Role of MRCP in the measurement of the CBD diameter

Several diagnostic methods such as ultrasonography, endoscopic retrograde cholangiopancreatography, and multidetector computed tomography have been used to measure the diameter of the common bile duct (CBD). Magnetic resonance cholangiopancreatography (MRCP) is a noninvasive procedure and a novel method for delineating biliary and pancreatic disorders. It requires no contrast material injection, generates both cross-sectional and projectional images, and provides an overview of the entire biliary and pancreatic ductal system. Furthermore, MRCP spatial and contrast resolutions are crucial in the effort to obtain the highest quality imaging results, which determine the detection rate of small pathologies and anatomic variants. Recent technical developments have also improved the image quality provided by magnetic resonance imaging of the abdomen, such as receiver coils, use of parallel-imaging and respiratory-monitoring techniques, and a more powerful gradient system, such as 3.0T MRI.

Although different kinds of MRCP imaging techniques have been used, most current protocols often use a two-dimensional (2D) single-shot fast spin-echo technique to obtain a combination of coronal thin-section images and rotating oblique-coronal thick-slab images. Thick-slab MR images are necessary to capture the entire biliary tree or pancreatic duct on one image by rotating oblique-coronal planes, and provide an overview of biliary and pancreatic ductal anatomic characteristics. However, the technique is operator-dependent, and necessitates identification of complex anatomic characteristics by a skilled MR technologist or a radiologist monitoring the examination. Even when MRCP examinations are well performed, inherent in-place volume averaging effects may obscure small stones or anatomic variants. It is true that thick-slab imaging provides an expanded anatomic overview, and thin-section imaging provides fine details.

However, patient respiratory motion during examination may result in areas of missed anatomic features, and can limit the suitability of these thin-section data from maximum intensity projections or other multplanar reformations. Two-dimensional techniques have anisotropic resolution with increased slice thickness compared with in-place resolution, which results in a marked degradation of maximum-intensity projections in areas oblique to the acquisition plane. Three-dimensional acquisition is also appealing for MRCP because it provides intrinsically contiguous sections that may be used to reconstruct images in any projection, which yields the anatomic overview normally provided by thick-slab 2D images. Conversely, the primary theoretical disadvantage of 3D acquisition is that artifacts from patient motion are distributed in a complex fashion throughout the full set of images; therefore, short breath-hold times are crucial for good image quality.

In the breath-hold MRCP technique, the use of a long breath-hold requires cooperative, nonsedated patients, which limits the spatial resolution. The projection technique can be performed in a short time and requires no postprocessing apart from image reconstruction, which can be completed in less than 1 second. This technique is fast because only a single voxel projection image is acquired through the imaging object. Respiratory misregistration and fast intestinal movements can be avoided with this short acquisition time. High signal intensity from intestinal fluids would decrease the quality of MRCP images due to superimposition with the biliary tract. Therefore, previous researchers have used oral negative contrast agents (including blueberry and pineapple juices) to suppress the high signal of the gastrointestinal tract.

The diameter of the CBD is one important factor clinicians use to determine if patients should be referred for endoscopic retrograde cholangiopancreatography. There were found to be considerable causative and significant biliary tract lesions in patients lacking any biliary symptoms or jaundice, but who had dilatation of the CBD. The possible causes of CBD dilatation in healthy nonsymptomatic individuals includes: juxtapapillary duodenal diverticulum, benign stricture, choledochal cyst, anomalous union of the pancreaticobiliary duct (AUPBD), and choledochal cyst with AUPBD.

The estimated incidence of choledochal cysts in Western countries is about 1 in 150,000 individuals. The incidence rate is higher in Asia and occurs more frequently in women (male/female = 1:4). Although the diagnosis of a choledochal cyst is most often made during childhood, 25% of patients are initially seen during their adult years. Type I choledochal cyst present as diffuse dilatation of the CBD. AUPBD is a kind of congenital anomaly in which the junction is located outside the duodenal wall. In addition, there is an elevated incidence of AUPBD in asymptomatic individuals with CBD dilatation.

The normal diameter of the CBD can be up to 10 mm in people advanced in age. It is postulated that this dilatation is...
due to a combination of age and/or chronic inflammation, which destroys the elastic recoil and contractibility of the duct wall.13 One report indicated that the mean width of the CBD is 4.1 mm, even in patients 71 years or older.14 In the current issue of Journal of the Chinese Medical Association, Chen et al15 evaluated the diameter of CBD in 187 asymptomatic Taiwanese adults by using MRCP, and showed that the average CBD diameter in this group is 4.6 mm, with a range of 1.76–10.49 mm. Breath-hold thick slab single-shot turbo spin–echo projections were used for the actual CBD diameter measurement. In their article, age is a significant factor related to CBD diameter, with participants over 65 years of age having significantly larger CBD diameter.

In conclusion, MRCP can be used to measure the diameter of CBD. Both conventional 2D thick-slab and 3D imaging sequences can provide the necessary diagnostic information. However, the 3D approach may be better suited for optimum visibility of the whole biliary tree as compared to the conventional 2D thick-slab sequence.

References


