
The Frequency and Management of CBD Stones in a Pediatric Series

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1. Introduction

The prevalence of cholelithiasis in children is rare and a fraction of these will also have concomitant choledocholithiasis. Detection and expeditious management of common bile duct (CBD) stones is critical to avoiding complications, some of which are potentially life threatening. Of concern are obstructive jaundice, recurrent pancreatitis, and ascending cholangitis. The management options for CBD stone are multiple and extraction can be achieved via, open choledochotomy, endoscopic retrograde cholangiography (ERCP) with sphincterotomy, choledochoscopy and percutaneously via trans-hepatic cholangiography (PTC).

2. Aim

To evaluate the epidemiology, associated comorbidity, and management of CBD stones in children. To focus on the effectiveness of ERCP with sphincterotomy, in this context, and the timing of cholecystectomy.

3. Method

A retrospective review of a prospectively recorded series of CBD stones over a 20-year period (2003-2023) in three, tertiary pediatric surgical centers, was undertaken. These were, The Royal Alexander Children's Hospital, Brighton, UK, between 2003 and 08/2015, King Faisal Specialist Hospital and Research Center (KFSHRC), Jeddah, from 2010 to 2020, and KFSHRC Medinah (2021-23). Data was collected prospectively in Excel (Microsoft) and a bespoke, expanded medical audit system

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(EMAS) database. A subgroup with CBD stones was identified preoperatively, from clinical presentation, biochemistry (Liver function tests) and radiological investigations (ultrasound and MRCP). Patient demographic data, presentation, investigations, details of intervention and outcome were documented.

4. Result

A total of 67 cases underwent laparoscopic cholecystectomy during the period of study. CBD Stones were suspected in 20 patients and confirmed in 13(19.4 %). The mean age of this sub-group was 8 years (range of 4-16 years) with a female to male ratio of 2:1. Nine patients had associated hemoglobinopathies (three sickle cells anemia, two each with erythropoietic porphyria and hemophagocytic lymphohistiocytosis, and single cases of sickle thalassaemia and hereditary spherocytosis). Seven presented with obstructive jaundice all with confirmed CBD stones on workup. A single case presented with jaundice and insulin dependent diabetes following 3 previous pancreatectomy for nesidioblastosis. Nine patients presented with a history of pancreatitis of which three were positive for CBD stones. Three had a history of cholangitis of which 2 were found to have CBD stones. All cases had right upper quadrant pain. Alkaline phosphatase was elevated in 6 cases with obstructed jaundice and, or cholangitis. AST and ALT values were variable and uncorrelated to clinical presentation. All patients underwent ultrasound scans of which 13 demonstrated CBD stones. MRCP was undertaken in 12 of the 67 cases who underwent cholecystectomy and CBD stones were discovered in 4 cases with another patient suspected to have a diverticulum of the CBD.

Seven patients of the 20 were investigated and cleared of CBD stones and proceeded to laparoscopic cholecystectomy. Of these, two underwent intraoperative cholangiography, one with an incidentally discovered impacted cystic duct stone at operation and the other a suspected CBD diverticulum on MRCP. Both cases had a normal biliary tree. The cystic duct stone was successfully dis-impaction in the former and the stone extracted in a retrieval bag.

All patients with CBD stones underwent initial ERCP and successful stone extraction. Five patients had stent placements. A single patient had a previous failed attempt at ERCP and stone extraction in another center. A stent was placed, and he was referred to us where a repeat sphincterotomy and stone clearance with cholecystectomy was successfully executed. Eleven patients had interval laparoscopic cholecystectomy within 2 months of stone clearance and were uncomplicated. One case had cholecystectomy, a day following ERCP, at the same admission. Our most recent case had a combined ERCP (FIG. 1), sphincterotomy, and stone extraction (FIG. 2) with cholecystectomy under the same anesthetic. Those patients having previous ERCP, and stent placements were noted to be surgically more challenging on account of extensive peri-cholecystic and choledochal inflammation with adhesions. The cystic duct was markedly dilated in three cases necessitating either vicryl endoloop or vascular endoclip application for control of the cystic duct. One case with previous pancreatitis and intermittent abdominal pain was discovered, intraoperatively, to have a hypermobile caecum and underwent a caecopexy at the time of cholecystectomy.

Median post-operative stay was one day and there were no post-operative complications. Patients were followed up for a median of 2 years and no recurrence of CBD stones were documented.

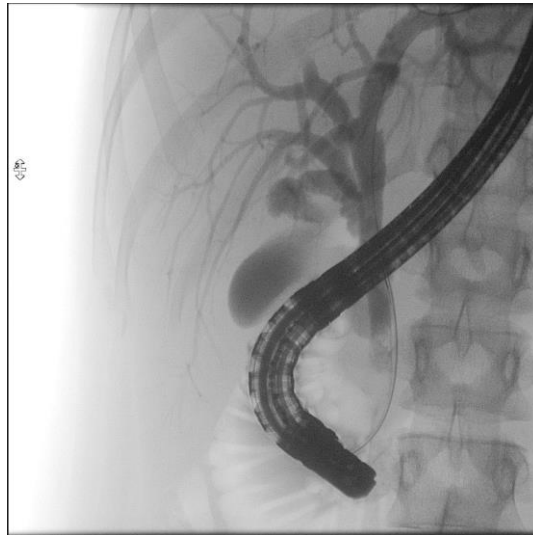


FIG. 1. ERCP, demonstrating a large stone seen as a filling defect in the distal CBD with proximal biliary dilatation.



FIG. 2. Successful stone extraction at ERCP.

5. Discussion

Biliary obstruction, whether from benign or malignant causes, is rarely seen in children. The most common benign causes of biliary obstruction are choledochal cyst, biliary atresia, and CBD stones. Although rare, rhabdomyosarcoma is the most frequent of the malignant causes of CBD occlusion. CBD stones are seen in up to 10 percent of patients with gallstones and their frequency is rising. The reason for this is multifactorial and increased incidental detection during radiological investigations and a rise in obesity levels are sited [1,2].

A significant number of these patients will have associated co-morbidities and figures up to 79.3% are quoted [1]. Listed among these are hemolytic disorders, obesity, post bariatric surgery, portal hypertension, pulmonary disease, total parenteral nutrition (TPN), hepatocellular disease, bacterial infection, biliary tract anomalies and short bowel syndrome [1-7]. In our experience

55% of patients had identifiable co-morbidities, the majority with hemaglobinopathies with a single case of insulin dependent diabetes following near total, pancreatectomy for nesidioblastosis.

CBD stone should be suspected when patients present with a history of jaundice, pancreatitis, rigors, and right upper quadrant pain. Except for those with active jaundice, pancreatitis, and cholangitis serological investigations at the time of admission are often normal. However, bilirubin and ALP levels have the highest specificity and will be elevated in nearly all cases with obstructive jaundice. We found no trend to the ALT and AST levels in these cases.

Ultrasonography, with a sensitivity over 85%, is a useful initial diagnostic tool in detecting CBD stones. Additional findings may include CBD dilatation, cholelithiasis and pancreatic pseudocyst in those with a history of pancreatitis [1,4]. MRCP is a useful complement to ultrasonography as it offers a physiological evaluation of the CBD. It is also noninvasive, quick and with no risk of exposure to ionizing radiation. In adults, MRCP is able to detect the presence and level of biliary obstruction with a sensitivity over 90% and a specificity approaching 100% [8-11].

If both US and MRCP are negative, then ERCP is probably not indicated. Seven of the cases in our series did not proceed to ERCP and did not subsequently manifest with CBD stones. The remainder, which were detected by either US and/or MRCP proceeded to ERCP. All had successful documentation and extraction of CBD stones, one patient at a second attempt where sphincterotomy was extended and the sphincter of Oddi, balloon dilated to 10 mm. ERCP has been successfully reported in older children but there is still debate about its safety and efficacy in those less than two years of age. The procedure requires a high level of expertise and specific scopes which are not widely available. Our youngest patient was 2 years of age but there is a reported case of a CBD stone extracted at ERCP in a patient less than 8 months old. ERCP is usually performed together with sphincterotomy although balloon dilatation of sphincter of Oddi with stone extraction has been described. We found ERCP to be completely safe but complications of post-ERCP pancreatitis (7.7%), immediate and delayed sphincterotomy bleed, and CBD injury, have been noted [12]. All cases are performed under general anaesthesia although conscious sedation has been attempted. The latter is not without risk and has led to premature discontinuation of the procedure with failure or conversion to general anesthesia in 7.1% of cases [13].

In preference to the above approach, some centers preferentially recommend routine intraoperative cholangiogram (IOC) [3,8]. We undertook IOC in two instances, a case of an impacted cystic duct stone incidentally noted at the time of cholecystectomy and for a suspected diverticulum in the distal CBD noted on MRCP. Both times the anatomy of the CBD was confirmed to be normal. The success rate of intraoperative cholangiogram and stone extraction using a choledochoscope aided by Dormia basket or Fogarty catheter is 72% [3,4,14]. IOC has a false positivity rate of 20%-25% in children. In addition to its low yield, factors of cost and extended operative time need to be considered. Furthermore, intra and post-operative morbidity rates of 6.3 and 15.9 percent respectively have been reported [1].

A less popular alternative to the above has been a percutaneous transhepatic approach used in combination with dilatation of the sphincter of Oddi. The CBD stone is then either retrieved or coaxed into the duodenum [15]. The use of open choledocotomy and stone extraction has receded as the laparoscopic approach has gained in popularity.

The timing of laparoscopic cholecystectomy relative to ERCP and stone extraction is flexible. Most units prefer to undertake cholecystectomy at the same admission, with some deferring to a later date [16,17]. Recently we have started to undertake both ERCP stone extraction and cholecystectomy under the same anesthetic. The benefits are multiple and principle among these are the cost and time saving as well as avoiding the risks of multiple anesthetics for the patient. Thus far we have had no complications with combining these interventions and have adopted this as the preferred approach in children. A recent meta-analysis of an adult series demonstrated clear benefit of cholecystectomy post ERCP on the same day or within 3 days of surgery. These patients enjoyed a shorter length of hospital stay with quicker operative time and a lower risk of complications [17].

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