Techniques

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SURGICAL ENDOSCOPY and Other Interventional Techniques

Paediatric cholecystectomy: Shifting goalposts in the laparoscopic era

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Abstract
Background: Laparoscopic cholecystectomy is the treatment of choice in symptomatic paediatric cholelithiasis. However, controversy exists about its role in asymptomatic cholelithiasis and biliary dyskinesia. We have reviewed the experiences of two UK paediatric centres with laparoscopic cholecystectomy over an 8.5 year period and critically evaluated the indications and outcomes of surgery.
Methods: Patients who underwent laparoscopic cholecystectomy by a single surgeon at the Royal Aberdeen and Royal Alexandra Hospitals between May 1996 to August 2003 and September 2003 to December 2005, respectively, were studied. Information was extracted from prospectively held databases and analysed.
Results: A total of 27 cholecystectomies were performed during the period of study. The mean age of patients was 11.7 years with a female preponderance. Symptomatic idiopathic cholelithiasis was the main indication for surgery (14). Cholecystectomy was also performed for haemolytic disease (3), acute recurrent pancreatitis of unknown cause (2), gallbladder trauma (1), and for asymptomatic calcific non-resolving stones (7). All patients were investigated with ultrasound scans with four patients undergoing magnetic resonance cholangiopancreatography (MRCP) for suspected common bile duct (CBD) stones. A standard four-port approach was used with the gallbladder extracted through the umbilical port. The mean operative time in the latter 13 cases was 105 minutes with a median postoperative stay of one day for the whole series. Histology revealed chronic cholecystitis in all but three cases. All patients were discharged after a six-month follow-up period.
Conclusions: The advent of laparoscopy has resulted in an expansion of the traditional indications for cholecystectomy. MRCP is a useful investigation in selected children to exclude choledocholithiasis and avoid intraoperative cholangiography. There appears to be no clear correlation between histology and presenting symptoms. The natural history of asymptomatic gallstones in children is not known although a consensus is emerging to support cholecystectomy for all calcific non-resolving gallstones.

Key words: Paediatric cholelithiasis — Laparoscopy — Choledocholithiasis — MRCP — Cholecystectomy

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Laparoscopic cholecystectomy has now become the treatment of choice in the surgical management of children with cholelithiasis. There has been a dramatic increase in the number of cholecystectomies performed for symptomatic stones which may be due to increasing diagnosis with routine ultrasound [1]. However, controversy still exists for asymptomatic cholelithiasis and biliary dyskinesia, especially in paediatric surgery where data are less extensive than with adults. With its lower morbidity and mortality and shorter inpatient stays, the laparoscopic option has resulted in an expansion of the traditional indications for cholecystectomy. We have reviewed our experience with laparoscopic cholecystectomy in two UK paediatric centres and critically evaluated the indications and outcomes of surgery.

Methods

Patients who underwent laparoscopic cholecystectomy under a single surgeon at two institutions over consecutive periods from May 1996 to August 2003 and between September 2003 to December 2005, respectively, were studied. Information on patient demographics, indications for surgery, operative technique, complications and length of hospital stay were collected prospectively and analysed. A comprehensive review of the paediatric literature was conducted to assess the indications for surgery and to ascertain practice following the introduction of laparoscopic surgery.

Results

A total of 27 cholecystectomies, 14 in one institution and 13 in the other, were performed during the period of study. The mean age of patients was 11.7 years with a female preponderance over males of 1.5:1. Symptomatic cholelithiasis was the main indication for surgery (16). Cholecystectomy was also performed for haemolytic disease in three cases (two with symptomatic gallstones), acute recurrent pancreatitis of unknown cause (2), gallbladder trauma (1), and for asymptomatic stones which were calcific and non-resolving (7).

All patients had ultrasound scans and four patients with suspected choledocholithiasis underwent an MRCP. An MRCP was indicated in two patients with a dilated extrahepatic biliary tree and two others having acute recurrent pancreatitis with suspected biliary microcalculi. All MRCPs were negative for choledocholithiasis and none of these patients subsequently developed symptomatic choledocholithiasis. However, intraoperative cholangiography was performed in a single patient with symptomatic cholelithiasis but normal liver biochemistry and ultrasound scan who had a mucocoele of gallbladder with incidental intra-operative discovery of an impacted cystic duct stone. The patient's common bile duct, whilst slightly dilated, was free of calculi (Fig. 1) and the cystic duct stone was disimpacted by retrograde milking of the proximally distended cystic duct prior to extraction in a retrieval bag.

For patients requiring only a cholecystectomy a standard four-port approach (1 x 10 mm, 3 × 5 mm) was used with the gallbladder extracted through the umbilical port. Two additional ports, one in the left paraumbilical area and one in the epigastrium, were placed for patients requiring a concomitant splenectomy. Two of the three patients with hereditary spherocytosis underwent splenectomy. There were no conversions to open laparotomy although the umbilical wound had to be extended in one of the patients with haemolytic disease to facilitate removal of a spleen that was too large for a retrieval bag.

Two cases of acute recurrent pancreatitis were comprehensively investigated, including biliopancreatic imaging and manometric studies of the sphincter of Oddi. With no cause apparent, cholecystectomy was offered on the basis that the gallbladders were seeding microcalculi. One patient benefited from surgery with attacks of pancreatitis resolving whilst the other continued to remain symptomatic.

The single case of cholecystectomy following trauma was for a seven-year-old boy who suffered a handle bar injury to the right upper quadrant following a fall off a bicycle. He remained haemodynamically stable after the injury and an ultrasound performed 12 hours later demonstrated a clot-filled gallbladder. Laparoscopy confirmed rupture of the gallbladder fundus with an underlying laceration to the inferior aspect of the right hepatic lobe with extensive biliary peritonitis. Cholecystectomy with meticulous washout of the abdominal cavity ensured a quick recovery.

Mean operative time in the latter 13 cases was 105 minutes with a standard deviation of 63.64 minutes. The median post operative stay for the entire series was one day with a range of stay of one to four days. There were no complications related to surgery in any of the cases although recovery was delayed in three cases who stayed in for a total of four days each.

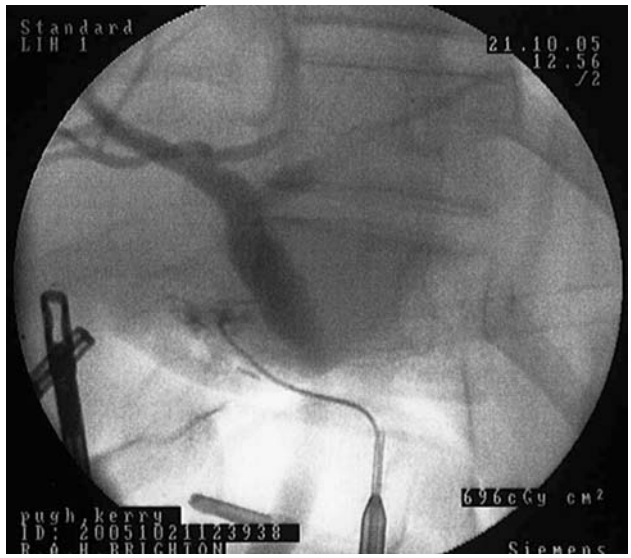

Fig. 1. Intraoperative cholangiogram demonstrating dilated but stone-free hepatic and common bile duct.

Histology revealed chronic cholecystitis in all but three cases which were normal. Follow-up was at six weeks and six months when all were discharged.

Discussion

Laparoscopic cholecystectomy has gradually increased in both popularity and acceptance in adults since its introduction in 1989 [2]. It has now also become the treatment of choice in the surgical management of children with cholelithiasis. The aetiology of gallstone disease in children compared to adults differs in many respects. It is historically found in children with haemolytic disease but can also be related to non-haemolytic conditions. The incidence of gallstones in children is not truly known but increases with age. With the widespread use of abdominal ultrasound in the diagnosis of non-specific abdominal pain the incidence may continue to increase.

Sickle-cell disease (SCD), hereditary spherocytosis, and thalassemia are the three major types of haemolytic disease that predispose children to gallstones. The incidence of gallstones in children with sickle-cell disease has been reported to be between 10 and 37% and increases to greater than 50% by the age of 18 [3–5]. In children with spherocytosis the incidence is higher and is estimated to be from 40 to 60% [6–7]. Therefore in this group ultrasound should be performed in those with abdominal pain or those with spherocytosis who are due to undergo splenectomy. Preoperatively good intravenous hydration is necessary and exchange transfusion is performed in those with SCD to reduce the percentage of sickle haemoglobin (Hb S). Compared to the morbidity and mortality of open cholecystectomy (36 and

6%, respectively [4,8]), laparoscopic cholecystectomy is associated with less postoperative pain and fewer complications such as vaso-occlusive crises [9]. Laparoscopic cholecystectomy is being advocated in children with SCD irrespective of symptoms as it prevents complications which could precipitate sickle crises (e.g. pancreatitis, cholecystitis, and jaundice) and reduces the likelihood of emergency surgery.

Non-haemolytic cholelithiasis in children is usually related to associated conditions such as prolonged total parenteral nutrition (TPN), post-ileal resection, metabolic disorders and cystic fibrosis. In teenagers the aetiology may include oral contraceptive use, obesity, and pregnancy. The vast majority of our patients (88%) who underwent surgery were in this category. No specific cause was found but obesity was certainly an issue in the older female patients. Symptoms may range from vague abdominal pain to more traditional symptoms of right upper quadrant pain related to fatty food ingestion. Laparoscopic cholecystectomy is advocated in this group since it is felt that the gallstones are unlikely to resolve and will eventually give rise to complications if not removed.

In this study there were no complications relating to surgery and, specifically, no child sustained a bile duct injury. In adults there appears to be a small but definite increase in risk of bile duct injury following laparoscopic cholecystectomy (0.18 to 0.8%) compared to a rate of bile duct injury of 0.1 to 0.2% in open cholecystectomy [10–12]. The incidence of bile duct injury in children is not truly known as there are few published large series looking at laparoscopic cholecystectomy and no reports of major bile duct injury [12–14]. Children should have a similar risk of sustaining bile duct injury as adults but their incidence may be under-reported and few paediatric surgeons will progress beyond the learning curve of 30 to 50 laparoscopic cholecystectomies where the incidence of bile duct injury increases [11].

Treatment of asymptomatic gallstones is a subject of controversy. Studies suggest that the vast majority of patients remain asymptomatic with 1 to 4% of patients per year developing symptoms or complications of gallstones [15–16]. With longer follow-up, 10% develop symptoms at five years and 20% at 20 years from their initial diagnosis [16–17]. Conversely, it has also been argued that surgery should be performed for asymptomatic gallstones given that the operating time, hospital stay, and complication rate are significantly lower for elective cases as compared to emergency cases [18]. In children some have encouraged cholecystectomy for asymptomatic gallstones under certain conditions. Bailey et al. [19] recommended that those children with symptoms, calcified stones, or non-calcified stones that did not resolve in three months should undergo cholecystectomy. Holcomb et al. [12] recommended cholecystectomy for children between the ages of two and 12 due to vulnerability to complications as they felt that these gallstones were unlikely to resolve. Infants underwent a period of observation for six months due to other reports suggesting spontaneous resolution [21] but then had cholecystectomy if gallstones were still present. As yet, there is still no consensus on whether cholecystectomy for asymptomatic gallstones is justified, although most centres seem to agree that asymptomatic gallstones secondary to haemolytic disease and non-resolving gallstones should be removed.

With improvements in equipment and increasing surgical confidence, laparoscopy is increasingly being utilised in emergency situations. Whilst studies suggest an advantage in the assessment and management of penetrating trauma and in the acute abdomen, its value in the management of blunt trauma, especially in children, is still evolving [22–23]. While laparoscopy for trauma is rare, our experience demonstrates that in the stable patient laparoscopy is a useful adjunct in the assessment and treatment of gallbladder injuries [24].

Gallstones can be complicated by cholecystitis, pancreatitis, or CBD stones causing jaundice. In this study four patients with suspected CBD stones had preoperative MRCPs which were negative for CBD stones and they proceeded to straightforward cholecystectomies. In adults MRCP is now replacing both endoscopic retrograde cholangiopancreatography (ERCP) and on-table cholangiogram as the diagnostic tool to look for CBD stones. ERCP in children has comparable success and complication rates to that in adults (90 and 11%, respectively) [25–26], although there have been far fewer studies to evaluate this. MRCP has the advantage of being non-invasive and avoiding exposure to ionising radiation while offering a physiological evaluation of the CBD. Studies in adults have shown that MRCP is able to detect the presence and level of biliary obstruction with sensitivities of over 90% and a specificity approaching 100% [27]. This approach, whilst precluding a need for intraoperative cholangiography in some cases, is not entirely foolproof as one patient in our series with an absence of clinical, biochemical, and radiological evidence of choledocholithiasis and therefore no indication for an MRCP went on to have an impacted cystic duct calculus. This necessitated intraoperative cholangiography and laparoscopic extraction before cholecystectomy. Therefore, whilst MRCP is useful in avoiding unnecessary CBD cannulation and exploration, not having the skill or the facility to undertake intraoperative cholangiography at the time of laparoscopic cholecystectomy risks missing the occasional biliary calculus [28].

Cholecystectomy is becoming an increasingly common approach to managing children with biliary dyskinesia, a syndrome of chronic upper abdominal pains, vomiting, nausea with or without fatty food intolerance, but normal ultrasound and gastroscopy findings. The aetiology is thought to be aberrant contractile behaviour either at the sphincter of Oddi, the cystic duct, or the gall bladder [29]. If an impaired gall bladder ejection fraction (less than 40%) is seen on cholecystokinin hydroxyl iminodiacetic acid (CCK-HIDA) scintigraphy, removal of the gall bladder is warranted [30]. Although this was not true in our series, these children may increasingly form the bulk of the laparoscopic cholecystectomy workload, with some centres already reporting biliary dyskinesia in up to 58% of their cases [31]. Cholecystectomy is successful in curing symptoms in 79 to 100% of the cases [29–31], especially in those

patients complaining of nausea, pain and decreased gallbladder emptying preoperatively [32]. The population with continuing symptoms may be part of a subset with sphincter of Oddi dysfunction and which is therefore unrelieved by cholecystectomy. In adults post-cholecystectomy syndrome is well described and appears to be more likely in those patients suffering from diarrhoea, fatty food intolerance, and both pain and non-pain symptoms preoperatively [33]. Its incidence in children is not known [34].

In this study we also looked at the histology of the removed gallbladders and tried to ascertain whether this had any correlation with the preoperative symptoms. The vast majority of our cases showed evidence of chronic cholecystitis whether the patients were symptomatic or not. We found no clear association between histology and presenting symptoms which is in keeping with other studies which have looked at this [35–36]. This may be due to children not always presenting with typical symptoms of gallstones or of symptoms of non-specific abdominal pain not being recognised to be due to gallstones.

Conclusions

In conclusion, laparoscopic cholecystectomy has resulted in an expansion of the traditional indications for cholecystectomy. The laparoscopic approach is safe in the right hands and has a short inpatient stay. MRCP is a useful investigation to exclude choledocholithiasis. The natural history of asymptomatic gallstones in children is not known although a consensus is emerging to support cholecystectomy for all calcific non-resolving gallstones.

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