

ORIGINAL ARTICLE

Transition from a low- to a high-volume centre for bile duct repair: changes in technique and improved outcome

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Abstract

Background: Improvements in bile duct injury repairs have been shown in centres with specialized surgeons. The aim of the present study was to demonstrate the temporal change in the pattern of referral, technical variation associated with repair and long-term outcome of bile duct injuries at a tertiary referral centre in Mexico City.

Methods: A retrospective case note review was performed. Patients were divided into two groups: group I (GI) 1990 to 2004 and group II (GII) 2005–2008, and appropriate statistical analysis undertaken.

Results: Over a 20-year period, 312 patients with iatrogenic bile duct injuries required surgical treatment (GI = 169, GII = 140 patients). All injuries were reconstructed using a Roux-en-Y hepaticojejunostomy. The proportion of patients who had undergone a laparoscopic cholecystectomy increased from 24% to 36% ($P = 0.017$) over the two time periods. In the second time period there was an increase in segment IV and V partial resections ($P = 0.020$), a reduction in the use of transanastomotic stents (42% to 2%, $P = 0.001$) and an increase in the proportion of patients requiring a neoconfluence (2% to 11%, $P = 0.003$). In the second time period, the number of patients requiring a hepatectomy during repair (2% to 1%, $P = 0.001$), a portoenterostomy (16% to 9%, $P = 0.060$) or a double-barrel hepatico-jejunostomy (5% to 1%, $P = 0.045$) significantly decreased. During follow-up, patients in the second time period had a reduction in the incidence of post-operative cholangitis (11% to 6%, $P = 0.310$) and the frequency of post-operative anastomotic stenoses (13% to 5%, $P = 0.010$). Mortality remained low throughout the series but was absent in the second group.

Conclusions: Changes in technique and growing experience of the multidisciplinary team improved operative and long-term results of bile duct injury repair.

Keywords

bile duct injury, cholecystectomy, biliary, gall bladder

Received 18 February 2011; accepted 31 May 2011

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Background

The incidence of bile duct injury (BDI) associated with a laparoscopic cholecystectomy has remained constant at 0.3% to 0.6%.^{1,2} Several studies have shown better long-term outcomes for patients with bile duct injury if subsequent surgery is performed at centres experienced in the repair of such injuries.^{3–6} Knowledge of the

mechanism of injury, correct classification and decision making with respect to the timing and method of repair (endoscopic, radiological and/or surgical) are all important in optimizing outcome. This is more likely to occur in a centre specialized in hepato-pancreato-biliary (HPB) surgery^{6–8} and the best post-operative results are reached with an individualized therapeutic approach.^{6,8–12}

Previous studies have reported complete rehabilitation after injury in 75–98% of patients.^{3–6,8–10,13–15} Such a wide range in rehabilitation may be explained by the difference in the mechanism of

This paper was presented at the American Hepato-Pancreato-Biliary Association 11th Annual Meeting, Miami, FL, USA.

injury and variability in the final anatomical status of the ducts. The individual characteristics of a given patient including the loss of biliary confluence and the state of the vascular blood supply of the ducts are important factors in determining long-term outcome.^{16,17} A Roux-en-Y hepaticojejunostomy remains the best surgical alternative in patients where complete transection of the duct has occurred.^{14,18}

The aim of the present study was to analyse the temporal change in referral pattern, surgical technique and long-term outcomes in patients who suffered a bile duct injury.

Methods

With prior approval of the local Institutional Committee for Human Investigation, a retrospective review of the hospital database from January 1990 to December 2008 was conducted.

All patients referred with a BDI were evaluated by a multidisciplinary group and the best available treatment option decided. For the purposes of the present study, only patients who underwent surgical reconstruction were included for further analysis. Patients were divided in two groups according to the year of repair: GI 1990–2004 (172 patients) and GII 2005–2008 (140 patients). All were treated by means of a Roux-en-Y hepaticojejunostomy. Modifications^{8,14,19} that occurred over time were recorded. This division of time periods was chosen as major changes (reduction of stent use, liver segment IV resections and the use of a neoconfluence as part of the reconstruction) had all occurred. All repairs were performed by one surgeon (M.A.M.).

Variables assessed were divided according to pre-operative, operative and post-operative periods. A minimum follow-up of 6 months was obtained in the second group to ensure adequate assessment of long-term results.

The index operation was defined as the first reconstructive procedure after referral to the HPB surgeon. A hepatectomy was recorded either as part of the index operation or as a reintervention. A partial segment IV and V resection is defined as a small wedge resection performed just above the bifurcation of the bile duct at the hilar plate. A neoconfluence is defined as the surgical approximation of separated right and left hepatic ducts in order to perform a single hepatico-jejunostomy (partial resection of liver segment IV is always performed in combination to allow a tension free approximation of the separated ducts). Operative mortality was considered within 60 days of the index operation or during the same hospitalization as the index operation.

Classification of the injury

The Bismuth classification was used before 1997²⁰ and the Strasberg classification has been applied since.²¹ Other classifications systems have been proposed but are not currently used.^{22,23} Since other imaging techniques were not readily available, ultrasound was used as the main imaging method in the 1990s to document intrahepatic dilation of the bile ducts and bilomas while providing very limited information on the type of injury. Percutaneous cho-

langiography was used and is still used selectively as a result of its invasive nature. A fistulography before the index operation through post-operative drains was a useful diagnostic tool in some patients. Magnetic resonance cholangio-pancreatography (MRCP) and endoscopic retrograde cholangio-pancreatography (ERCP) have been used in the last decade as the most effective tools to visualize of the biliary tree pre-operatively.

In recent years, patients were scheduled for endoscopic or radiological treatment, mainly when there is continuity of the bile ducts and in some situations where stenotic bilio-enteric anastomoses can be dilated percutaneously (either before or after the index operation).

In terms of timing, patients underwent reconstruction as soon as adequate anatomical detail had been obtained. Patients who presented with severe sepsis and multiple organ failure were excluded from such an approach. In this situation, repair was delayed until the patient's condition had stabilized. Thus the time of repair in this series was dictated mostly by the timing of referral.

Surgical technique

The standard approach consisted of selectively dissecting the porta hepatis, preserving all the identified arterial branches and freeing the anterior aspect of the proximal bile ducts. The repair was undertaken to the anterior surface of the proximal bile ducts to preserve the circulation and to permit a more proximal anastomosis. In some patients lowering the hilar plate was performed to access more proximal ducts for the anastomosis. To obtain a wide, tension-free anastomosis and to give room for the intestinal loop, partial resection of segments IV and V was performed frequently.²⁴ The extension of the anterior opening of the common bile duct towards the left duct was common practice, particularly for thin ducts. The jejunal limb is anastomosed in a side-to-side fashion, with interrupted everted sutures of 5–0 hydrolyzable monofilament material (Figs 1,2).¹⁶ A major hepatectomy was performed at an index operation in patients in whom a duct was identified as having irreversible damage and/or the intrahepatic biliary tree was affected because of major arterial injury, mainly the right hepatic artery.^{14,25} A closed suction drain was used routinely.

After discharge, routine follow-up was maintained via outpatient clinic appointments at 1, 3, 6, and 12 months and yearly thereafter. A clinical history and biochemical analysis²⁶ for cholangitis were undertaken at each visit. If there was any suspicion of cholangitis, further imaging of biliary tree by percutaneous cholangiography (PTC) or magnetic resonance imaging (MRI) were undertaken. Depending on the results, management ranged from ambulatory antibiotic use to hospitalization and, in rare situations, reoperation.

Statistical analysis

Continuous variables are presented as medians (range). GraphPad software was used, calculating Fisher's exact test to compare all dichotomic variables.

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