Iatrogenic Bile Duct Injury at Cholecystectomy

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Injury to the biliary tree at cholecystectomy is an uncommon, but serious complication of this procedure. Our experience in the management of five patients with such injuries is reported. The injury presented as jaundice in two patients, and as jaundice with cholangitis, intraoperative bile leak and ascites with peritonitis in each of the remaining three patients. The most useful diagnostic tools were percutaneous transhepatic cholangiography and endoscopic retrograde cholangiopancreatography. Repair of the injury was performed by a primary end-to-end anastomosis of the common bile duct in one patient and by a Roux-en-Y choledocho- or hepaticojunostomy in four. The best results were achieved when the patient was referred early following the initial operation or prior to the development of liver damage and irreversible cholestasis. The literature on the subject is reviewed.

Cholecystectomy is the most frequently performed major abdominal operation in Saudi Arabia,¹ showing a more than tenfold increase in incidence in the last decade.² An uncommon but serious complication of this operation is injury to the biliary tree; the overall incidence being 0.2–0.9%.³,⁴ These injuries occurred during simple cholecystectomies in 86% of cases, and the remaining 14% during concomitant exploration of the common bile duct.⁵ In other series 80% of bile duct injuries were reported to have resulted following procedures on the bile system and 20% were during exploration of the common bile duct, gastric resection, portacaval shunt and other upper abdominal operations.⁶ These injuries lead to chronic biliary strictures with subsequent biliary cirrhosis and hepatic failure if the stricture is not repaired properly. Morbidity and mortality rates were reported to be between 6% and 44%, and between 7.9% and 17% respectively.⁵,⁷,⁸

The purpose of this study was to identify some of the factors predisposing to such an injury, to emphasize the individual character of the injury and its management based on our own experience. We have therefore considered it appropriate to describe five patients, who came under our care.

Materials, Methods and Results

Between April 1985 and September 1990 five patients were referred to us with injuries to the biliary tract following cholecystectomy performed elsewhere. Four patients had the initial surgery in this kingdom and one abroad. The diagnosis was made postoperatively 3 days to 1 month following the operation in four patients,
while in one, the injury was detected during the operation (Table 1). In four the operation was an elective cholecystectomy which was considered 'simple', and in one the procedure was for an acute cholecystitis. The records of these patients were analysed with particular emphasis on the risk factors leading to the trauma of the biliary tract. The technique of repair and the nature of the morbidity were also reviewed.

Case 1

This sickle cell positive patient was febrile and jaundiced on admission. Ultrasound (US) revealed hepatomegaly and moderate dilatation of the intra- and extrahepatic ducts. The common bile duct (CBD) was not identified. Percutaneous transhepatic cholangiogram (PTC) showed the site of injury 1.5 cm below the confluence of hepatic ducts (Fig. 1).

At exploration 12 days after cholecystectomy the CBD was found to be divided. The resulting gap of 1 cm was bridged by duodenal mobilization and an end-to-end anastomosis over a T-tube. Three weeks later, while still in the hospital, her total bilirubin had dropped to 118 μmol/litre. At follow-up examination 4 months later she was in good condition and free of jaundice. Her T-tube was removed following a cholangiogram, which was normal. After this she was lost to follow-up, but was accidentally discovered 5 years later, when she was found to be non-icteric with normal liver functions.

Case 2

This patient came under our care 4 years after cholecystectomy and injury to her common hepatic duct, which had been treated in Riyadh by a Roux-en-Y hepaticojejunostomy over a transhepatic stent. On admission, she was icteric with a firm and enlarged liver. She gave a history of intermittent attacks of fever, jaundice and itching starting 2 years previously. Her liver functions were normal. A PTC revealed a tight stricture at the confluence of the right and left hepatic ducts.

At laparotomy the liver was icteric; the anastomosis had stenosed. While dilating the stricture via a jejunostomy the anastomosis became disrupted. A new Roux-en-Y hepaticojejunostomy was fashioned with a subcutaneous jejunostomy for future dilatation if needed. A post-operative cholangiogram showed a good anastomotic calibre. Six months later she developed a blind sac syndrome with ascending cholangitis and a serum bilirubin of 58 μmol/litre necessitating re-exploration. However, the anastomosis was found to be patent. The afferent jejunal loop was detached from the skin and a jejuno-jejunostomy performed. A liver biopsy confirmed the diagnosis of cholangitis. After this the serum total bilirubin dropped to 22 μmol/litre. Later however, the jaundice became deeper with a rising serum bilirubin level.

Case 3

This patient was re-operated for jaundice, fever and pain following a cholecystectomy in Yemen. A year later her symptoms recurred. At that time ultrasound revealed dilatation of the intra- and extrahepatic ducts; a PTC showed obstruction at the porta hepatis.

On exploration, at our hospital, several silk stitches were found, at and around the junction of the hepatic ducts which were obstructed. A Roux-en-Y hepaticojejunostomy was fashioned with a transanastomotic T-tube as a stent. Postoperatively, the fever and jaundice subsided. Her total bilirubin level was 14 μmol/litre. The T-tube was removed 3 months later, when a cholangiogram confirmed satisfactory drainage. At follow-up examination 1 year later the patient was well with normal liver function test results.

Case 4

This male patient underwent cholecystectomy for cholecystitis and jaundice. At exploration the gallbladder was severely inflamed and compressing the CBD. Despite careful dissection the CBD was injured, necessitating a Roux-en-Y hepaticojejunostomy. A month later he was well and remained free of jaundice for 2.5 years. Thereafter he became gradually icteric, and the serum bilirubin level rose to 128 μmol/litre (direct 116 μmol/litre). Ultrasound and PTC showed moderate dilatation of the intrahepatic biliary radicals and an hyperechoic shadow anterior to CBD. At laparotomy there was a stricture at the hepaticojejunostomy and stones were found in the hepatic duct proximal to the anastomosis. Through the jejunal loop the stricture was dilated and stones removed. After this operation he became free of jaundice, and has remained well.

Case 5

This patient was referred with the diagnosis of 'post-cholecystectomy biliary leakage' 3 weeks after her operation. She was found to be dehydrated, jaundiced, and febrile with a high serum alkaline phosphatase level. Other liver function test results were normal. Her abdomen was distended, tender and with a positive fluid thrill. An initial peritoneal tapping removed 5 litres of bile stained fluid, and a second tap yielded another 3 litres. Ultrasound and computed tomographic (CT) examinations revealed massive ascites; the liver and biliary tree were within normal limits. Endoscopic retrograde cholangiopancreatography (ERCP) demonstrated the CBD with a fistula leakage contrast into a pool (Fig. 2).

On exploration it was impossible to define the structures of Calot's triangle. There was a cavity containing bile surrounded by friable tissue. An attempt to negotiate the papilla of Vater via a duodenotomy failed. The procedure was terminated by simple drainage of the cavity. The patient was discharged with the catheter in situ. The bile leak stopped 2 months later, the jaundice improved and her stool was coloured. A contrast study revealed no communication between the cavity and the
Table 1
Injury of extrahepatic bile ducts discovered after cholecystectomy

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Weight (kg)/height (cm)</th>
<th>Presenting features on admission</th>
<th>Site of injury; and presenting symptoms after injury</th>
<th>Time of recognition following operation</th>
<th>Diagnostic imaging</th>
<th>Operative procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>F</td>
<td>40/162</td>
<td>Jaundice (serum bilirubin 590 μmol/litre; direct 266) tender hepatomegaly</td>
<td>Common hepatic duct; jaundice</td>
<td>3 days</td>
<td>US, PTC</td>
<td>End-to-end anastomosis of common hepatic duct</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>F</td>
<td>60/163</td>
<td>Jaundice (serum bilirubin 104 μmol/litre; direct 77)</td>
<td>High common hepatic duct; jaundice</td>
<td>2 weeks</td>
<td>PTC</td>
<td>Roux-en-Y hepaticojejunostomy; transhepatic stent</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>F</td>
<td>50/159</td>
<td>Jaundice, fever, pain (serum bilirubin 36 μmol/litre; direct 24)</td>
<td>High common hepatic duct; jaundice, fever</td>
<td>2 weeks</td>
<td>US, PTC</td>
<td>Roux-en-Y hepaticojejunostomy; T-tube</td>
</tr>
<tr>
<td>4</td>
<td>47</td>
<td>M</td>
<td>90/170</td>
<td>Jaundice (serum bilirubin 149 μmol/litre; direct 132)</td>
<td>High common hepatic duct near bifurcation; intraoperative bile leak</td>
<td>Immediately</td>
<td>—</td>
<td>Roux-en-Y hepaticojejunostomy</td>
</tr>
<tr>
<td>5</td>
<td>38</td>
<td>F</td>
<td>64/165</td>
<td>Ascites, jaundice, fever (serum bilirubin 53 μmol/litre; direct 34)</td>
<td>Choledochus at the cystic duct; ascites, jaundice, fever</td>
<td>4 weeks</td>
<td>US, PTC, ERCP</td>
<td>Roux-en-Y Side-to-side choledochojejunostomy</td>
</tr>
</tbody>
</table>

US: Ultrasound; PTC: Percutaneous transhepatic cholangiogram; ERCP: Endoscopic retrograde cholangiopancreatography.
biliary tree. The catheter was removed. A year later she was readmitted deeply jaundiced with a total serum bilirubin level of 386 μmol/litre (direct 246 μmol/litre). At exploration a hole in the CBD was found; it was partially filled with debris preventing the free flow of bile into the distal segment. A side-to-side Roux-en-Y choledochojejunostomy was performed. Now 8 months after the second procedure the patient is afebrile and free of jaundice.

Discussion

Factors commonly predisposing to surgical trauma of the biliary tree are anatomical abnormalities, misinterpreted cholangiogram, avulsion of the cystic duct and tenting of CBD.\textsuperscript{3,7-9} Indiscriminate clamping or suturing in an attempt to control bleeding, as was observed in Case 3, has been found to be responsible for the trauma in 11% to 57% of cases.\textsuperscript{5,7} This tragedy may be prevented by making use of Pringle’s manoeuvre prior to the application of clamps or sutures. (Pringle’s manoeuvre is a technique to achieve haemostasis by compressing the hepatic artery between the index finger and thumb of the left hand. The index finger is placed in the foramen of Winslow behind the hepatoduodenal ligament while the thumb is situated in front of the same ligament.) Local inflammatory changes, as in Case 4, were reported to be responsible for injury in 19–50% of cases.\textsuperscript{7,8} In such a situation a meticulous dissection is required. If the tissue is extremely friable cholecystostomy is a safer and wiser procedure. Traumatic dissection in the vicinity of the CBD can impair the blood supply and cause an ischaemic stricture.\textsuperscript{5} Contrary to the commonly held surgical opinion obese patients appeared to be at less of a risk than thin patients. Four of our five patients and all six patients reported recently by Malatani\textsuperscript{10} were thin. Mathisen et al. found that 43% cases in their series were described as ‘simple’ cholecystectomies.\textsuperscript{8}

The ductal injury in our patients presented as jaundice in two, and jaundice with cholangitis, intraoperative bile leak and massive ascites with peritonitis in one case each. Similar presentations have been reported by others.\textsuperscript{8}

Ultrasound, intravenous cholangiogram, \textsuperscript{99m}Tc HIDA scanning and standard liver function tests have been found quite disappointing in defining the site and form of injury.\textsuperscript{11} In our limited experience the most useful diagnostic tools proved to be PTC and ERCP.

Recognition of the injury during the initial operation was reported in 19–85% cases.\textsuperscript{5,11,13} In such cases a primary end-to-end anastomosis with a T-tube constitutes the ideal surgical approach.\textsuperscript{12} This was used in our Case No. 1
10 days following the initial operation with very good results. However, a Roux-en-Y choledocho-
hepaticojjunostomy is the procedure of choice if the defect is more than 1 cm long, or is detected a long time after the injury.\textsuperscript{7,9,10}
It gives the best possible results with the least need for re-exploration. The overall mortality from this procedure is 9\% compared with 22\% for others.\textsuperscript{8}

Restenosis with consequent recurrent cholangitis and liver cirrhosis are well documented complications.\textsuperscript{5,7,9} To avert these complications, modifications in the Roux-en-Y hepaticojjunostomy have been suggested such as a Smith mucosal graft and a transanastomotic tubal splint.\textsuperscript{3,9} (Smith's mucosal graft is a technique to achieve mucosa to mucosa anastomosis between a jejunal loop and an inaccessible intrahepatic duct; it is the most successful way to prevent restenosis.)

Currently, splinting is indicated only when the anastomosis has been technically difficult.\textsuperscript{5,8} Long-term follow-up examinations initially at 3- to 6-month intervals and later yearly with recognition of early symptoms, physical examination, liver function tests and HIDA scanning are required.\textsuperscript{5} Such a careful follow-up would help in an early detection of restenosis to prevent its serious sequelae. Symptoms of intermittent cholangitis are definite pointers to restenosis.\textsuperscript{7} When diagnosed it should be corrected without delay to avoid cirrhotic changes.

High rates of morbidity and mortality, despite all technical refinements in the methods of diagnosis and repair of injury, emphasize the need for greater accuracy and care during dissection of the vital structures in the initial cholecystectomy. Undue traction at the cystic duct and indiscriminate clamping of bleeding points may lead to ductal and vascular injury and should therefore, be avoided. In the presence of oedema and friable tissue cholecystostomy is a better alternative. Technical skill, familiarity with the anatomical abnormalities of the biliary tree and competence in performing and interpreting intraoperative cholangiograms are considered decisive factors for success. Moreover, patience during dissection and willingness to call for help, are the special surgical attributes required in order to prevent biliary trauma.

References