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## SURGICAL TECHNIQUE

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# ROLE OF LAPAROSCOPY IN BLUNT LIVER TRAUMA

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Although much has been written about the role of laparoscopy in the acute setting for victims of blunt and penetrating trauma, little has been published on delayed laparoscopy relating specifically to complications of conservative management of liver trauma. There has been a shift towards managing liver trauma conservatively, with haemodynamic instability being the key indication for emergency laparotomy, rather than computed tomography findings. However, as a side-effect of more liver injuries being treated non-operatively, bile leak from a disrupted biliary tree presenting later in admission has appeared as a new problem to manage. We describe in this article three cases that have been managed by laparoscopy and drainage alone, outlining the advantages of this technique and defining a new role for delayed laparoscopy in blunt liver trauma.

**Key words:** bile leak, laparoscopy, liver trauma.

Abbreviations: CT, computed tomography; ERCP, endoscopic retrograde cholangiopancreatography; HIDA, hepatobiliary iminodiacetic acid.

## INTRODUCTION

Previously, with more patients proceeding to laparotomy for major liver injuries, uncontrolled bile leak was less of a problem because injuries were repaired or drained at the original laparotomy. Development of ascites because of bile or resolving haematoma during the first week following a traumatic injury may present as increasing abdominal distension, pain, sepsis of unknown origin, or deranged liver function tests (particularly hyperbilirubinaemia) or noted on computed tomography (CT) for other indications. The management of this problem is dictated by the quantity of ascites and the presence or absence of sepsis. Clearly, patients with large-volume ascites and sepsis or abdominal compartment syndrome need drainage for diagnosis as well as for treatment. Sepsis in the setting of small-volume ascites may warrant aspiration of the fluid to exclude this as the infective source. Small-volume ascites with no sepsis that is discovered incidentally on CT scan can usually be managed conservatively with no further intervention. When required, drainage can be achieved with percutaneous aspiration, laparoscopy, or laparotomy and is often supplemented with endoscopic decompression of the biliary tree.

## CASE DETAILS

### Case 1

A 20-year-old female driver involved in a multiple car collision presented in a haemodynamically stable condition with a grade IV liver laceration (American Association for the Surgery of Trauma,

Organ Injury Scale: liver<sup>1</sup>) on admission CT (Fig. 1a), as well as a lacerated knee and a minor closed head injury, all of which were treated conservatively, and no initial blood transfusion was required. A repeat CT scan taken 48 h later (Fig. 1b), following a fall in haemoglobin that required transfusion of 2 units of packed red blood cells, showed increasing haemoperitoneum, and an angiogram subsequently showed active bleeding into segment V, as well as contrast entering the biliary tree. In the setting of haemodynamic instability, bleeding was controlled with selective angiographic embolization. Three days following that, in the setting of developing sepsis, the patient underwent laparoscopy for drainage of a large accumulation of haemobiloma. Thereafter, abdominal drainage of initially 300–400 mL bile stained irrigation fluid daily rapidly declined with clearing of biliary staining, and the drains were removed on day-4 post operative for the pelvic drain, and the subphrenic day-14 post op after biliary drainage had subsided. Treatment with i.v. amoxicillin, gentamicin, and metronidazole was continued for 5 days with a further 10 days of oral amoxicillin/clavulanic acid. No further complications were found during the patient's 15-day inpatient stay.

Laparoscopy was preferred to endoscopic retrograde cholangiopancreatography (ERCP) because the primary problem of large-volume ascites directed management towards the drainage of that collection. Once the bile leak was controlled with drain tubes, it rapidly subsided, making subsequent ERCP unnecessary in this case. Hepatobiliary iminodiacetic acid (HIDA) scan was also deferred because the large-volume ascites dictated surgery and further imaging would not have changed management strategy.

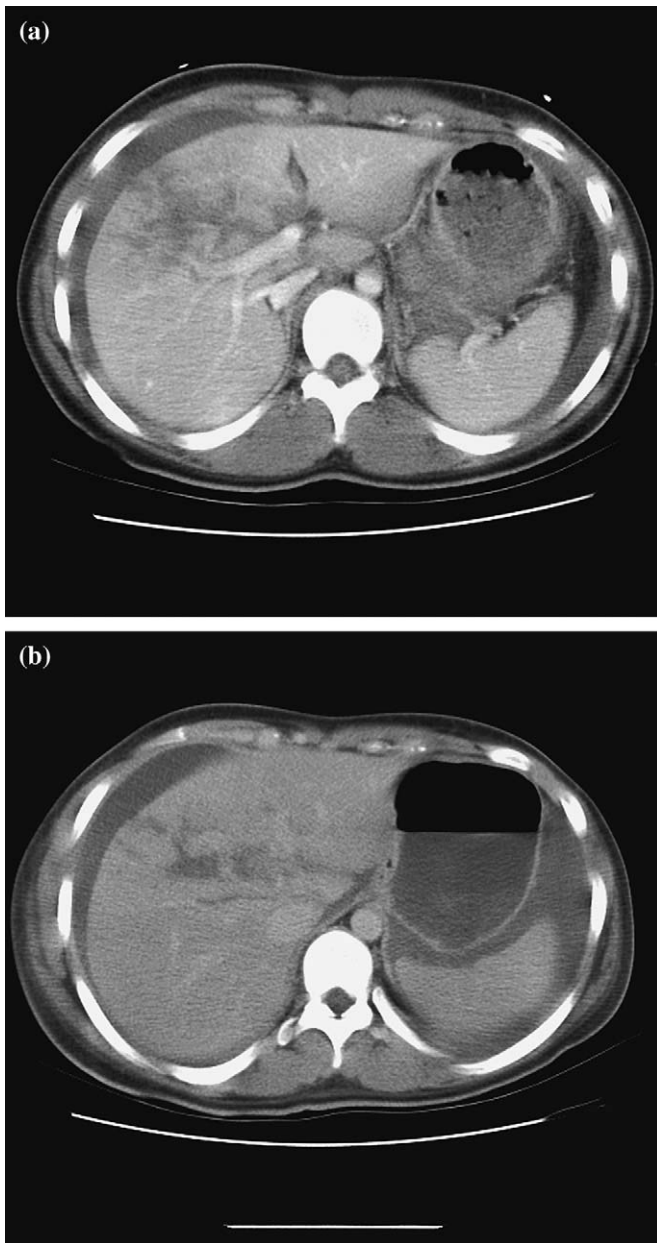
### Case 2

A 46-year-old male farm hand was initially treated conservatively at a regional hospital for a horse kick to his right flank, resulting in fractured ribs, haemopneumothorax, and pulmonary contusion and in a liver laceration involving segments VII and VIII. He was

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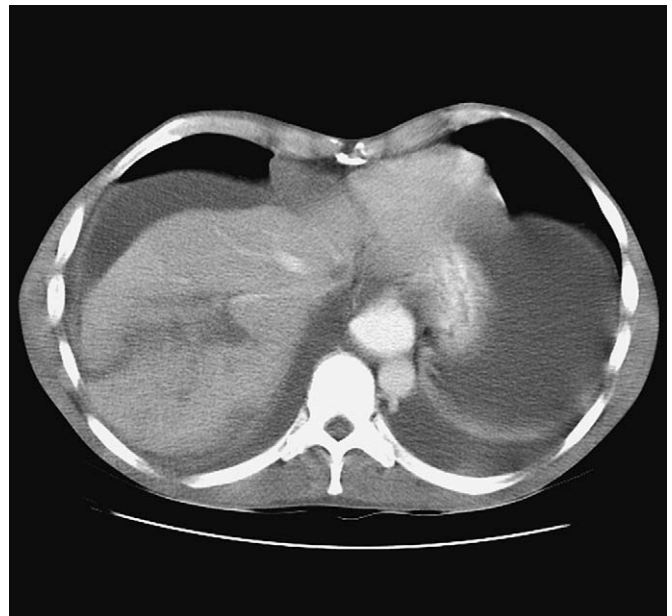
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**Fig. 1.** (a) Initial computed tomography (CT) scan of case 1 showing grade IV liver laceration. (b) Repeat CT at 48 h with diffuse haemobilious ascites, note especially around the spleen.

transferred to a level 1 trauma centre on day 14 with deteriorating liver function tests, an ileus, and respiratory distress as part of abdominal compartment syndrome. CT showed extensive ascites and pleural effusion (Fig. 2). Operative intervention was indicated to drain the fluid accumulation, so neither HIDA scan nor ERCP was carried out. Laparoscopy was carried out and 5.5 L of bile-stained haemoperitoneum was drained. A right-sided intercostal catheter was inserted for a sympathetic pleural effusion. Two drains were left in the abdominal cavity. Stenting at subsequent ERCP was considered, but the volume of bile draining did not persist at high levels. Both drains were removed 9 days after surgery, once bilious staining had resolved. The patient was then discharged, 23 days following the injury and 9 days after

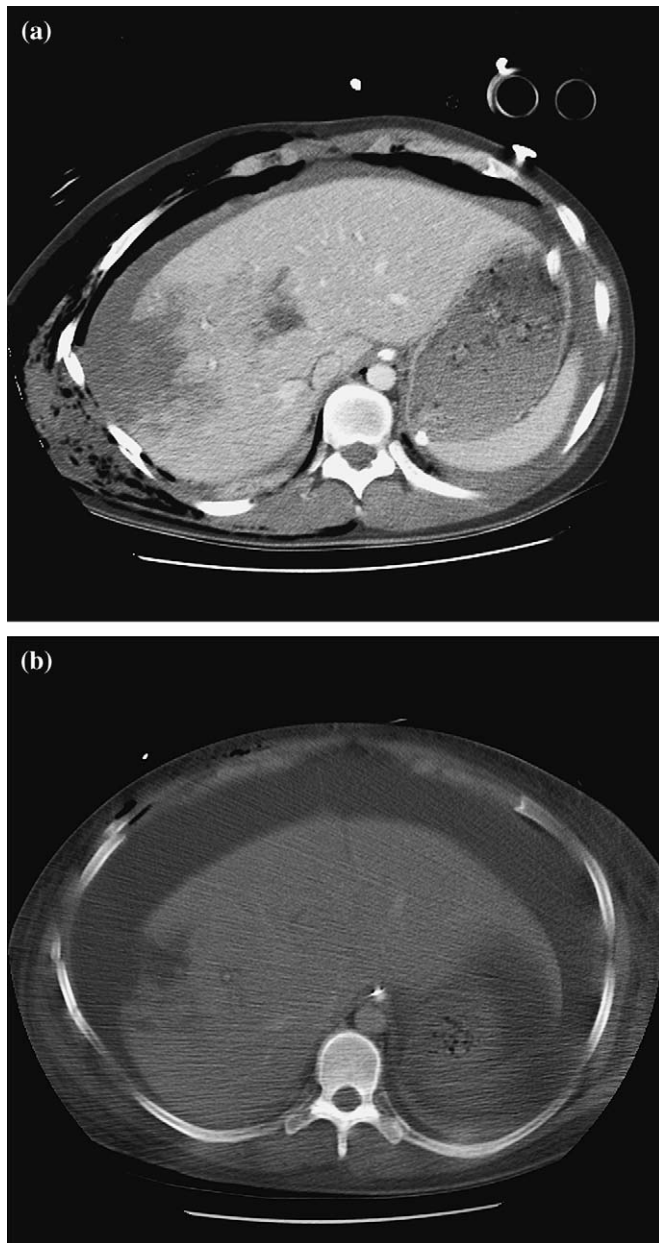


**Fig. 2.** Computed tomography scan of case 2 showing extensive ascites and pleural effusion.

transfer, without further complication. The patient required transfusion of 2 units of packed red blood cells during his inpatient stay and was placed on a course of oral amoxicillin/clavulanic acid for 10 days following surgery.

### Case 3

A 24-year-old, female, hepatitis C-positive driver from a single vehicle motor vehicle accident was admitted with a grade IV liver laceration (Fig. 3a). In addition, she had suffered thoracic and orthopaedic injuries including a flail segment, a haemopneumothorax, pulmonary contusion, and multiple limb and facial fractures. The abdominal injury was treated conservatively given the patient's haemodynamic stability, requiring only 2 units of packed red cells on admission, 2 more units on day 1 of admission and 1 more unit on day 4 of admission. Antibiotic prophylaxis with cephalosporin was changed after 48 hours to treatment with tobramycin, vancomycin, and timentin in the intensive care unit. On day seven of admission, in the setting of increased abdominal distension, unresolved sepsis, and the requirement of 4 units of packed red cells, a CT scan was arranged, which showed large-volume ascites (Fig. 3b). The patient then proceeded to laparoscopy and peritoneal lavage to drain 6 L of bile-stained haemoperitoneum. Over 1 L of fluid was drained from each of the drains for the first 2 days and the volume of fluid drained fell rapidly with resolution of bile staining. The pelvic drain was removed on day 3 post op and the subphrenic drain on day 22 in hospital, 8 days after the bile leak had resolved and once drain volumes fell below 50 mL/day. Antibiotics were ceased after 10 days. Neither HIDA scan nor ERCP were undertaken because diagnosis or treatment of biliary leak was not the clinical indication for intervention, rather treatment of falling haemoglobin, sepsis, and developing ascites, which at operation proved to be bilious. Postlaparoscopy stenting was considered, but with the rapid decline in the volume of bilious leak seen through the drains, it was clear that the leak had been adequately controlled without the need for any further



**Fig. 3.** (a) Initial computed tomography (CT) scan of case 3 showing grade IV liver laceration. (b) CT scan taken 1 week later showing increased ascites.

intervention. The patient was discharged after 22 days, without further complication.

## DISCUSSION

Conservative management of blunt hepatic trauma is safe and effective, being successful in 94% of cases.<sup>2</sup> Non-operative management may result in bile leak or other complications, such as fistula (arteriovenous, arteriohepatic, biliovenous) or abscess (intrahepatic or perihepatic), because of a failure to initially adequately debride and repair injured tissue. The three cases reported here support the concept that laparoscopy is a safe, effective, and

minimally invasive treatment for haemobilious ascites following blunt hepatic trauma.

In the initial setting of multitrauma, laparotomy for biliary reconstruction or repair is clearly inappropriate but nevertheless, more than 50% of grade IV and 70% of grade V hepatic injuries initially treated conservatively will eventually require secondary intervention.<sup>3</sup> Conversely, of patients who do require intervention, 94% have suffered a grade IV or V injury.<sup>3</sup> In fact, up to a quarter of patients with any grade of liver injury may be expected to require further intervention, most commonly embolization for bleeding but up to 10% laparotomy for problematic bile leak.<sup>3</sup> The role of laparoscopy in this setting has never been clearly elucidated, probably because most case series have very few of these high-grade injuries.<sup>3</sup> Only 15 cases of delayed laparoscopy following blunt liver trauma over a 5-year period have been reported by Carrillo *et al.*<sup>4</sup> and a further two cases were reported by Griffen *et al.*<sup>5</sup> in 2000.

Laparoscopy gives the opportunity to carry out lavage with the ability to manipulate the intra-abdominal organs around which biliary collections form. Drains can also be directed under vision into the peritoneal cavity. In this setting where other intra-abdominal injuries are not suspected, laparotomy has little to add at the cost of significant morbidity.

ERCP may be required secondarily to decompress the biliary tree and to promote internal drainage but it does not address the problem of a potentially infected, large fluid collection in the peritoneal cavity. Its role is complementary to laparoscopy and may be required following washout and drainage, particularly in the setting of a persistent leak postlaparoscopy. Ongoing, unresolved leaks usually require a stent.

Although percutaneous drainage of small collections may be appropriate, initial percutaneous drainage of infected collections may require further aspirations, with 40% of patients who were initially drained radiologically subsequently proceeding to operation.<sup>6</sup> These patients with larger collections may well have been treated more definitively with laparoscopy, lavage, and better placement of drain tubes.

Routine repeat CT scan to pre-empt requirement for intervention is a controversial area. Bile leak of clinical significance with unresolved abdominal pain, increased bilirubin, increasing abdominal distension, and sepsis mandates CT scan. High-grade injuries often result in complications requiring intervention and may warrant routine scanning, although in patients with injury that is grade III or lesser, scanning is probably not warranted.

There are currently no good indicators to show that a patient will develop a bile leak following major hepatic trauma. Patients with grade IV or V injury can, however, be anticipated to develop at least some complication, be it leak, fistula, or abscess, particularly if their injury extends to the central areas of the liver.<sup>8</sup> Awareness of this likely eventuality and a willingness to consider laparoscopy should be encouraged. A low threshold for CT in patients treated conservatively with grade IV or higher liver trauma is appropriate. In each of our cases, it was clear that the patients required prompt surgery, however, further imaging of the biliary tree is probably appropriate in most cases before intervention, especially non-invasive imaging such as magnetic resonance cholangiopancreatography and HIDA scanning. Laparoscopy is an excellent option in the management of this group of patients with a preoperatively defined bile leak and a collection requiring drainage. Laparoscopy should be considered as an alternative to percutaneous radiological drainage and ERCP in stable patients with blunt liver trauma and haemobilious ascites as it may be

superior by providing more extensive lavage, while avoiding the morbidity of a laparotomy.

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