound scan, CT; Computed tomography, LSCS; Lower section caesarian section

lacerations with sutures, liver segmentectomy, partial hepatectomy and peri-hepatic packing were the procedures used in our series. All these have been widely used in other reputable hepatobiliary surgical units.[1] Among our series, one patient (Case 8) with LIS grade II injury had laparoscopic evaluation and management. This patient only had an US and did not have a CT scan pre-operatively. The liver lacerations were treated with diathermy. Therefore, laparoscopy may be a good option in patients with low grade injuries.

Other associated organ injuries in our series included splenic rupture, diaphragmatic rupture, lung laceration and descending aortic rupture. All our patients with other associated injuries had required emergency laparotomy. Not surprising, our patients with splenic rupture as well as descending aortic rupture were haemodynamically more unstable than those with liver injury alone. This observation is in keeping with the findings in other series.[9]

In this study, non-operative management may be an option in patients with blunt liver trauma with low LIS severity, if there is no other indication for surgery. However, one patient (25%) treated non-operatively subse-

quently required surgery. This patient had a high LIS (grade IV) and therefore, not unexpectedly failed non-operative management. Generally patients with blunt liver trauma of high LIS severity, surgical interventions are required. However, it has been reported that even in patients with liver injury of high LIS severity, selected cases can be still be managed by non-operative treatment.[10-13] Our series showed that 85% of the blunt liver trauma patients underwent surgery. This is in contrast to a recent report that showed 85% of blunt trauma had non-operative management.[15] The severity of the liver trauma, as seen in the higher incidence of high LIS severity liver injury in our series may account for this increase in operative management.

The causes of death in our series were due to continuing bleeding, septicaemia and multi-organ failure. All six deaths in our study occurred post-operatively. In the remaining 14 patients, there were three complications and these were seen in the operated group. Other studies have reported higher complications in non-operated patients with liver injuries.[16] The small number in our study probably accounts for this observation.

The mortality rate of our series was 30%. This is in contrast to the reported rates of between 10% and 15% in other series.[1] The high mortality rate in our study is probably due to the high incidence of severe blunt liver injuries, which has consistently been shown to be associated with a higher mortality rate than penetrating injuries.[17]

Patients with isolated blunt liver injury who have low LIS score and are haemodynamically stable can be managed conservatively without emergency surgery. Patients with penetrating liver injuries or those with blunt liver injury and other associated organ injuries are usually managed operatively within four hours of admission.

In conclusion, RTA remains the major cause of blunt liver trauma in our local setting. Most had high grade injuries (LIS ≥ grade III) and required surgical interventions. Despite this, the mortality remains high. For patients who are haemodynamically stable and have low grade injuries (LIS < grade III), non-operative managements are can be attempted. Apart from haemodynamic instability and the severity of liver injury, the nature of associated injuries also influence the outcome in these patients.

REFERENCES

1: Parks RW, Chrysos E, Diamond T. Management of liver trauma. Br J Surg 1999; 86:1121-35.

2: Hammond JC, Canal DF, Broadie TA. Non-operative management of adult blunt hepatic trauma in a municipal trauma centre. Am Surg 1992; 58: 551-5.

3: Croce MA, Fabian TC, Menke PG et al. Non-operative management of blunt hepatic trauma is the treatment of choice for haemodynamically stable patients: results of a prospective trial. Ann Surg 1995; 221:744-55.

4: Pachter HL, Feliciano DV. Complex hepatic injuries. Surg Clin North Am 1996; 76:763-82.

5: Pachter HL, Hofstetter SR. The current status of non-operative management of adult blunt hepatic injuries. Am J Surg 1995; 169:442-54.

6: Beckingham IJ, Krige JEJ. Liver and pancreatic trauma. BMJ 2001; 322:783-5.

7: Moore EE, Cogbill TH, Malangoni MA, et al. Organ injury scaling. Surg Clin N A 1995; 75:293-303.

8: Richardson JD, Franklin GA, Lukan, JK. Evolution in the management of hepatic trauma: a 25-year

perspective. Ann Surg 2000; 232:324-30.

9: Meredith JW, Young JS, Bowling J et al. Non-operative management of blunt hepatic trauma: the exception or the rule? J Trauma 1994; 36:529-35.

10: Croce MA, Fabian TC, Menke PG, et al. Non-operative management of blunt hepatic trauma is the treatment of choice for hemodynamically stable patients. Results of a prospective trial. Ann Surg 1995; 221:744-55.

11: Pachter HL, Hofstetter SR. The current status of non-operative management of adult blunt hepatic injuries. Am J Surg 1995; 169:442-54.

12: Carrillo EH, Platz A, Miller FB et al. Non-operative treatment of blunt hepatic trauma. Br J Surg 1998; 85:461-8.

13: Farnell MB, Spencer MP, Thompson E et al. Non-operative management of blunt hepatic trauma in adults. Surgery 1988; 104:748-56.

14: Knudson MM, Maull KI. Non-operative management of solid organ injuries: past, present and future. Surg Clin North Am 1999; 79:1357-71.

15: Malhotra AK, Fabian TC, Croce MA et al. Blunt hepatic injury: a paradigm shift from operative to non-operative management in the 1990s. Ann Surg 2000; 231:804-13.

16: Gourgiotis S, Vougas V, Germanos S et al. Operative and non-operative management of blunt hepatic trauma in adults: a single-centre report. J Hepatobiliary Pancreat Surg. 2007; 14:387-91.

17: Scollay JM, Beard D, Smith RS et al. Eleven years of liver trauma: the Scottish experience. World J Surg 2005; 29:744-9.