Jaundice Post Laparoscopic Cholecystectomy

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ABSTRACT

In just over 20 years, laparoscopic cholecystectomy has emerged as the standard therapy for cholelithiasis and is now being performed with increased safety. However, an uncommon complication of this technique has been jaundice even in patients without iatrogenic bile duct injury. We report on two cases where this complication occurred and review the literature on this topic.

Keywords: Cholecystectomy, Cholelithiasis, jaundice, laparoscopic

Ictericia post Colecistectomía Laparoscópica

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RESUMEN

En sólo poco más de 20 años, la colecistectomía laparoscópica se ha convertido en la forma de terapia estándar de la colelitiasis, y se la está utilizando en la actualidad con mayor seguridad. No obstante, una complicación poco común de esta técnica ha sido la ictericia, incluso en pacientes sin lesión iatrogénica de la vía biliar. Reportamos dos casos en lo que ocurrió esta complicación, y examinamos la literatura sobre este asunto.

Palabras claves: Colecistectomía, colelitiasis, ictericia, laparoscópica

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INTRODUCTION

Operations on the biliary tree are among the most common abdominal procedures performed worldwide (1, 2). Approximately 103 years after the first open cholecystectomy by Langenbuch (1), the first laparoscopic cholecystectomy (LC) was performed by Muhe in 1985 (3, 4). Laparoscopic cholecystectomy has now become the preferred method of treatment for symptomatic cholecystitis (4–7).

Approximately 700 000 cholecystectomies are performed in the United States of America (USA) every year (8). Seventy-five per cent of all cholecystectomies are performed laparoscopically with a reduction in hospital length of stay and decreased postoperative morbidity (9). However, it has been documented that following LC, the serum level of certain liver enzymes rises markedly in patients who had normal liver enzyme values preoperatively (1, 10–14). While these abnormal parameters are seen frequently, they are thought to have no clinical sequelae (10–14). We present two patients with normal liver function preoperatively who underwent LC and subsequently developed jaundice. In both patients, investigations failed to reveal any anatomical complications related to the surgical procedure.

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SUBJECTS AND METHODS

Case 1 – A 41-year old female was admitted for elective laparoscopic cholecystectomy. She had a history of biliary colic and had an ultrasound which had diagnosed chronic cholelithiasis. She reported no episodes of jaundice and preoperative investigations including liver function tests were all normal. Her common bile duct was within the normal range on preoperative ultrasound and laparoscopic cholecystectomy was performed via four ports. Induction of anaesthesia for the procedure was with propofol and pancuronium and anaesthesia was maintained with halothane and nitrous oxide. The procedure was complicated by spillage of stones on extraction of the gallbladder but was otherwise uneventful. Total anaesthetic time was two and a half hours. She was discharged home after two days tolerating a normal diet.

Twelve days later, she returned to the hospital complaining of pyrexia and dyspnoea. She was anicteric, afebrile

with pink mucous membranes and her abdominal examination was unremarkable. She was admitted with a provisional diagnosis of a pulmonary thromboembolism and commenced on oxygen therapy while full anticoagulation was commenced with unfractionated heparin. A ventilation-perfusion scan obtained the following day was of low probability for pulmonary embolism. Two days after her second admission, she was noted to be icteric and repeat liver function tests were ordered. Her abdominal examination remained unremarkable and she had been tolerating meals. Her liver function tests revealed a picture of hepatocellular jaundice with results as shown below:
bilirubin $_{\text{Total:}}$ 71.9 (normals (n) 3.4 – 25.6, μM/L) $_{\text{Direct:}}$ 12.4 (n 0 – 6.8, μM/L) alkaline phosphatase: 169 (n 17 – 52, U/L) gamma glutaryl transferase: 123 (n 5 – 45, U/L) alanine aminotransferase: 909 (n 5 – 30, U/L).

She was assessed as hepatitis likely drug-induced and she was managed conservatively and discharged five days after admission. Her icterus gradually resolved in the post-operative period and she remained otherwise well. She was last seen three months after surgery when she was anicteric and asymptomatic.

Case 2 – A 35 year-old female was admitted for elective laparoscopic cholecystectomy. She admitted to two previous admissions for acute cholecystitis but had never been jaundiced and on examination she was mildly obese, anicteric but otherwise well. Her preoperative liver function tests were all within normal limits. At surgery, she had induction of anaesthesia with propofol and pancuronium and anaesthesia was maintained with halothane and nitrous oxide. The procedure was uneventful and duration of anaesthesia was just under two hours. She was discharged home the following day. Approximately one week later, she returned with a history of progressive yellowing of the eyes. She was admitted and repeat liver function tests showed significant elevation of her liver transaminases with minimal elevation of her alkaline phosphatase and gamma glutaryl transferase. She decided to seek further management overseas where an abdominal ultrasound was done which showed an absent gallbladder with normal intra- and extra-hepatic ducts and no evidence of an intra-abdominal collection. She also had Endoscopic Retrograde Cholangio-Pancreatography which showed no abnormality of the ductal system. She was managed non-operatively and resolved without further intervention.

DISCUSSION

The primary indication for LC is symptomatic cholelithiasis (6). Although initially criticized by many academic and community surgeons, the overwhelming benefits of LC have been realized. These include a dramatic decrease in hospital stay, postoperative pain and the recovery time (4). The scope of laparoscopic biliary tract surgery has been broadened to include treatment of choledocholithiasis (6).

Nearly every patient with documented biliary tract disease can be considered a candidate for LC, even those with a history of upper abdominal surgery, morbid obesity, acute cholecystitis, chronic liver disease or pregnancy (4). At present, the only remaining contraindications to attempting LC are surgeon inexperience, inability to tolerate general anaesthesia and inability to tolerate a pneumoperitoneum (4). Contraindications to completing LC include inability to clearly identify all of the anatomic structures (8) as well as persistent haemorrhage and suspicion of bile duct injury (4). On average, conversion from laparoscopic to open cholecystectomy occurs in approximately 5 – 10% of cholecystectomies performed in the USA (9).

The preoperative evaluation of patients undergoing LC does not differ significantly from that of patients offered open biliary tract surgery(4). In addition to a careful history and physical examination, preoperative evaluation usually includes an ultrasound scan of the right upper quadrant as well as a hepatic biochemical profile (alkaline phosphatase, gamma glutaryl transferase and bilirubin) to rule out choledocholithiasis (6). In atypical cases of acute cholelithiasis, radionuclide scanning with the radiotracer $_{99}$Tc-HIDA may be used to confirm the diagnosis where non-filling of the gallbladder indicates an obstructed cystic duct and has a 95% sensitivity and specificity for cholelithiasis (8). Striking abnormalities in the hepatic profile or an ultrasonically dilated common bile duct may warrant endoscopic retrograde cholangiography or an abdominal computed tomography scan to search for the cause of the bile duct obstruction (6).

All patients undergoing LC should be properly informed of the risks of cholecystectomy, the potential for conversion to open cholecystectomy as well as the potential complications associated with laparoscopic and open cholecystectomy (4). A Foley catheter and orogastric tube may be utilized to improve visualization and prevent inadvertent injury and the patient is prepared and draped in a similar fashion as for open surgery. A pneumoperitoneum is then created using either an open (Hasson) or closed (Veress needle) technique and the intra-abdominal pressure kept below 12 – 15 mmHg (8). Carbon dioxide is the standard gas used for the creation of the pneumoperitoneum because it suppresses combustion, is relatively innocuous within the peritoneal cavity and, because of its high absorption coefficient, there is a decreased risk of gas embolism if small amounts enter the bloodstream (4).

In the USA, the four-puncture technique described by Reddick is the most common method used for performing laparoscopic biliary tract surgery (4) although LC has been performed by surgeons using one, two and three ports (15). The gallbladder infundibulum is retracted laterally to expose Calot's triangle and dissection begun at the gallbladder and cystic duct junction to reveal both cystic duct and artery. If a cholangiogram is to be performed it is usually done at this stage but if not the duct and artery are usually clipped and a retrograde dissection of the gallbladder performed (8). Dis-

section of the gallbladder from the liver is usually performed with electrocautery but care should be taken to avoid the use of electrocautery in Calot's triangle (4). The ultrasonic dissector (harmonic scalpel) uses vibrational energy to denature cellular proteins and has been suggested as a safer alternative to diathermy during LC (15). If the gallbladder is necrotic or obviously infected, it can be placed within a sterile specimen bag to facilitate retrieval and to minimize contamination of the puncture sites. The gallbladder is then extracted under direct laparoscopic visualization usually *via* the umbilical trocar site and the remaining trocars removed (4).

Complications of laparoscopic biliary tract surgery include those described with open surgery as well as some that are unique to or more likely with the laparoscopic approach (4). Trocar and insufflation needle injuries are specific to laparoscopic surgery with visceral perforation being described in 0.1 to 0.3% of all LCs and major intra-abdominal vascular injury in 0.4% of laparoscopic procedures (4). Misplacement of the Veress needle can lead to intravascular, subcutaneous tissue, preperitoneal space, visceral, mesenteric or retroperitoneal insufflation of carbon dioxide (16). The Hasson or open insertion technique is associated with a decreased incidence of vascular injury although visceral injury may still occur in the patient with previous surgery and extensive adhesions (4). Another problem unique to laparoscopic surgery is trocar site herniation which occurs in 0.1 to 0.5% of cases. Most surgeons routinely close all fascial openings that are 10mm or greater in diameter (4).

Laparoscopy induces particular pathophysiological changes in response to pneumoperitoneum. Instillation of carbon dioxide leads to hypercapnia which increases minute ventilation by as much as 60% and activates the sympathetic nervous system leading to an increase in blood pressure, heart rate, myocardial contractility and arrythmias. It also sensitizes the myocardium to catecholamines, particularly when volatile anaesthetic agents are used. Pneumoperitoneum raises intra-abdominal pressure which can have significant cardiovascular, respiratory and neurological effects. Major haemodynamic changes include alterations in arterial blood pressure (hypotension or hypertension), arrythmias and cardiac arrest. Changes in pulmonary function include reduction in lung volumes, increase in peak airway pressure, and decrease in pulmonary compliance secondary to increased intra-abdominal pressure and patient positioning. Hypercapnia, increased systemic vascular resistance, head-down positioning and elevated intra-abdominal pressure give rise to an increased intracranial pressure along with a decrease in cerebral perfusion pressure (16). Moderate to severe shoulder tip pain thought to be related to stretching of the sub-diaphragmatic peritoneum after pneumoperitoneum has been reported to occur in as many as one-third of patients. Prolonged procedures may lead to hypothermia which may be offset by the use of heated or humidified gas (4).

Intra- or postoperative haemorrhage is usually the result of injury to the cystic artery, right hepatic artery or hepatic artery proper as well as from the hepatic bed. If bleeding cannot be controlled easily with clip application or judicious use of electrocautery, the procedure should be converted to an open laparotomy. Blind application of clips into a pool of blood should be condemned because it may lead to inadvertent injury to one of the main bile ducts or the hepatic artery. Anecdotal reports have described post-operative abscess or fistula formation from spilled gallstones left in the peritoneal cavity, however, most surgeons believe that perforation of the gallbladder and loss of stones are not reasons to convert to an open cholecystectomy but as many stones as possible should be removed. Spilled gallstones can be extracted either with a Dormia basket or specialized grasping forceps (4).

Postoperative bile leaks have been reported in 0.02% to 2.7% of all laparoscopic cholecystectomies. Symptoms include shoulder tip or abdominal pain, fever, ileus, hyperbilirubinaemia and leukocytosis. Bile leaks can occur from the gallbladder bed, cystic duct remnant or from injury to the common bile duct. Cystic duct leaks occur because of faulty clip application or the clip falling off after acute inflammation and oedema have resolved. Nuclear scintillation scans are often used to determine whether a bile leak exists and may also help localize it. Most bile leaks heal spontaneously if external drainage is adequate and no distal bile duct obstruction exists (4). Endoscopic retrograde cholangiopancreatography should be performed to exclude significant bile duct injury, clear the distal biliary tree and may also effect closure of any biliary fistula with the aid of endoscopic techniques such as sphincterotomy or stenting (17).

Bile duct injuries remain one of the most devastating injuries during LC (4, 12, 18). These injuries occur at a rate of 0.6% which is approximately two to three times the rate in open cholecystectomy (18). The reason for such injury is usually due to failure to accurately identify biliary anatomy at the time of surgery (6). Factors which may contribute to such failure include anatomical anomalies of the extra-hepatic biliary system, local pathology such as inflammation or fibrosis in Calot's triangle, as well as technical aspects related to the procedure including excessive traction on the infundibulum of the gallbladder causing tenting of the common bile duct into the field of dissection (19). Lawrence *et al* reviewed 252 cases of laparoscopic bile duct injuries and showed that errors predisposing to bile duct injury stemmed from visual perceptual illusion where the surgeon felt confident of the anatomy intra-operatively (20). Routine laparoscopic intra-operative cholangiogram has been advocated as a way of reducing the incidence of bile duct injuries (21). However, Metcalfe *et al* in their review of the topic found that routine intra-operative cholangiography gave very little useful information over a selective policy and would result in a large number of unnecessary cholangiograms being performed without clear clinical benefit (22).

Transient disturbances in liver function tests have been documented in patients undergoing open as well as laparoscopic surgery (12). In LC, these changes have been shown to be more common in female patients and not related to age, duration of surgery or the acuteness of gallbladder inflammation (10). Obviously, patients with damage to the biliary tree usually display worsening clinical signs and increasing enzyme levels and such patients require endoscopic retrograde cholangiopancreatography to preclude any damage to the biliary tree (12). The patients in the present study all had imaging of the biliary tree after developing jaundice which ruled out bile duct injury.

Various aetiologies have been suggested for this disturbed liver function. Anaesthetic drugs such as halothane, nitrous oxide and thiopentone have been identified (12). This becomes extremely important in a Third World setting where access to newer anaesthetic agents with a more favourable side-effect profile is limited. Other suggested causative factors include circulatory failure during operation (12) and the carbon dioxide pneumoperitoneum (11).

The incidence and significance of these transient disturbances in liver function have been investigated. Halevy *et al* in their study of sixty-seven patients documented a 1.8-fold increase in aspartate aminotransferase in 73% of patients and a 2.2-fold increase in alanine aminotransferase in 82%. There was a statistically insignificant increase in alkaline phosphatase in 53% of patients while 14% of patients had increased bilirubin levels primarily of the unconjugated type (12). Other investigators have documented similar findings especially within the first 48 hours after surgery but, in general, these changes have had little clinical import (1, 10, 11, 13). Tan *et al* in a head-to-head study of 286 patients compared LC and laparoscopic colonic resection to open cholecystectomy and open colonic resection. He found statistically significant increased levels of hepatic transaminases during the first 48 hours postoperation in patients undergoing LC and laparoscopic colonic resection compared to patients having open procedures. In most patients, these changes were transient and values had returned to normal in patients undergoing LC by seven days postoperatively. He concluded that laparoscopic surgery may not be optimal for patients with pre-existing liver impairment (11).

Laparoscopic cholecystectomy provides maximum benefit for patients in whom the procedure can be conducted safely. However, knowledge of potential complications is ex-ceedingly important for the surgeon. Surgeons operating in the Third World may be at a unique disadvantage because of limited access to techniques which may improve patient safety such as the harmonic scalpel or the routine use of newer anaesthetic agents like Sevoflurane and Isoflurane. While uncomplicated LC may produce silent biochemical derangements in the majority of patients, clinical icterus may be observed in the absence of anatomical injury to the biliary tree especially if there are risk factors for hepatocellular injury. This should be taken into account when consenting patients for surgery and indeed when evaluating patients postoperatively after anatomical injury has been excluded. Indeed while most patients will recover spontaneously, careful follow-up is essential.

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