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Case Report

Bile Duct Injury Following Open Cholecystectomy in a Child: A Rare Complication

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Keywords
Cholelithiasis
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Abbreviations
BDI - Bile duct injury
CBD - Common bile duct
CHD - Common hepatic duct, **IHBRD** - Intrahepatic biliary radicle dilatation, **LC** - laparoscopic cholecystectomy, **LFT** - Liver function test, **OC** - Open cholecystectomy, **PTBD** - Percutaneous trans-hepatic biliary drainage

Abstract

Cholelithiasis is an uncommon pathology in the pediatric age group, with an incidence of 0.13-1.9%. The standard of treatment is laparoscopic cholecystectomy (LC). Open cholecystectomy (OC) has been rarely performed nowadays. We report a 5-year-old boy who underwent OC for gallstones and had sustained bile duct injury (BDI), which was missed intra-operatively. The child presented with fever, abdominal collection, and sepsis. We discuss the management of a patient with BDI along with the review of pertinent literature.

INTRODUCTION

Cholelithiasis is uncommon in the pediatric age group, with an incidence of 0.13-1.9 %.(1) Although complications are less common in open cholecystectomy (OC) than in laparoscopic cholecystectomy (LC), the LC is the preferred approach. Bile duct injury (BDI) is a well-reported major complication of cholecystectomy in adults with high morbidity and mortality. The incidence of BDI is 0.04-0.2% in OC and 0.01-1% in LC.(2) Its management includes endoscopic procedures like stenting, sphincterotomy, and percutaneous trans-hepatic biliary drainage (PTBD), which may be either additional or definitive interventions of BDI. There is a lack of literature on BDI management in the pediatric population. In this paper, we are discussing a case of BDI in a child after OC and its treatment.

CASE REPORT

A 5-year-old male child presented at our institute with jaundice, abdomen distension, and deranged liver function test (LFT) following an OC done two weeks prior at another hospital.

As per the records of the previous hospital, he had had cholelithiasis and had experienced symptoms consistent with acute cholecystitis, (viz. pain in the right hypochondrium, fever, and vomiting). Ultrasonography of the abdomen had revealed a

distended gallbladder with multiple calculi, the largest being 11mm located near the neck of the gall bladder. There was also minimal free fluid, indicative of acute inflammation. Surgical intervention had been planned after the failure of conservative management (nil by mouth, nasogastric aspiration, and intravenous antibiotics and intravenous fluids). Due to the unavailability of laparoscopy, an open cholecystectomy (OC) had been performed to address the critical condition (acute cholecystitis). Intraoperatively, the gall bladder was found to be tense, enlarged and was at the risk of perforation. Adjacent structures were severely inflammed and the omentum was adherent to the gallbladder and porta hepatis. This underscores the challenges posed by the absence of LC facilities and the need for timely intervention to prevent complications like gallbladder perforation. In the immediate postoperative period, the child had been apparently stable and was discharged after starting oral feeds. After one week, the child developed fever and progressive jaundice, which had been managed conservatively initially and then he was referred to our centre for further management.

On arrival at our hospital, the child was sick, jaundiced (total bilirubin-17.1mg/dl, direct bilirubin-13.6mg/dl), febrile, and his abdomen was distended with hepatomegaly of 3cm below the costal margin. Ultrasonography of the abdomen showed a loculated collection in the GB fossa, with intra-hepatic biliary radicle dilatation (IHBRD). Magnetic resonance cholangio-pancreatography (MRCP) revealed hepatomegaly with a fluid collection of 9x7cm in the sub-capsular location of segment V of the liver.(Fig.1A) Bilateral IHBRD (Left>Right) with abrupt narrowing and cut-off sign in the common hepatic duct (CHD) was demonstrated. The right anterior duct communicated with the left duct while the right-posterior duct was coursing towards the primary confluence with narrowing at the communication site; the CHD and the CBD were not seen (Bismuth type 3 BDI).(Fig.1B) The ultrasound-guided abdominal drain and PTBD catheter were placed. After receiving two weeks of antibiotics, his clinical condition improved, and LFT normalized. Contrast study done through PTBD tube (Fig.1C), showed opacification of the left and the right biliary radicles; however, there was no contrast in the CHD and the CBD.

The child was then taken up for surgery. On exploration, stomach, duodenum, small bowel loops and surrounding structures were densely adherent to the porta hepatis. It was challenging to delineate anatomy. On flushing saline through the PTBD catheter, the area of leakage was identified, and thus the hepatic ducts were traced. Three ducts, namely the right anterior, right posterior and left hepatic duct, were traced, and the PTBD catheter was seen protruding from the left hepatic duct. A standard retro-colic end-to-side hepatico-jejunostomy was done by single layer anastomosis. The postoperative period was uneventful, and the child was allowed orally on postoperative day-5 and discharged on the day-8. At a 2-year follow-up, the child is doing well with normal LFT.

DISCUSSION

Cholelithiasis is uncommon in the pediatric age group. Although OC is not currently a standard procedure for cholelithiasis, it has fewer complications than LC. The OC gives a better view of the anatomy and thus has less chance of injury to the surrounding structures. In studies comparing LC and OC, LC is associated with more operative time, less hospital stay, and less postoperative pain.[3] Studies have shown that BDI is not because of the surgeon's inexperience but due to the visual misperception of the anatomy in around 70-90% of cases.[4] The frequent causes of BDI include poor anatomical delineation, non-identification of the Calot's triangle, congenital variations, complicated cholelithiasis (e.g. perforation, fibrosis, adhesions, malignancy), difficult hemostasis, technical inexperience and retrograde cholecystectomy.[5]

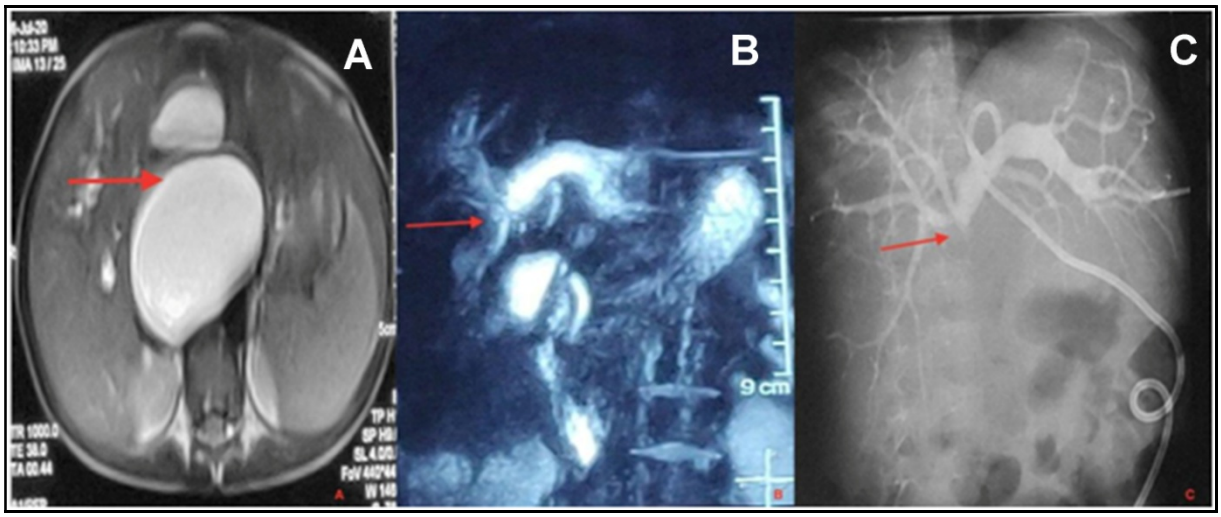

Fig.1 *(A) T2 weighted axial magnetic resonance image showing a collection (arrow) along the surface of the liver. (B) Coronal MRCP (magnetic resonance cholangio-pancreatography) image showing dilated right and left biliary radicles (left > right) with abrupt cut-off (arrow) just beyond the primary confluence. (C) PTC (Percutaneous trans-hepatic cholangiogram) showing the opacification of dilated right and left biliary radicles (left > right) with no passage of contrast across the primary confluence (red arrow) into the common hepatic duct and the common bile duct.*

In the index case, the exact cause could not be identified as the child was operated on elsewhere; the intra-operative difficulties, adhesions, and deviation in bile duct anatomy might be the contributory factors. BDI may lead to bile leakage, intra-abdominal abscess, cholangitis, and secondary biliary cirrhosis.[6]

Once BDI is suspected, on-table intra-operative cholangiography should be done to identify the level of injury and anomalous biliary ducts. Primary repair of the bile duct is ideal, as it prevents morbidity and mortality. If primary repair is not feasible, inserting a catheter into the duct and T-tube drainage will help control local sepsis and will assist in identifying the anatomy during the definitive procedure. The duodenum must be mobilized adequately to attain tension-free end-to-end anastomosis of bile ducts. Multiple studies support that Roux-en-Y hepatico-jejunostomy has the best long-term results.[7] However, in many instances, the injury is not recognized ontable and it presents later with a bile leak as it is in our case. The more delayed the presentation, the more difficult it is to manage because of the inflammation and fibrosis.

The aim of treatment in delayed presentation is immediate management of sepsis, biliary fistula and CBD obstruction. In our case, there was a complete transection of the CBD with injury to the right and the left hepatic ducts. The abdominal drain was placed to decrease biliary sepsis; at the same time, PTBD catheter was inserted to relieve the biliary obstruction. After stabilization elective surgery was done. This management is similar to the algorithm suggested by Andreas.[8]

BDI has been classified by many, and the commonly used classification is that of Bismuth-Strasberg. Depending on the type of injury, the management can be endoscopic, percutaneous or surgical. In general, any fluid collection should be drained.[4] An endoscopic retrograde cholangio-pancreatography (ERCP) is done to evaluate the biliary tree and stenting of the injured duct. PTBD

can be done to drain any collection and provide an alternate channel for bile drainage. It is a low-risk procedure.[9] It decreases sepsis and allows the biliary tract to heal. In case of minor leaks, PTBD alone is sufficient. The injured bile ducts may heal spontaneously or develop stricture, which will require definitive surgery after the critical period is overcome.[6] PTBD catheter also helps in identifying the injured bile duct by injecting either radiographic contrast, fluorescene dye or saline intraoperatively, as we did. The timing of intervention is crucial. In severely septic patients, PTBD alleviates intra-abdominal sepsis and aids in preparing patients for open surgery in case of a major leak, as it is in our case.[6] However, cholangitis can be a severe complication of PTBD; fortunately, the index patient did not have this complication. In transection or stricture of the bile duct, surgical intervention depends upon the availability of bile duct length and its diameter. End-to-end anastomosis of the bile duct has a high chance of leak as is usually under tension. So, a Roux-en-Y hepatico-jejunostomy is preferred.[10]

Prevention of BDI during cholecystectomy is crucial. Identifying the 'critical view of safety' before ligating anything is vital in LC.[11] The infundibular technique and antegrade dissection close to the gall bladder could prevent BDI.[12] Calabro advocated fluorescent cholangiography using indocyanine green.[13] By using infra-red imaging, entire biliary system can appropriately be delineated and hence the anatomical variations, thus decrease the chance of BDI in complex cases.

Managing pediatric BDI is indeed challenging, particularly due to the increased risk of rapid onset of biliary sepsis. Anatomical variations further complicate the scenario, as the small caliber of the duct may not be adequately visualized in preoperative imaging. The insertion of stents or pigtails becomes challenging due to the small size of the ducts, and pediatric-sized equipment may not be readily available in all places. Additionally, addressing BDI in children involves risks associated with interventions such as airway management. Sedation is often required even for investigation, adding another layer of complexity. All these factors underscore the need for a careful and comprehensive approach to pediatric BDI. The management requires a multi-disciplinary approach, and surgery should only be considered after the patient has been stabilized and the ductal injury has been correctly classified.

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