

# THE PHYSIOLOGIC ACCUMULATION OF BILE IN THE GALL BLADDER: EVALUATION BY MEANS OF DYNAMIC CONTRAST-ENHANCED MR CHOLANGIOGRAPHY WITH Gd-EOB-DTPA

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**Purpose:** Assessment of bile accumulation in gallbladder might play an important role in determining appropriate treatment strategies for patients with biliary symptoms and in investigating the pathophysiology of gallbladder disorders such as cholecystolithiasis and acute or chronic cholecystitis. Gd-EOB-DTPA has an excretion rate of up to 50%, and can be used to obtain non-invasively high resolution dynamic contrast-enhanced MR imaging (DCE-MRI) including MR cholangiography (MRC) of the liver and biliary system. The aim of this study was to evaluate the physiologic accumulation of bile in gallbladder using DCE-MRC obtained with Gd-EOB-DTPA.

**Methods and Materials:** A total of 75 consecutive patients with or without chronic liver disease underwent Gd-EOB-DTPA enhanced MR imaging using a 1.5-T scanner with a multi-channel phased array coil. Among the MR imaging protocols, multiphasic hepatobiliary phase (HP) imaging was used for data analysis. HP images were obtained at 8, 10, 12, 14, 16 and 20 min in the coronal plane and 11, 15 and 21 min in the transverse plane after contrast media administration using a 3-dimensional T1-weighted GRE sequence with fat-suppression technique (liver acquisition with volume acceleration (LAVA) or Quick 3D) and serial HP imaging in each subject were qualitatively reviewed to evaluate the accumulation of bile in the gallbladder using a six-point scale. The bile was defined as high signal intensity region which corresponds to biliary excretion of Gd-EOB-DTPA in the hepatic duct, common bile duct, gallbladder and duodenum, and the accumulation pattern of gallbladder were classified into two groups; group 1 (Orthodromic type = Visualization of Gd-EOB-DTPA in the gallbladder is earlier than that of end of the common bile duct.) and group 2 (Delayed type = Visualization of Gd-EOB-DTPA in the end of the common bile duct is earlier than that of gallbladder.). Furthermore, the results in differences of the presence of 1) T1 hyperintense bile or sludge of gallbladder, 2) gall stones, 3) wall thickening of gallbladder of 4mm or more, 4) chronic liver disease and 5) liver cirrhosis between two groups were compared using the Pearson's chi-square or the Fisher exact tests.

**Results:** Forty-eight of 75 patients (64%) were included in group 1, and remaining 27 (36%) were in group 2 (Fig. 1). The frequency of the presence of 1) T1 hyperintense bile or sludge of gallbladder was significantly higher in patients with group 2 (70%; 19/27) than that in patients with group 1 (46%; 21/48) ( $P = 0.027$ ). There were no significant differences in the presence of 2) to 5) items between two groups ( $p = 0.232$  to  $0.954$ ).

**Conclusions:** The physiologic accumulation of bile in the gallbladder could be assessed visually with DCE-MRC using Gd-EOB-DTPA. Furthermore, the delay in the bile accumulation in the gallbladder is associated with T1 hyperintense bile or sludge of gallbladder, indicating the increase of viscosity and pressure in the gallbladder. Accordingly, radiologists should recognize that the physiologic accumulation of bile in the gallbladder changes according to the pathological condition.

Figure 1. Delayed type of bile accumulation in gallbladder. On the 16 min HP image, MRC shows excretion of Gd-EOB-DTPA in intra-hepatic duct to duodenum (a). However, there is no accumulation of Gd-EOB-DTPA in the gallbladder even in the 20 min HP imaging (b). On the in-phase fast spoiled gradient-echo T1 weighted image, this patient had T1 hyperintense bile (c).

