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Magnetic Resonance (MR) Cholangiopancreatography Demonstration of the Cystic Duct Entering the Right Hepatic Duct

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Data Interpretation D
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Literature Search F
Funds Collection G

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Patient: Female, 51
Final Diagnosis: Cystic duct draining into the right hepatic biliary duct
Symptoms: Recurrent abdominal pain
Medication: —
Clinical Procedure: MR-cholangiopancreatography
Specialty: Radiology

Objective: Congenital defects/diseases

Background: MR cholangiopancreatography is widely performed before laparoscopic cholecystectomy to rule out choledocholithiasis and to avoid iatrogenic injuries that may be related to the high frequency of anatomical variations of the biliary tree. Although most of these variants have already been demonstrated surgically and by endoscopic retrograde cholangiopancreatography and CT cholangiography, there are no references in which MR cholangiopancreatography has shown a cystic duct draining into the right hepatic biliary duct.

Case Report: A 51-year-old woman with a history of recurrent abdominal pain underwent an abdominal ultrasound in an outside center, which revealed gallbladder cholelithiasis. In this patient, an MR cholangiopancreatography was performed and the laboratory data were obtained. Laboratory findings showed only a mild increase of cholestasis. MRCP did not reveal significant dilatation of intra- or extrahepatic biliary ducts, while the cystic duct showed an atypical insertion, draining directly into the right hepatic duct.

Conclusions: To avoid unintentional bile duct injuries, MRCP evaluation of the biliary anatomy is particularly important for pre-operative evaluation of patients undergoing laparoscopic cholecystectomy. In particular, in the case we describe, the right hepatic duct might have been mistaken for the cystic duct, with potentially severe surgical complications and clinical consequences.

MeSH Keywords: Bile Ducts, Extrahepatic • Cholangiopancreatography, Magnetic Resonance • Cholecystectomy, Laparoscopic • Cystic Duct

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Background

The biliary tree is easily studied with a large variety of imaging modalities. However, endoscopic retrograde cholangiopancreatography (ERCP) still remains the most accurate technique for depicting biliary anatomy and for detecting most of its pathological entities [1].

A potential non-invasive alternative to ERCP is magnetic resonance cholangiopancreatography (MRCP), which during the last decade has markedly improved its accuracy due to increasingly faster sequences with higher spatial resolution [2]. MRCP has been used more often for pre-operative bile ducts exploration to rule out choledocholithiasis in all symptomatic patients and to exclude gall stone-associated disease (e.g., cholangitis and pancreatitis); the use of the more invasive ERCP is preferred only in subjects with high probability of needing therapeutic intervention. Furthermore, MRCP has the advantage of accurately demonstrating anatomical variants of the biliary system, which are a potential intra-operatively risk factor for iatrogenic injuries.

We present a case in which a female patient with gallbladder cholelithiasis underwent MRCP, which showed an anomalous junction of the cystic duct into the right hepatic duct. This uncommon anatomical variant has never been detected preoperatively using MRCP. In fact, according to the scientific literature, it has been mostly demonstrated with ERCP or found intra-operatively.

Case Report

A 51-year-old woman with a history of persistent abdominal pain underwent an abdominal ultrasound in an outside center, which revealed gallbladder cholelithiasis.

The same patient presented to our institution 3 weeks later to undergo MRCP, which was suggested in the pre-operative setting of laparoscopic cholecystectomy. Laboratory findings showed only a mild increase of cholestasis: gamma-glutamyl transpeptidase (67 U/L, normal range 0–50), alkaline phosphatase (110 U/L, normal range 33–98), total bilirubin (0.9 mg/dl, normal range 0.0–1.2), and direct bilirubin (0.40 mg/dl, normal range 0.00–0.30).

MRCP was performed after the ingestion of approximately 400 ml of blueberry juice. We used multiplanar 2D single-shot turbo spin echo (TSE) (TR/TE ∞/800 ms, acquisition time 8 s, slice thickness 40 mm), 3D TSE (TR/TE 1200/650 ms, acquisition time 190 s, slice thickness 1.8 mm) and axial and coronal half-Fourier acquisition single-shot turbo spin echo (HASTE) (TR/TE ∞/80 ms, acquisition time 12 s, slice thickness 4 mm) sequences.

The maximum intensity projection (MIP) algorithm was used to produce a three-dimensional cholangiogram from 3D TSE.

MRCP did not reveal significant dilatation of the intra- or extrahepatic biliary ducts. However, the cystic duct showed an atypical insertion, draining directly into the right hepatic duct (Figure 1). Moreover, it detected 2 pancreatic cystic lesions consisting of side-branch intraductal papillary mucinous neoplasms

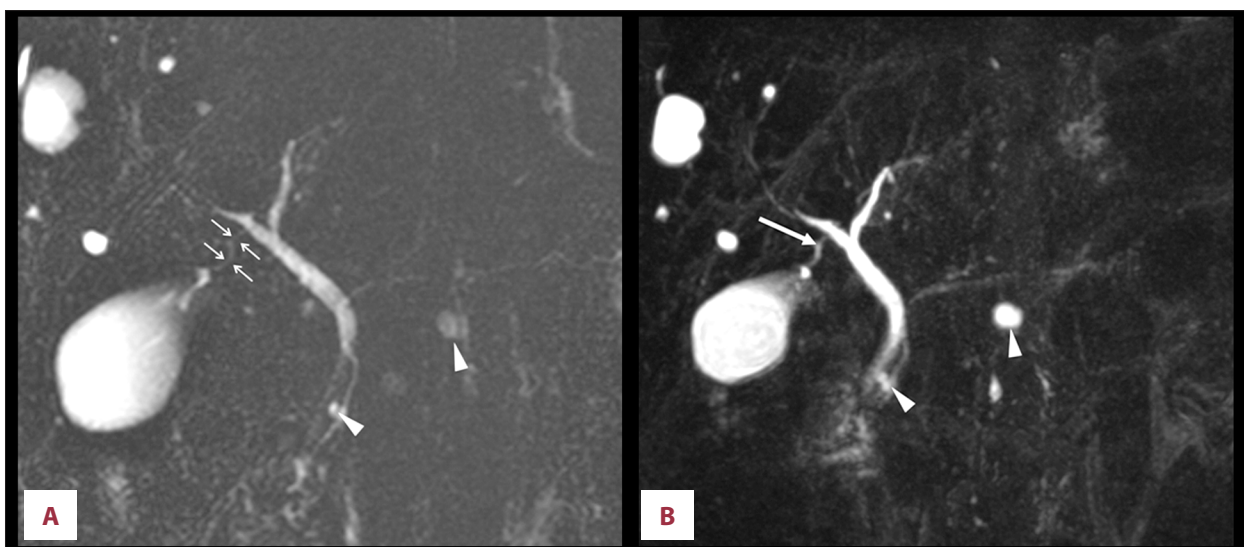


Figure 1. 3D TSE image (A) and 3D TSE MIP reformatted image (B) show the abnormal insertion of the cystic duct directly into the right hepatic duct (arrows), with normal calibre of the common bile duct. Also, note multiple cystic lesions of pancreas (arrowheads) and liver.

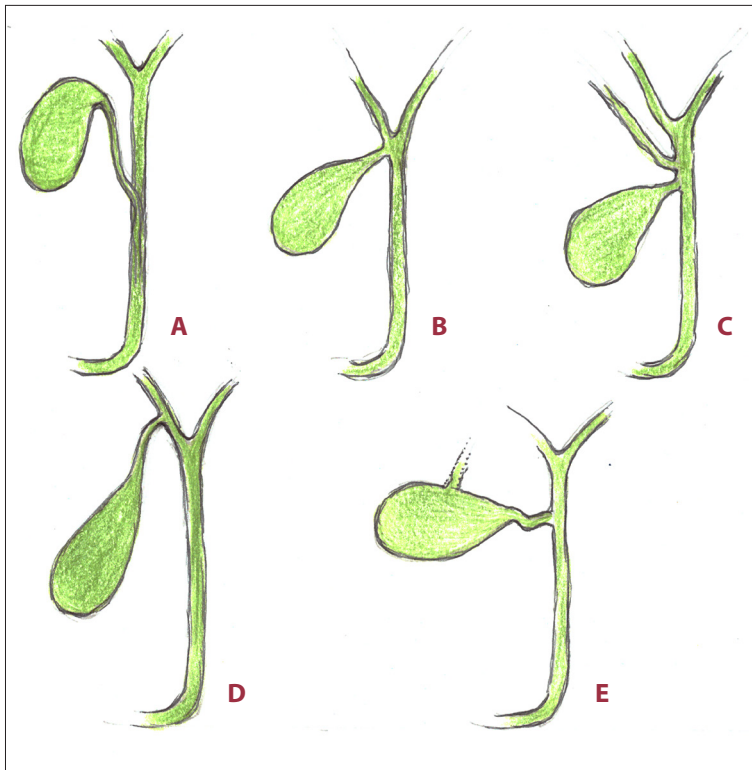


Figure 2. Drawings illustrate the different anatomical variants of the cystic duct insertion according to the Benson and Page classification. (A) Long cystic duct with low fusion with the common hepatic duct. (B) Abnormally high fusion of the cystic duct with the common hepatic duct (trifurcation). (C) Presence of an accessory hepatic duct. (D) Abnormal insertion of the cystic duct into the right hepatic duct. (E) Presence of a cholecystohepatic duct.

(IPMNs). The patient then began annual follow-up for these pancreatic lesions.

Discussion

The cystic duct typically joins the common hepatic duct with a right-lateral approach, below the confluence of the right hepatic duct and left hepatic duct. It may have an anterior or posterior spiral insertion. This biliary anatomy is considered normal because of its prevalence in 58% of individuals [3,4].

Congenital anatomical variants of extrahepatic bile ducts have been described by Benson and Page based on 205 dissections and classified into 5 main types [5]. In particular, they found 3 proper anatomical variants of cystic duct insertion (Type A, B, and D), 1 variant in which a cholecystohepatic duct was present (Type E) and 1 variant consisting of an accessory hepatic duct (Type C) (Figure 2).

According to the Benson and Page classification, a low-lateral insertion with a common sheath enclosing both the cystic duct and common bile duct, or a low-medial insertion at or near the ampulla of Vater, configures a Type A variant. This has an incidence of approximately 10% [4].

Less commonly, the cystic duct may join the common hepatic duct at the porta hepatis, together with the right hepatic duct

and left hepatic duct, configuring a “trifurcation” or Type B variant, which has an incidence of approximately 2%.

The Type D variant, occurring in approximately 0.7% of patients, consists of an abnormal insertion of the cystic duct directly into the right hepatic duct.

The Type E variant, also occurring in 0.7% of patients, is defined by the presence of a cholecystohepatic duct (also known as the duct of Luschka), in addition to a normal cystic duct. Finally, the presence of an accessory hepatic duct (usually originating from the right lobe of the liver and draining into the common hepatic duct) with a normal cystic duct describes a Type C variant, with an incidence of 1.4% [5].

Among the anatomical variants of extrahepatic bile ducts, Type D has never been identified by MRCP [5,6].

The recent improvement in spatial resolution achieved by MRCP, combined with ultra-fast sequences, results in high diagnostic accuracy in delineating anatomic variants of bile ducts and cystic ducts. Moreover, the use of a negative oral contrast agent further improves the quality of MRCP images, avoiding the possible superimposition of intestinal contents in the evaluation of biliary anatomy [7,8].

Finally, MIP images may also be helpful to identify the insertion of the cystic duct.

Conclusions

Accurate imaging of the biliary anatomy is particularly important for pre-operative evaluation of patients undergoing laparoscopic cholecystectomy, because poor visualisation of the surgical field may cause unintentional bile duct injury. In

particular, in the Type D variant, the right hepatic duct may be mistaken for the cystic duct, a rare but potentially severe complication with clinical consequences that may include the formation of a biliary fistula, biloma, and occurrence of pain, fever, and sepsis [9,10].

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