Endoscopic sphincterotomy and temporary internal stenting for bile leaks following complex hepatic trauma

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Background: Biliary leak secondary to blunt or penetrating hepatic trauma and damage to the intrahepatic biliary tree remains a challenging problem. The role and safety of endoscopic retrograde cholangiopancreatography (ERCP) and stenting in this setting were studied.

Methods: All trauma victims who developed a bile leak secondary to hepatic trauma were included. Bile leak was defined as the appearance of bile in a surgical wound or intra-abdominal drain after surgery, following percutaneous drainage of a perihepatic bile collection, or evidence of a leak on hepatobiliary scintigraphy. ERCP was performed within 24 h of diagnosis and included biliary sphincterotomy and internal stenting. Recovery was defined as cessation of leakage.

Results: Between 1996 and 2004, six patients with penetrating injuries and five with blunt abdominal injuries were treated according to the study protocol. Eight underwent surgery to control bleeding or for additional intra-abdominal injuries. All bile leaks resolved completely within 10 days of ERCP. One patient died from pulmonary sepsis; ten recovered without hepatobiliary sequelae.

Conclusion: ERCP, biliary sphincterotomy and temporary internal stenting, together with percutaneous drainage of intra-abdominal or intrahepatic bile collections, represent a safe and effective strategy for the management of bile leaks following both blunt and penetrating hepatic trauma.

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Introduction

Non-operative management of haemodynamically stable patients following blunt hepatic trauma has become standard practice in most trauma centres1–3. Liberal use of ‘damage control’ techniques is currently the recommended guideline in the management of unstable patients and this approach is also frequently applied to patients with penetrating hepatic trauma4,5. As a result of improved survival following severe extensive hepatic parenchymal damage, secondary bile leak from the intrahepatic biliary tree has become a more common complication, with potentially serious sequelae.

Therapeutic ERCP, including sphincterotomy and internal stenting, has been suggested for the treatment of bile leaks after laparoscopic cholecystectomy6,7 and after elective hepatic surgery8,9. Extending the indication for endoscopic treatment to post-traumatic leaks has been proposed in a few small series and case reports10–16, but its safety and effectiveness in this setting has not been established. This paper presents the results of endoscopic management of post-traumatic bile leaks in patients with complex hepatic injuries.

Patients and methods

The records and imaging studies of patients treated in two high-volume level 1 trauma centres (more than 3500 admissions annually for major trauma with an injury severity score (ISS) greater than 15) in the Tel-Aviv area were reviewed retrospectively. Patients were identified from the codes for diagnosis (hepatic trauma) and procedure (ERCP).
All patients who developed a post-traumatic bile leak were included, regardless of the trauma mechanism (blunt, stab or gunshot wound) or initial method of management (surgical versus expectant, definitive versus staged).

Initial treatment, resuscitation and investigation were carried out strictly according to the guidelines of the Advanced Trauma Life Support and American College of Surgeons. Patients were assigned to surgical or non-surgical treatment according to the mechanism of trauma and their haemodynamic status. The algorithm describing the decision-making process is shown in Fig. 1. Unstable patients with very severe injuries were managed by a staged ‘damage control’ approach (perihepatic packing to control bleeding, spillage control, temporary abdominal closure, stabilization in an intensive care environment and planned reoperation for definitive treatment).

The definition of bile leak was based on the persistent drainage of bile through a surgical wound or via an intra-abdominal drain after surgery, following percutaneous drainage of a perihpatic collection, or a positive diagnostic hepatominodiacetic acid (HIDA) scan in patients who were treated conservatively. When bile drainage was negligible (less than 50 ml per day) or had ceased within 48 h of onset, the patient was not treated endoscopically and was not excluded from the study. As these patients were not coded for ERCP and there was no special coding for bile leak or external biliary fistula, it was not possible to determine the total number of patients with minor bile leakage following hepatic trauma. This report is therefore limited to diagnostic and therapeutic aspects of the events and excludes epidemiological, pathophysiological and predictive issues.

ERCP was performed within 24 h of diagnosis and included diagnostic cholangiography, demonstration of the leak, sphincterotomy and internal stenting with an 8- or 10-Fr transpapillary plastic stent. There was no intention to bridge the leak site with the stent.

All patients were maintained on enteral nutrition by eating or via a jejunal feeding tube. Somatostatin was not used routinely. Bile collections were drained percutaneously and antimicrobial therapy was administered according to the results of drainage and blood culture.

Recovery was defined as the cessation of leakage, and drains were removed once this had been achieved. Stent removal was performed 6–8 weeks after insertion. Follow-up continued for up to 3 months after discharge and included liver function tests.

**Results**

Between 1996 and 2004, a mean of 280 patients were admitted annually with documented liver injury. Some 40–70 per cent were classified as having serious trauma (ISS above 15) and 20–40 per cent as having a severe injury (ISS above 25). Eleven patients with a mean age of 31 (range 15–47) years were identified with bile leakage following hepatic trauma. The mechanism of the injury was penetrating trauma in six patients (three high-velocity gunshots, one low-velocity gunshot, two stabbings) and blunt abdominal injury in five (all motor vehicle accidents).

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**Fig. 1** Principles of initial wound management. *Criteria included prolonged haemodynamic instability, hypothermia, severe acidosis, coagulopathy and massive transfusion
Initial management included emergency laparotomy in eight patients, of whom five had penetrating and three had blunt trauma. Operative procedures included packing (four patients), ligation of the left hepatic artery (one), distal pancreatectomy (two) and right hepatic lobectomy (one). Immediate postoperative angiographic embolization of the right hepatic artery was performed in one patient after laparotomy and packing. Two patients had postoperative abdominal compartment syndrome that required reoperation for decompression of abdominal pressure.

Bile leaks presented clinically as fistulas in the surgical wound (three patients), bile in the surgical drain (three), sepsis with bile-stained ascites (two) and peripancreatic bilaoma (three) following persistent bile leak through drains placed percutaneously.

ERCP demonstrated a leak from the right hepatic duct (one patient), peripheral branches of the right hepatic duct (five), the left hepatic duct (three), peripheral branches of the left hepatic duct (one) and the cut surface of the liver following right hepatic lobectomy (one). All 11 patients underwent biliary sphincterotomy and insertion of a plastic stent.

The bile leak resolved in all patients. The mean interval between ERCP and complete resolution (defined by removal of the external drain) was 6.7 (range 5–10) days. One patient died after the development of pulmonary sepsis. All patients underwent ERCP 6–8 weeks after the initial procedure; cholangiography was performed to demonstrate resolution of the leak, and stents were removed.

**Discussion**

The use of ‘damage control’ techniques in the management of unstable patients with major hepatic trauma and non-operative management of haemodynamically stable patients with blunt hepatic trauma has improved survival. In turn, this has led to an increased incidence of complications resulting from extensive liver parenchymal damage that has intentionally been left untreated, including persistent haemorrhage, intrahepatic and peripancreatic abscesses, haemobilia and bile leak. Most of these problems can be managed by interventional techniques that are less invasive than laparotomy, including arteriography and selective embolization, computed tomography-guided drainage of infected collections, and ERCP with endoscopic sphincterotomy and biliary stenting. Non-operative techniques can be successful in up to 85 per cent of these patients.

Postoperative bile leak is a significant problem, with morbidity and mortality rates as high as 40 per cent in some studies. Reoperation in patients with bile leak and septic intra-abdominal complications carries a significant risk of death. ERC and placement of a transpapillary plastic stent led to successful resolution of the leak in 90–100 per cent of patients. The theory behind the effectiveness of this method is that stenting reduces the pressure gradient between the bile duct and the duodenum by eliminating the physiological role of the sphincter of Oddi. Bile is drained preferentially into the duodenum, allowing the disrupted duct to heal spontaneously. This may be accomplished by sphincterotomy, stent placement, or a combination of the two. However, as stenting may be superior to sphincterotomy alone and stenting alone may increase the risk of pancreatitis, the present authors decided to use the combined approach.

The successful use of ERCP and stenting of the papilla in patients with bile leak following hepatic injury has been described previously. The present series is the largest reported to date and led to the resolution of both minor and major bile duct damage. All leaks resolved within 10 days of the procedure and there was no extravasation of contrast on cholangiography performed 6–8 weeks later.

The extent of hepatic damage and presumed leak source should not exclude a diagnostic and therapeutic endoscopic attempt. Whether peripheral leaks would resolve spontaneously, with no intervention, cannot be addressed by analysis of the present data. The rapid resolution of leakage after this relatively simple and safe procedure indicates its value when used without delay and irrespective of the source of the leak.

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**References**


