



Case series

Severe liver injuries; a case series and review of the literature

Joel Arudchelvam¹, MBBS, MD (Surg), MRCS (Eng), FCSSL Asela Jayathilaka², MBBS, MD, MRCS, FCSSL, FAACT

¹ Senior Lecturer, Department of Surgery, faculty of medicine, University of Colombo.

Consultant Vascular and Transplant Surgeon, National Hospital of Sri Lanka, Colombo.

² Consultant Surgeon, National Hospital of Sri Lanka, Sri Lanka.

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Correspondence to:

Dr. Joel Arudchelvam

E-mail: joelaru@srg.cmb.ac.lk

Telephone : 0775409765

Abstract**Introduction**

Severe hepatic injuries are associated with high morbidity and mortality. Liver injuries occur frequently. In a series of 48 patients who underwent laparotomy at the national hospital of Sri Lanka, Colombo (NHSL), there were 11 (22.9%) liver injuries. Severe liver injuries may require resection as management. This study reports the outcome of liver resection following severe liver injuries.

Methods

This is a retrospective study of liver resections following abdominal trauma. Data on Basic demographics, surgical procedures, and the outcomes were collected and analysed. American Association for the Surgery of Trauma (AAST) classification was used to classify the liver injuries.

Results

Six patients were included. All were males. Median age was 40.0 years (7-87). Four (66.7%) were following road traffic accidents. Three (50%) had AAST grade V and two (33.3%) had AAST grade III injuries. Three (50.0%) underwent staged right hepatectomy. Two (33.3%) patients died as a result of the effects of haemorrhage in the early post-operative period. At a median follow-up of 32.9 months, others have recovered and are well.

Discussions and Conclusions

At present the management of the patient with liver trauma depends on the hemodynamic stability, associated injuries and the evidence of bleeding from the liver on. If the patient is haemodynamically stable and if there are no other indications for laparotomy the patient can be managed conservatively. When there are injuries to the hepatic artery, portal vein, hepatic veins and major branches, with severe bleeding and if the patient remains unstable these should be ligated. The patient is resuscitated for about 24 to 48 hours and the infarcted area of the liver can be resected later (staged liver resection). In this way the mortality of undergoing primary liver resection can be reduced.

Introduction

Severe hepatic injuries are associated with high morbidity and mortality (30%) and are challenging to manage¹. Liver injuries occur frequently following abdominal trauma. For example in a series of 48 patients who underwent laparotomy following trauma at the national hospital of Sri Lanka, Colombo (NHSL), 11 patients had liver injuries (22.9%). Most of the liver injuries can be managed non operatively. In case of surgical management the focus is on damage control,

packing, and vascular ligation and resection. Interventional radiological modalities are also used in the management (e.g. embolisation of the bleeding vessels). This report is on the outcome of patients who underwent liver resection following severe liver injuries.

Methods

This is a retrospective analysis of the patients who underwent liver resections following abdominal trauma for severe liver injuries. The study was done from March 2017 to March 2023. Data on patients, who underwent liver resection following liver injuries at the NHSL, were collected retrospectively. Basic demographics, surgical procedures, and the outcomes were analyzed. To classify liver damage, the AAST hepatic Injury Scale was used. Patients who were lost to follow up and incomplete records were excluded.

Results

Six patients who underwent liver resection after trauma were included. All patients were males. Median age was 40.0 years (7-87). 4 (66.7%) were following road traffic accidents and two (33.3%) were after a fall from a height. Three (50%) had AAST grade V liver injury and two (33.3%) had AAST grade III and one (16.7%) had AAST grade IV liver injury. The indication for laparotomy in all 6 patients was haemodynamic instability. One patient (16.7%) who had near total separation of the left lobe, underwent primary left hepatectomy, three (50.0%) underwent staged right hepatectomy. In patients who underwent staged hepatectomy, a primary resuscitative laparotomy was done first. At the time of the initial laparotomy, selective portal vein and hepatic artery branch ligation to control the bleeding was done. Following this the patients were sent to the intensive care unit for resuscitation for 24 to 48 hours. This was followed by a relaparotomy and hepatectomy. At a median follow-up of 32.9 months, two (33.3%) patients died as a result of the effects of haemorrhage in the early post-operative period others have recovered and are well.

Discussion and conclusions

Liver is one of the commonly injured abdominal organs following abdominal trauma². Liver injury is encountered at a rate of 22.9% among abdominal trauma patients undergoing emergency laparotomy at the NHSL (NHSL, unpublished data). According to the severity of the liver injury, it can result in increased mortality and can result in complications in the late recovery phases of the patient. Liver injuries are graded according to the

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Table 1 AAST grading scale

Grade I	Sub-capsular haematoma involving less than 10% of the surface area Capsular laceration involving less than 1 cm depth
Grade II	Sub-capsular haematoma involving 10% -50% surface area or Intra-parenchymal less than 10 cm diameter Laceration - capsular laceration involving 1 cm -3 cm parenchymal depth and less than 10 cm length
Grade III	Subcapsular hematoma involving greater than 50% of the surface area or enlarging Intra-parenchymal haematoma of greater than 10 cm or enlarging Laceration involving more than 3 cm of parenchymal depth
Grade IV	Parenchymal laceration involving 25% -75% of the hepatic lobe
Grade V	Laceration involving more than 75% of the hepatic lobe Retro hepatic vena caval or major central hepatic venous injuries
Grade VI	Hepatic vascular avulsion (not compatible with life. These patients do not reach the hospital).

size of the haematoma, the degree of laceration, presence of bleeding into the peritoneum and the presence of hepatic venous injuries³.

Computerised tomographic scan (CT) of the abdomen and pelvis is the gold standard investigation in patients with suspected liver injuries. This allows grading of the liver injuries and also helps in identifying the associated injuries.

Based on the CT findings the liver trauma is classified into 6 grades according to the American Association for the Surgery of Trauma (AAST) grading scale⁴ (Table 1).

World Society of Emergency Surgery (WSES) classification grades liver injuries incorporating the AAST classification and the haemodynamic status⁴ (Table 2).

Table 2 WSES liver trauma classification

Minor	WSES grade I	AAST I-II	Stable
Moderate	WSES grade II	AAST III	Stable
Severe	WSES grade III	AAST IV-V	Stable
	WSES grade IV	I-VI	Unstable

The concept of management of liver injuries has changed over time. Initially all patients with liver injuries underwent exploratory laparotomy⁵. At present the management of the patient with liver trauma depends on the hemodynamic stability, associated injuries and the evidence of bleeding in the liver on imaging (blushing in contrast enhanced CT scan). Liver injuries can be associated with other abdominal injuries. In a series of 11 patients with liver injury at the NHSL, 3 (27.27%) patients had bowel injury, 2 (18.18%) had diaphragmatic injury and one (9.09%) had mesenteric tear. Grading of the liver injury according to the CT scan can be used to plan the operative management.

Haemodynamic stability is defined as follows. A haemodynamically unstable patient is defined as a patient with the systolic blood pressure of less than 90 mmHg with other features of shock i.e. poor peripheral circulation, reduced urine output and altered level of consciousness (3). Some patients who maintain the systolic blood pressure above 90 mmHg with inotrope infusion or fluid infusions or blood transfusions of more than four units in the first 8 hours are also considered haemodynamically unstable.

A patient is categorised as transient responder if the blood pressure rises following initial resuscitation and then subsequently the patient develops features of hemodynamic instability³.

If the patient is haemodynamically stable and if there are no other indications for laparotomy, the minor (WSES I / AAST I-II), moderate (WSES II / AAST III) and severe (WSES III / AAST IV-V)

injuries can be managed non-operatively (NOM). However these patients should be carefully monitored at the Intensive Care Unit with preparedness for intervention if the clinical situation of the patient deteriorates. In addition serial investigations should be done to detect complications. If there is any deterioration in the clinical status or haemodynamic stability of the patient, he or she should be reevaluated and sent to the theatre for emergency resuscitative laparotomy³.

In patients managed non-operatively and are haemodynamically stable, if there are evidence of active bleeding on CT images i.e. blush, urgent angiography and embolisation should be offered.

During laparotomy, a midline incision is done first. An initial assessment of the peritoneal cavity and the retroperitoneal area is done. In case of bleeding from the liver, the following methods can be used to stop bleeding. Initial manual compression on both sides of the laceration is applied. This will reduce the bleeding by approximating the damaged edges. Bleeding is also stopped by application of gauze packs around the liver to compress the lacerated edges together. More severe bleeding can be stopped compressing the hepatoduodenal ligament (Pringle manoeuvre).

After controlling the bleeding from the liver, the damage to the liver and the bleeding site is assessed. For superficial parenchymal injuries packing, diathermy cauterisation, parenchymal suturing is often adequate to stop bleeding.

One study reported among 804 liver injuries that were treated with peri hepatic packing, the mortality was between 14% to 30%. However the re-bleeding rates were higher when the packs were removed before 36 hours (21% vs. 4% / P less than 0.001)⁶.

In severe liver injuries with unstable patient (WSES IV), inspect for major bleeders. The injured hepatic artery, portal vein and hepatic veins can be repaired. However if the patient remains unstable these should be ligated. The patient is sent to the intensive care unit (ICU) for further resuscitation. During this period, reevaluation is done with CT scan. Subsequent re laparotomy can be done in 28 to 48 hours and the infarcted hepatic segment or the lobe can be resected (staged liver resection). However liver resections following liver injuries are associated with high mortality. In one series of 216 patients, the mortality following liver resection was 30.0% compared to the overall mortality of 17.8%¹.

If the bleeding remains uncontrolled despite the above mentioned methods, total hepatic vascular exclusion should be done followed by inspection of the hepato caval junction or retro hepatic inferior vena cava (IVC). These should be repaired. For irreparable retro hepatic IVC injuries, various temporary cava to atrial shunt techniques are used.

If there is a near total laceration of the hepatic segments or the lobe is found on initial laparotomy, that segment can be excised.

Therefore in conclusion, hepatic injuries are associated with high mortality. Presence of major vascular injuries increases the mortality further. Non-operative management can be offered in most patients provided the patient is haemodynamically stable and has no other indications for laparotomy. However, these patients should be observed in an intensive unit with readiness to intervene if the patient deteriorates. Further data (countrywide and institutional) on liver injuries is needed to arrive at further conclusions and to plan the system improvement.

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ORCID iD Joel Arudchelvam <http://orcid.org/0000-0002-4371-4527>

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References

1. Hepatic Resection in the Management of Complex Injury to the liver. Patricio Polanco, Stuart Leon, Jaime Pineda, Juan C. Puyana, Juan B. Ochoa, Lou Alarcon, Brian G. Harbrecht, David Geller, Andrew B. Peitzman, 6, 2008, The Journal of trauma Injury, Infection, and Critical Care, Vol. 65, pp. 1264-1270.
2. Non-operative management of blunt liver trauma: safety, efficacy and complications of a standardized treatment protocol. Brillantino A, Iacobellis F, Festa P, Mottola A, Acampora C, Corvino F. 1, 2019, Bull Emerg trauma, Vol. 7, pp. 49-54.
3. Liver trauma: World Society of Emergency Surgery (WSES) 2020 guidelines. Coccolini, F., Coimbra, R., Ordonez, C. 1, 2020, World J Emerg Surg, Vol. 15, p. 24 (2020).
4. Isolated abdominal trauma: diagnosis and clinical management considerations. Prachalias AA, Kontis E. 2, 2014, Curr Opin Crit Care, Vol. 20, pp. 218-25.
5. Liver trauma--operative management. Morrison JJ, Bramley KE, Rizzo AG. 2, 2011, J R Army Med Corps, Vol. 157, pp. 136-44.
6. Perihepatic Packing of Major Liver Injuries: Complications and Mortality. Caruso DM, Battistella FD, Owings JT, Lee SL, Samaco RC. 9, 1999, Arch Surg, Vol. 134, pp. 958-963.