

Respiratory Variation of the Extrahepatic Bile Duct: Evaluation with Deep Inspiratory and Expiratory MRCP

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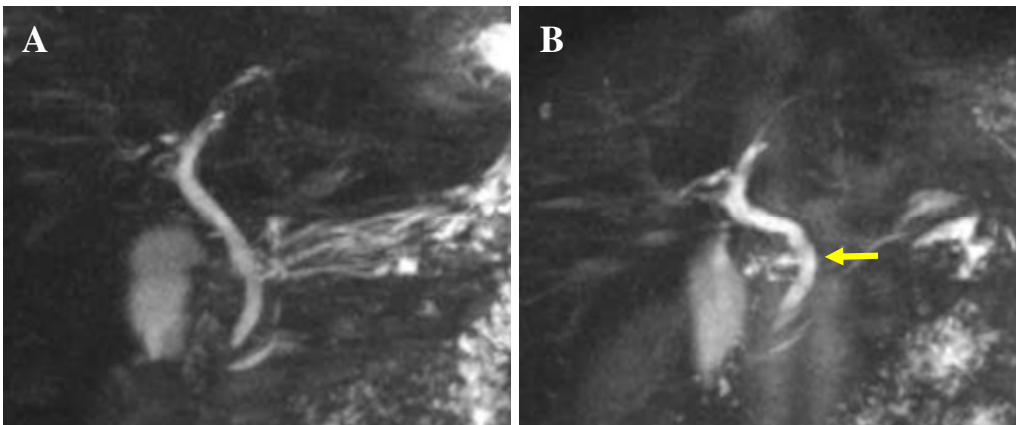
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Purpose: The extrahepatic bile duct is tethered to the liver superiorly and to the pancreas inferiorly. Diaphragmatic descent during deep inspiration cause more displacement of the liver as the intraperitoneal organ than of the pancreas as the retroperitoneal organ, causing morphologic changes of the extrahepatic bile duct during the deep respiration. However, respiratory changes in morphology of the extrahepatic bile duct have not been fully investigated. In this study, we evaluated the respiratory variation of the extrahepatic bile duct in morphology including shape, length and duct diameter on the breath-hold MR cholangiopancreatography (MRCP) obtained during deep inspiration and deep expiration in patients with or without biliary diseases.

Materials and Methods: This study included 55 patients with or without biliary diseases who underwent MR imaging including MRCP (30 men and 25 women; mean age, 62.7 years; age range 36-80 years). Breath-hold MRCP was obtained twice during the end-inspiration and the end-expiration. MR images were reviewed by two radiologists experienced in abdominal MR imaging. MRCP images were evaluated for 1) the length of the extrahepatic bile duct between the bifurcation of left and right hepatic duct and the end at papilla vater, 2) the maximal diameter of the extrahepatic bile duct, and 3) the presence and its grade (3-point scale; 1=mild, 2=moderate, 3=severe) of “bowing” of the extrahepatic bile duct during the deep inspiration. MRCP findings and measurements were compared between inspiratory and expiratory MRCP.

Result: On MRCP obtained during the end-expiration, the maximal diameter of the extrahepatic bile duct was equal or more than 10mm in 21 (38%) of 55 patients (dilated group) while the maximal diameter of the extrahepatic bile duct was less than 10mm in 34 (62%) of the 55 patients (normal group). In the dilated group, there was no significant difference in the mean maximal diameter of the extrahepatic bile duct between the end-inspiratory MRCP (14.7mm, range; 10-23.8mm) and the end-expiratory MRCP (14.1mm, range; 10-23.7mm). In the normal group, the mean maximal diameter of the extrahepatic bile duct was significantly larger on the end-inspiratory MRCP (8.4mm, range; 5.5-10.9mm) than on the end-expiratory MRCP (7.7mm, range; 5.2-9.9mm) ($p < 0.03$). In the normal group, 11 (32%) of the 34 patients had an increase in the mean maximal diameter of the extrahepatic bile duct of more than 1mm at the end-inspiration, whereas 1 (5%) of the 21 patients in the dilated group had an inspiratory increment in the mean maximal diameter of the extrahepatic bile duct of more than 1mm. With regard to the prevalence of inspiratory increase in the mean maximal diameter of the extrahepatic bile duct, there was a significant difference between the normal and the dilated group ($p = 0.016$). The bowing of the extrahepatic bile duct, usually convex laterally, on the end-inspiratory MRCP was observed in 27 (79%) of the 34 normal patients (mean grading score, 2.1 ± 0.63) while it was seen in 8 (38%) of the 21 patients with biliary dilatation (mean grading score, 1.2 ± 0.46), showing a significant difference between these two groups ($p = 0.002$). The shortening of the extrahepatic bile duct on the end-inspiratory MRCP was observed in both the dilated group (end-expiration vs end-inspiration = 80.3mm vs 77.1mm) and the normal group (end-expiration vs end-inspiration = 82.2mm vs 76.2mm).

Conclusion: Deep inspiratory and expiratory MRCP demonstrated the substantial respiratory variations of the extrahepatic bile duct in the shape (bowing), length, and maximal duct diameter. Awareness of this normal phenomenon will be important for the correct interpretation of MRCP in patients with or without biliary diseases.



Shortening and Bowing of the Extrahepatic Bile Duct at Respiratory MRCP

(A) Breath-hold MRCP obtained during the end-expiration shows the overview of the extrahepatic bile duct. (B) Breath-hold MRCP obtained during the end-inspiration demonstrates the “bowing” and shortening of the extrahepatic bile duct (arrow).