Anatomic variants of the biliary tree at MRCP: still too rarely reported!

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Aims and objectives

Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive and fast method for evaluating requiring neither the use of contrast medium injection nor any biliary intervention. It is actually indicated for the direct visualization of the intrahepatic and extrahepatic biliary ducts and the pancreatic duct. MRCP images allow also to record many different anatomic abnormalities as anatomic variants of biliary tree. For this reason, MRCP is increasingly used for preoperative planning, as in donor candidates for living related liver transplantation, since anatomic variants of biliary tree may increase the complexity of hepatic surgical procedures and biliary interventions.

In normal anatomy, which is present in about 58% of the population, the right hepatic duct drains the segments of the right liver lobe and has two major branches: the right posterior duct draining the posterior segments, VI and VII, and the right anterior duct draining the anterior segments, V and VIII. The right posterior duct usually runs posterior to the right anterior duct and fuses it from a left approach to form the right hepatic duct. The left hepatic duct is formed by segmental tributaries draining segments II-IV. The common hepatic duct is formed by fusion of the right hepatic duct and the left hepatic duct. The bile duct draining the caudate lobe usually joins the origin of the left or right hepatic duct. The cystic duct classically joins the common hepatic duct below the confluence of the right and left hepatic ducts.

However, as demonstrated in different studies, there is great variability in the anatomy of the hepatic biliary tree, gallbladder, and pancreatic ducts, since biliary tract structure shows racial and ethnic variation. In approximately 30% of the general population, two segmental ducts drain the right hepatic lobe and separately join with the left hepatic duct, cystic duct, or common bile duct. Rarely, the cystic duct is absent or duplicated. The length and course of the cystic duct are frequently anomalous and in about 5%-15% of the population, the common bile duct and main pancreatic duct enter the duodenum separately.

Our purpose was to investigate the anatomic variants of the biliary tree using MRCP in a large cohort of Sicilian patients and evaluate in how many cases they had been reported.

Methods and materials

We reviewed both reports and images of MRCP performed in 516 patients (60,9±15,6 years) who had been submitted to diagnostic MRCP from June 2009 to May 2013 in order to identify the type of biliary tree variants. All patients had been submitted an MRCP with a 1.5 Tesla super-conducting magnet with surface or 8-channel phased-array coils.

All exams had been performed acquiring a Fat-saturated axial FIESTA sequence (TR 3600, TE min, FOV 38, thickness 6mm Nex 1), Dual Phase FSPGR (TR 150, FA 80, NEX 1, thickness 1mm, matrix 256x192), axial T2 SSFSE (TE180, TR 827, thickness 7mm, matrix 384x224) and a MRCP radial sequence (TR 10000, TE min, FOV 36, thickness 0.4mm).

The MRCP had been performed after oral administration of 400 ml of a solution of superparamagnetic iron oxide particles with silicone coating. All images were reviewed and common variations of the biliary tract were divided into the following types: type 1, 2, 3a, 3b, 3c, 4, 5a, 5b, 6 as shown in Figure 1.

Images for this section:

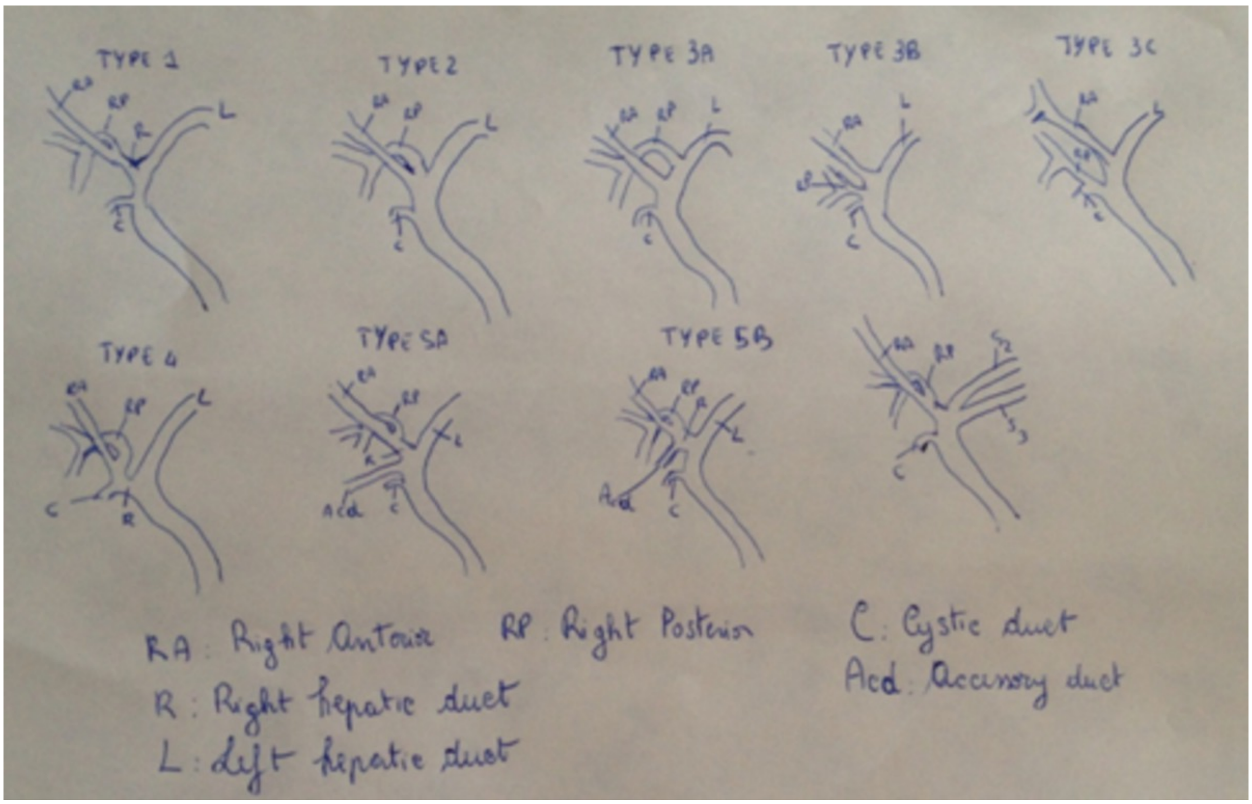

Fig. 1: Figure 1. Schematic drawing of Biliary ductal anatomic variants.

Results

In less than 1% of the MRCP reports it was specified the presence of an anatomical variant of the biliary tree. On the other hand the imaging findings showed that around 23% of the patients had anatomical variants of the biliary tree (see Figures 2-4). Type 3a was the most common variant. The distribution of the different percentage of the anatomic variants according to Yoshida classification is shown in Figure 5.

Images for this section:

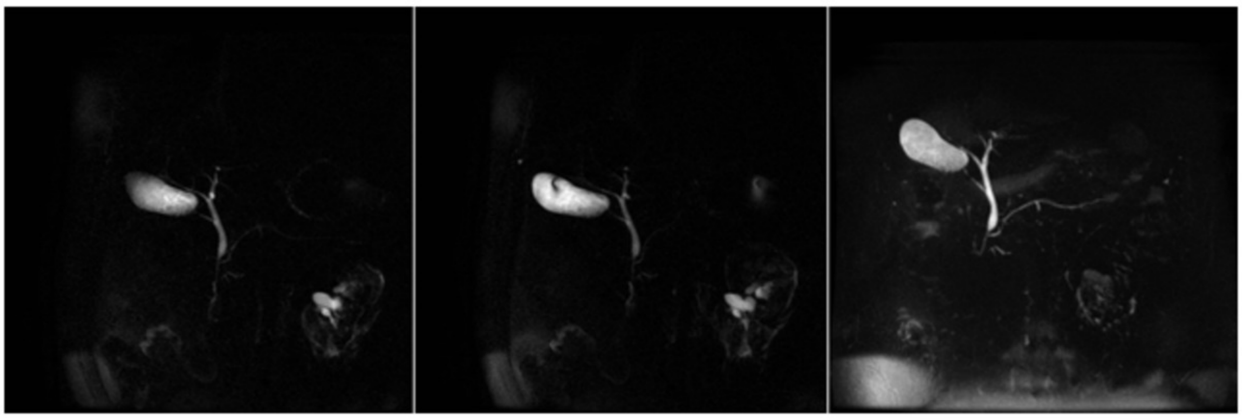

Fig. 2: Figure 2. MRCP showing type 1 anatomic variant of the biliary tree.

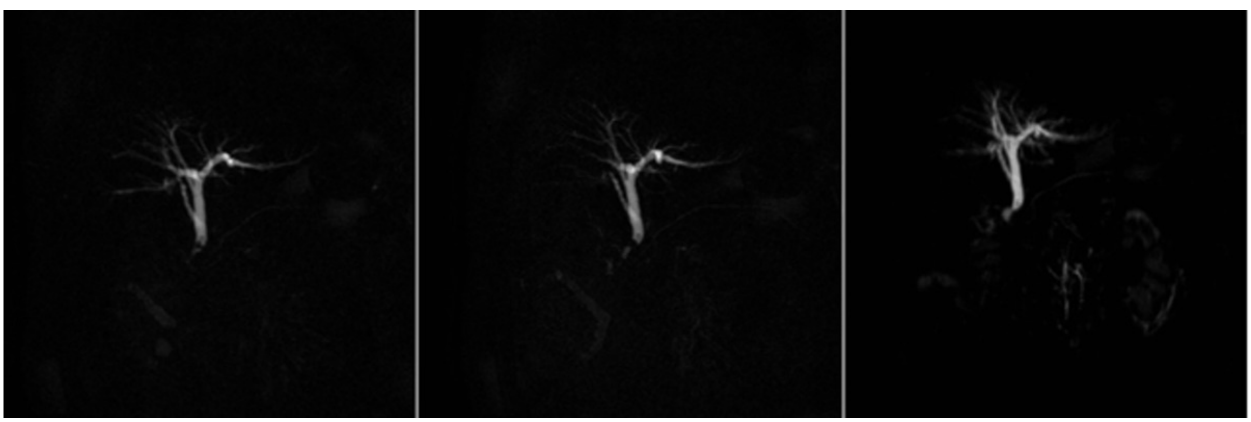

Fig. 3: Figure 3. MRCP shows type 3a anatomic variant of the biliary tree.

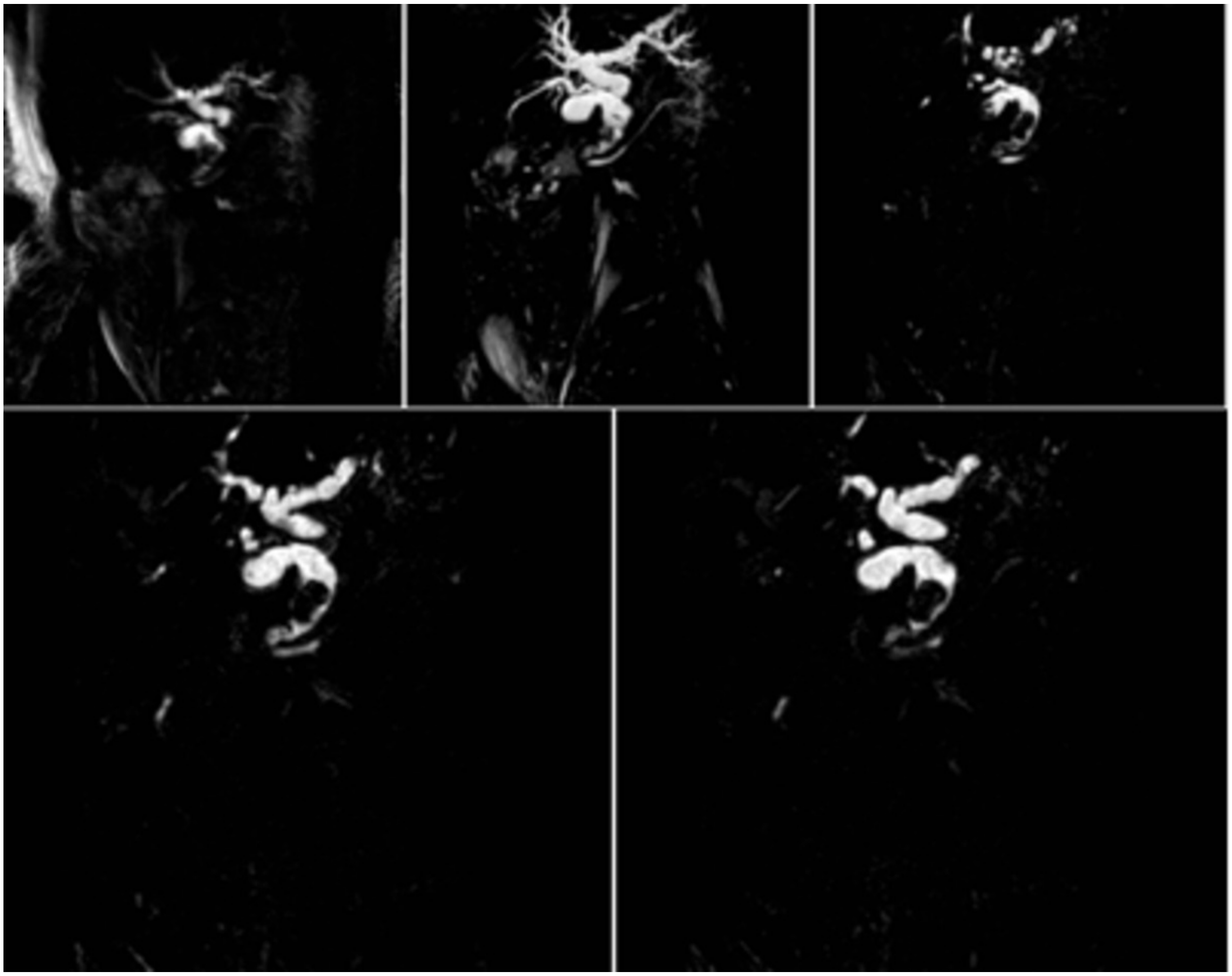

Fig. 4: Figure 4. MRCP shows a type 5a anatomic variant of the biliary tree.

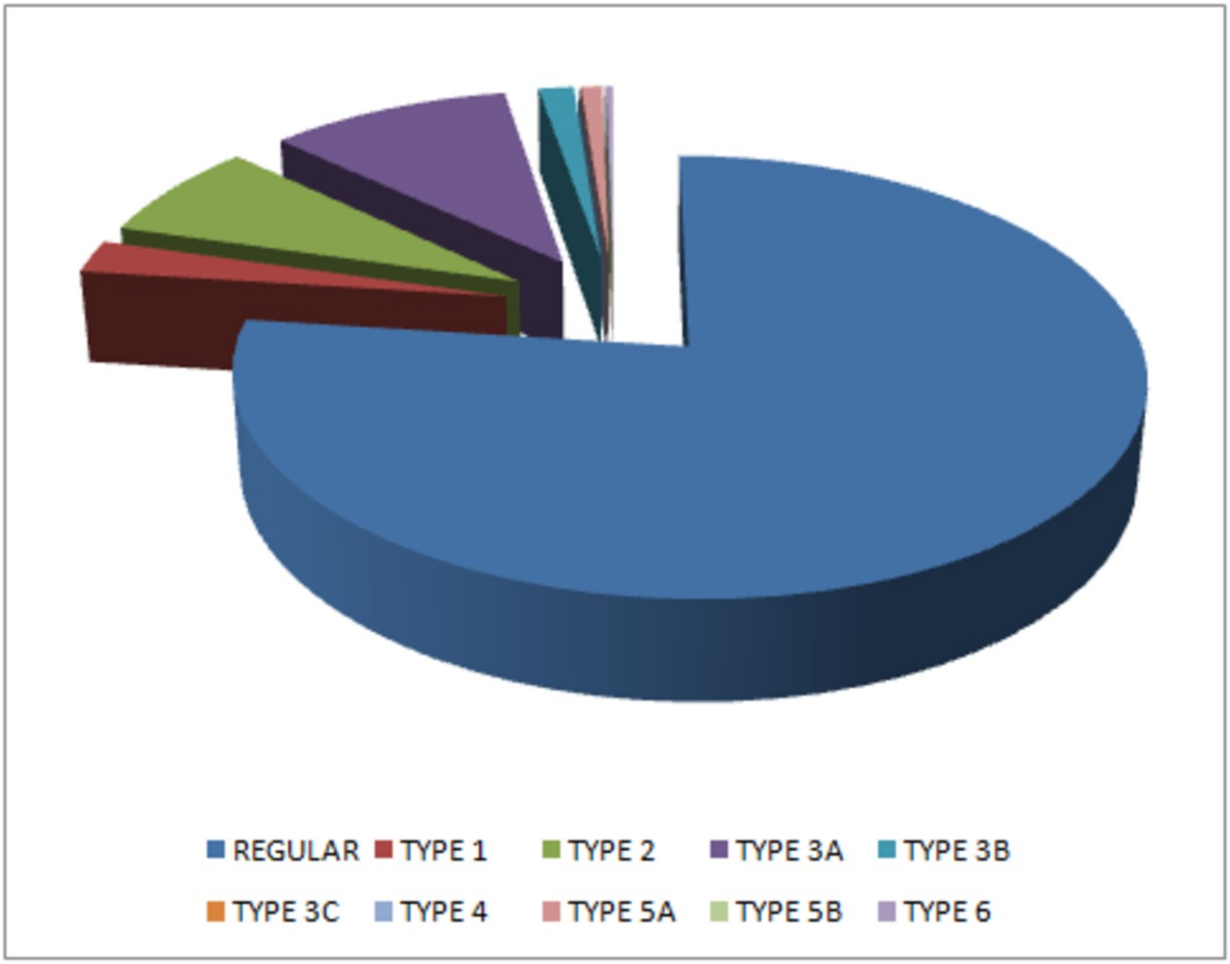

Fig. 5: Figure 5. Distribution of the common variants of biliary tree in our population.

Conclusion

Anatomical variants of the biliary tree present a complex spectrum of frequent alterations, which can be easily identified by MRCP. Knowledge of the presence of these variants can be useful for both the clinician and the surgeon. Preoperative imaging of the biliary branching pattern proves to be a succesful method to diagnose these variants. However, in our experience, comparing reports and imaging analyses it merges that in most of the cases the presence of anatomical variants of the biliary tree is not reported by the radiologist.

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