

**NON - OPERATIVE MANAGEMENT OF A GRADE 4 LIVER LACERATION**

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**ABSTRACT**

During the previous 3 decades, the management of traumatic liver injury has evolved significantly. The advancement of imaging studies has played an important role in the conservative management of this condition with a shift from operative to non - operative management for most haemodynamically stable patients with hepatic injury. In determining the optimal treatment strategy of a patient with traumatic liver injury the haemodynamic status and associated injuries should be considered. The appropriate management of liver trauma is based on the anatomy of the injury and the patient's physiology. In this case report the non - operative management of a patient with a grade 4 liver laceration is discussed.

**KEYWORDS:** Liver trauma, interventional radiology, damage control surgery.**INTRODUCTION**

Trauma is the second leading cause of hospital admission, representing some 16% of the global burden of all health costs. The World Health Organization (WHO) predicts that by the year 2020 trauma will be the leading cause of worldwide mortality.<sup>[1]</sup> Approximately 31% of patients with poly-trauma have abdominal injuries, and almost 16% of these patients have a hepatobiliary injury.<sup>[2]</sup>

Despite the notable advances in recent decades in the resuscitation and surgical management of patients with traumatic liver injury, severe liver trauma still accounts for significant morbidity and mortality.<sup>[3,4,5,6]</sup> Major liver injury is the leading cause of death in patients with abdominal trauma, and its treatment continues to challenge surgeons.<sup>[7,8]</sup> The main cause of early liver injury-related death is uncontrolled haemorrhage, and it is associated with a mortality rate of 50-54% within the first 24hr following admission.<sup>[8]</sup>

Ironically it is however recognized that between 50% and 80% of liver injuries cease bleeding spontaneously, and with improved diagnostic and resuscitative management there is an increasing acceptance of non-operative management, resulting in decreased morbidity and mortality rates.<sup>[7,8]</sup>

We report a case of an elderly patient who presented with a traumatic grade 4 liver laceration who was managed successfully with interventional radiology thus

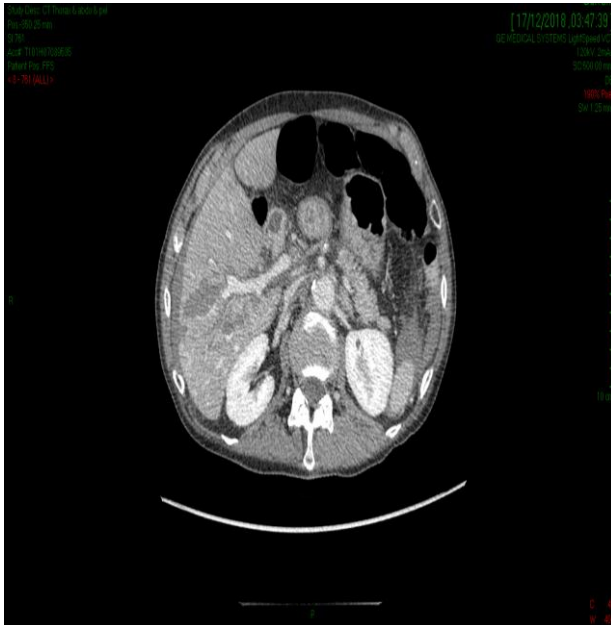
avoiding major surgical treatment with likely significant morbidity and potentially post-operative mortality.

**CASE REPORT**

A 72yr old lady was admitted via the emergency department to the acute surgical ward following a fall down 6 stairs at home after alcohol consumption. The patient fell onto her right side and on admission complained of severe right - sided abdominal pain, she denied other injury. Admission examination demonstrated a Glasgow coma score (GCS) of 15/15. She had equal air entry bilaterally and a soft abdomen with tenderness and localised peritonism elicited over the right upper quadrant and right flank region, with no evidence of external bruising. Admission observations demonstrated a tachypnoea, a relative hypoxia (oxygen saturations 98% on 15L/minute of oxygen and a tachycardia of 110bpm, blood pressure and temperature were normal. IV access was established and the patient was resuscitated with IV fluids and given analgesia and bloods were sent urgently. Admission bloods were normal, including coagulation screen and amylase. The liver function tests were also normal with the exception of ALT that was 6times the upper limit of normal. An arterial blood gas demonstrated a metabolic acidosis and a chest x-ray was normal. An urgent CT scan of chest, abdomen and pelvis was performed and this revealed extensive intra-hepatic liver lacerations with disruption of the liver parenchyma in segments 5 and 6. Active arterial bleeding was also present (figure 1). A CT angiography with hepatic artery embolization was

performed by the interventional radiologists with immediate cessation of bleeding.

The patient was transferred to the surgical high dependency unit post - procedure where she was remained haemodynamically stable.



**Figure 1: CT demonstrating active arterial bleeding and extensive intra-hepatic liver lacerations with disruption of the parenchyma in segments 5 and 6.**

A repeat CT scan was performed 48hrs following embolization and this demonstrated no further bleeding (figure 2). An MRCP was performed on day 3 post procedure and this demonstrated a focal biliary fistula secondary to the hepatic laceration and oral antibiotics were commenced. The patient was discharged home day four post - hepatic artery embolization.



**Figure 2: CT demonstrating coils in the hepatic artery and no intra-hepatic bleeding.**

The patient was re-admitted two weeks post discharge with right upper quadrant pain and raised inflammatory markers. She was clinically well and haemodynamically stable. A repeat CT scan demonstrated a triangular area of hypo-attenuation in liver segments 5 and 6 corresponding with the previous laceration. A small sub-capsular liver collection was also evident, felt likely to be a biloma or haematoma and a collection was evident within the peritoneal cavity, there was no evidence of further haemorrhage. A therapeutic paracentesis was undertaken with significant improvement in the patient clinically and biochemically. The patient completed a course of intra-venous and subsequently oral antibiotics and was discharged home. The patient was reviewed in clinic 6weeks post - discharge and was clinically well with complete normalisation of inflammatory markers and liver function tests.

## DISCUSSION

The American Association for the Surgery of Trauma (AAST) liver injury scale is the most widely used liver injury grading system (table 1).<sup>[9]</sup>

**Table 1: The AAST liver injury scale.<sup>[9]</sup>**

Injury	Description
<b>Grade I</b>	Haematoma: sub-capsular, <10% surface area Laceration: capsular tear, <1 cm parenchymal depth
<b>Grade II</b>	Haematoma: sub-capsular, 10-50% surface area Haematoma: intra-parenchymal <10 cm diameter Laceration: capsular tear 1-3 cm parenchymal depth, <10 cm length
<b>Grade III</b>	Haematoma: sub-capsular, >50% surface area of ruptured sub -capsular or parenchymal haematoma Haematoma: intra-parenchymal >10 cm Laceration: capsular tear >3 cm parenchymal depth Vascular injury with active bleeding contained within liver parenchyma
<b>Grade IV</b>	Laceration: parenchymal disruption involving 25-75% hepatic lobe or involves 1-3 Couinaud segments Vascular injury with active bleeding breaching the liver parenchyma into the peritoneum
<b>Grade V</b>	Laceration: parenchymal disruption involving >75% of hepatic lobe Vascular: juxta-hepatic venous injuries (retro-hepatic vena cava/ central major hepatic veins)

In determining the optimal treatment strategy the haemodynamic status and associated injuries should also be considered. The appropriate management of liver trauma is based on the anatomy of the injury and the patient's physiology.<sup>[10]</sup> In haemodynamically unstable patients with haemorrhage from major liver injury and massive haemoperitoneum on abdominal imaging, the strategy and techniques for bleeding control can be extremely demanding and complex.

Since Pringle's publication of inflow vascular control on liver, the primary focus of trauma surgeons was to find the best way to achieve haemostasis, bile-stasis and infection control in hepatic injuries.<sup>[11]</sup> Today the focus of trauma surgeons is selection of appropriate patients for operative management, which patients are candidates for surgery, who can be managed with non-operative management and when to operate or refer to the interventional radiologists? The general contraindications for non-operative management in liver trauma include haemodynamic instability, extravasation of intravenous contrast during CT angiography, an expanding hematoma and grade IV and V liver injury.<sup>[12]</sup> In the case presented the patient had a grade 4 liver injury with extravasation of contrast but as she was consistently haemodynamically stable she underwent successful angiography with embolization of the hepatic artery. Following this procedure the patient was closely monitored in level 2 care to ensure continued stability with early repeat CT scan performed to exclude re-bleeding or expanding haematoma, and despite the high grade liver injury the patient avoided operative management with its associated morbidity and potential mortality. The management of the patient described in this study is supported by the results of a recent Cochrane review that supported non-operative management by concluding that currently there is no evidence to support the use of surgery over non-operative management for patients with blunt abdominal trauma.<sup>[13]</sup>

It is important when managing a patient with significant blunt trauma liver injury non-operatively that the patient is closely monitored, in our patient, she was initially managed in surgical high dependency so that any change in haemodynamic stability or clinical deterioration can be immediately recognised with repeat CT angiography to exclude re-bleeding or expansion of haematoma, in which case operative intervention may have been required.

The operative management of liver injuries requires the use of some of the most complex surgical techniques, including extensive hepatotomy with selective deep vessel ligation, hepatorrhaphy, selective hepatic artery ligation, non-anatomic resection and debridement, hepatectomy or damage control surgery with liver packing.<sup>[8,12]</sup>

Over 50% of patients surviving grade III–V liver injuries will be at risk for the development of complications, these include haemorrhage, haemobilia, arteriovenous fistula, pseudo-aneurysm, biloma, bile leak and abscess formation.<sup>[14]</sup>

Complex hepatic injuries have a high mortality rate and mortality varies depending on the grade of the injury, associated injuries and the general condition of the patient. A reduction in operative mortality, especially for higher-grade liver injuries (Grades III, IV and V), is attributed to new approaches in the form of non-operative management strategies, damage control and the use of peri-hepatic packing. The overall mortality rate may vary from 10% to 42%.<sup>[15]</sup> Various factors have been found to have a strong association with the mortality rate, these include hemodynamic instability, coexisting musculoskeletal and chest injury, high levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT), lactate dehydrogenase, long activated partial thromboplastin time, prothrombin time, low fibrinogen levels and platelet count on admission.<sup>[16]</sup> Unsurprisingly mortality from blunt liver injury is significantly reduced when managed by hepatobiliary surgeons.<sup>[16]</sup>

## CONCLUSION

Major liver injury is the leading cause of death in patients with abdominal trauma. Traditionally patients with severe blunt trauma to the liver were managed with complex operative techniques with not insignificant morbidity and mortality. Modern management of these patients demands careful assessment and resuscitation with early imaging and providing the patient is physiologically stable with interventional radiology under hepato-biliary specialist management non-operative management can often lead to full patient recovery with minimal morbidity and early discharge.

## Grant

None.

## CONFLICTS OF INTEREST

We the authors of this case report have no conflicts of interest to declare.

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