CASE REPORT

Complicated bile duct stones

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manchester.ac.uk**SUMMARY**

Common bile duct stones (CBDs) are solid deposits that can either form within the gallbladder or migrate to the common bile duct (CBD), or form *de novo* in the biliary tree. In the USA around 15% of the population have gallstones and of these, 3% present with symptoms annually. Because of this, there have been major advancements in the management of gallstones and related conditions. Management is based on the patient's risk profile; young and healthy patients are likely to be recommended for surgery and elderly patients with comorbidities are usually recommended for endoscopic procedures. Imaging of gallstones has advanced in the last 30 years with endoscopic retrograde cholangiopancreatography evolving from a diagnostic to a therapeutic procedure in removing CBDs. We present a complicated case of a patient with a CBDs and periampullary diverticulum and discuss the techniques used to diagnose and remove the stone from the biliary system.

BACKGROUND

Gallstones in the gallbladder occur when the constituents of bile become saturated and they precipitate as microscopic crystals that can aggregate to form macroscopic stones. Most patients with gallstones are asymptomatic. However, it is important to understand that in those who do develop symptoms, they can present with differing levels of severity. This can range from acute cholecystitis which is usually painful and unpleasant, to the development of pancreatitis and cholangitis which can be rapidly fatal.

It is also important to emphasise the range of non-operative interventions that are available for patients with gallstone-related disease. The diagnosis of common bile duct stones (CBDs) is made using radiological imaging and numerous techniques have been developed that provide accurate visualisation of the biliary tree and can reveal the precise location of CBDs. In patients with significant comorbidities or altered biliary anatomy, the management of CBDs is usually through non-operative interventions. The use of interventional endoscopy and radiology has meant that imaging techniques now have an essential therapeutic role in the removal of CBDs.

This case report highlights the flexible use of different interventional techniques in the removal of CBDs from the biliary system.

CASE PRESENTATION

A 76-year-old man of British origin presented with a 3-week history of right upper quadrant pain with a transient episode of jaundice and fever. He

was overweight and his medical history included non-insulin dependent diabetes mellitus, atrial fibrillation, hypertension and hypercholesterolaemia. He works as a coach driver and lives at home with his wife. The presentation with pain, fever and jaundice (Charcot's Triad) was suggestive of ascending cholangitis due to the presence of a gallstone within the common bile duct (CBD).

INVESTIGATIONS

The patient underwent a transabdominal ultrasound scan which showed a thick-walled gall bladder which was normally distended and contained stones. There was mild intrahepatic and extrahepatic bile duct dilation extending down to the pancreatic head with the CBD measuring 10 mm (normal <6 mm) in diameter.

As there was diagnostic uncertainty regarding the presence of a CBDs, a MR cholangiopancreatogram was arranged. This showed a stone present in a non-thickened gall bladder (figure 1). The CBD diameter was in the normal limits for the patient's age but there was a 6 mm filling defect at the distal end of the CBD consistent with a small ductal stone. There was no intrahepatic or common duct dilation and the pancreatic duct was normal.

An endoscopic retrograde cholangiopancreatography (ERCP) was arranged as a therapeutic procedure in order to remove the suspected CBDs; however, bile duct cannulation was unsuccessful because of a difficulty in locating the ampulla of Vater. The patient was referred to a specialist centre where a second ERCP was attempted but bile duct cannulation was again unsuccessful. It was apparent that the difficulty in locating the ampulla of Vater

Figure 1 MR cholangiopancreatogram showing the presence of a stone in the distal end of the common bile duct. GB, gallbladder; CBD, common bile duct; CBDs, common bile duct stone; PD, pancreatic duct; S, stomach.

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was because it appeared to be within a large periampullary diverticulum (PAD).

The patient subsequently underwent an endoscopic ultrasound in order to locate the position of the bile duct relative to the PAD. An attempt to puncture the bile duct was planned, but there was uncertainty as to whether the bile duct drained anteriorly or posteriorly to the PAD, and so the distal bile duct was not located.

A CT scan showed the gallbladder contracted around several stones. The distal CBD measured 1.5 cm with a 0.8 cm probable calculus above the ampulla. The PAD appeared to lie posteroinferiorly and medial to the bile duct and ampulla, measuring 3×2 cm. The CBD was dilated with a filling defect consistent with a CBDS (figure 2).

TREATMENT

A percutaneous transhepatic cholangiogram (PTHC) was arranged with the initial aim of gaining a suitable level of biliary drainage. Insertion of a transhepatic biliary drainage catheter was undertaken, but it proved impossible to gain access to the duodenum so an external drain catheter was positioned in order to drain bile externally (figure 3). A second procedure was conducted the following day and a catheter was inserted through the CBD into the duodenum, gaining access to the biliary system through the ampulla of Vater and forming an internal-external drain (figure 4). This allowed the bile to drain internally and externally.

A combined ERCP/PTHC procedure was conducted the following day with the aim of grasping a wire passed through the catheter using the endoscope to pull up the wire, allowing endoscopic access. Thereafter, a sphincterotomy was performed and once access was obtained, a balloon was introduced through the endoscope and inflated to dilate the sphincterotomy and to pull the stone out (figure 5). Adequate balloon dilation allowed for successful stone extraction into the duodenum. A 7/7 pigtail stent was inserted to prevent recurrence of ascending cholangitis and the transhepatic catheter was removed.

DISCUSSION

In this case, the patient's individual risk factors and demographics meant that management was through non-operative interventions. The case became more complicated due to the ampulla of Vater being located within a large PAD. It has been shown that PADs make ERCP more difficult and are associated with a

Figure 2 CT scan showing a filling defect within the common bile duct consistent with that of an intraductal stone (circled in yellow).

Figure 3 First percutaneous transhepatic cholangiogram showing a dilated CBD due to biliary obstruction. Stones can be seen within the gallbladder. The transhepatic external catheter which was inserted to drain bile externally can also be seen. THEC, transhepatic external catheter; GS, gallstone; GB, gallbladder; CBD, common bile duct.

higher complication rate.¹ It also raises the question as to whether the presence of a PAD is associated with a greater risk of CBDSs within the CBD. A possible mechanism is that the sphincter of Oddi becomes incompetent and there is duodenal bacterial growth in and around the PAD.² This results in the bile duct becoming colonised with bacteria producing β -glucuronidase which converts conjugated bilirubin into unconjugated bilirubin. This unconjugated bilirubin can combine with biliary calcium to form insoluble calcium bilirubinate stones within the CBD.³ It has also been proposed that PADs may compress the lower end of the CBD, resulting in obstructive jaundice and predisposition to stone development.⁴

As illustrated in this case, a major concern when investigating and managing patients with a PAD is the higher failure rate associated with endoscopic procedures. PADs have been shown to be more common with advancing age, which further limits diagnostic and therapeutic options.⁵ A combined ERCP/PTHC procedure was conducted in this case because endoscopic access

Figure 4 Repeat percutaneous transhepatic cholangiogram which shows the final position of the internal/external catheter in the CBD. The CBD is less dilated due to successful biliary drainage. GS, gallstone; I/EC, internal/external catheter; CBD, common bile duct.

Figure 5 Combined endoscopic retrograde cholangiopancreatography and percutaneous transhepatic cholangiogram procedure showing the endoscope grasping a wire passed through the catheter. The de-inflated balloon within the catheter is labelled. E, endoscope; BDC, balloon dilation catheter.

alone was not possible. The internal catheter that was inserted into the CBD transhepatically provided the internal–external extension in order to drain the bile so that the subsequent ERCP would be successful in removing the CBDS. Normally in the non-operative management of CBDSs, the aim is to avoid PTHC as the procedure is more invasive and has higher associated morbidity than endoscopic procedures. However, the altered anatomy due to the presence of the PAD meant that biliary access was difficult with an ERCP procedure. Access to the biliary system is through the liver. The right costophrenic sulcus can be visualised on inspiration, and the puncture site is the mid-axillary line at an intercostal space caudal to this sulcus. Once access is obtained through the CBD, a contrast medium is injected which can reveal CBDSs.

Endoscopic procedures combined with radiological guidance have advanced significantly over the last 30 years. From being primarily diagnostic, ERCP is now carried out with a therapeutic aim and has provided a highly successful alternative to surgery in the management of CBDS. However in complicated cases where a PAD is present, ERCP should be conducted with caution and by experienced endoscopists.

Learning points

- ▶ Common bile duct stones (CBDS) are solid deposits that can form within the gallbladder and migrate to the common bile duct or can form *de novo* in the biliary tree.
- ▶ Diagnosis is made using imaging techniques which are able to identify the location of a CBDS precisely within the biliary tree.
- ▶ The use of interventional radiology has meant that imaging techniques can now be used as a therapeutic measure in the management of complicated cases of CBDS.
- ▶ In cases where a periampullary diverticulum is present, endoscopic retrograde cholangiopancreatography (ERCP) may be difficult and combination procedures using ERCP and percutaneous transhepatic cholangiogram are used in the removal of CBDSs.

Contributors Manuscript was drafted by AR and all procedures were conducted by DM.

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