Biliary Enhancement of Gd-BOPTA (MultiHance®) and Gd-EOB-DTPA (Primovist®) - a Study in Healthy Volunteers

N. Dahlström[1,2], T. B. Brismar[3], A. Persson[1], N. Albiin[3], Ö. Smedby[1]

[1]Center for Medical Image Science and Visualization (CMIV), Linköping University Hospital, Linköping, Sweden, [2]Department of Radiology, Hudiksvall Hospital, Hudiksvall, Sweden, [3]Department of Radiology, Karolinska University Hospital Huddinge, Stockholm, Sweden

Introduction: The gallbladder and in particular the bile ducts are readily depicted by heavily T2-weighted MRC(P) acquisitions. Contrast media giving intraluminal enhancement in the biliary system can, in addition to displaying its morphology, also provide functional dynamic information of the hepatobiliary system. There are two contrast agents based on gadolinium which may be used, Gd-BOPTA (Multihance®) and Gd-EOB-DTPA (Primovist®). They differ in hepatocellular enhancement properties as well as in the degree of biliary elimination (5% for Gd-BOPTA and 50% for Gd-EOB-DTPA). This study aimed to investigate the dynamics of bile duct enhancement relative to that of liver parenchyma for both these contrast agents.

Materials and methods: After approval by the local ethics committee and written informed consent, ten healthy subjects (four men and six women), aged 29 years (19-46 years) were evaluated with each agent. Exams were performed in the early morning after >7 hours of fasting using a 1.5 T Siemens Vision and a combined spine and flexible body array coil. The amounts of contrast media used were 0.025 mmol/kg for Gd-EOB-DTPA, and 0.1 mmol/kg for Gd-BOPTA. Axial breath-hold gradient-echo T1-weighted scans (TE 1.9 ms, TR 4.5 ms, FOV 40 cm and 120 slices, 1.7 mm thickness) of the liver were performed before and at 10, 20, 30, 40, 130, 240 and 300 min after intravenous contrast injection. After one hour of scanning a light meal containing <2 g fat was allowed. The signal intensity (SI) of the common bile duct (CBD), liver parenchyma and an external reference phantom was measured in a single representative slice by three independent certified radiologists. The ROI was 0.7 cm^2 for liver and reference phantom. In the CBD a single voxel located centrally in the duct was measured. The SI values of bile duct and liver were normalized by dividing with the SI of the reference phantom.

Results: All subjects completed both their examinations with no reported adverse reactions or subjective symptoms. One sequence of a total of 160 did not display a reference phantom and was excluded. The peak signal intensity in the CBD occurred for both agents at 40 minutes after injection. The signal intensity in the CBD rose earlier with Gd-EOB-DTPA compared to Gd-BOPTA. The former gained a clearly discernible high signal at 10 minutes delay while the latter at the same delay did not display any obvious biliary enhancement. At 20 minutes after injection, distinct biliary enhancement was noted for both agents. In the phases from 40 to 300 minutes post-injection, the signal of the CBD decreased for both Gd-EOB-DTPA and Gd-BOPTA to a level of about 70 % of the peak signal. When studying image contrast by calculating the SI difference between the CBD and the liver parenchyma, Gd-EOB-DTPA reached a difference greater than that for Gd-BOPTA up until 30 minutes post-injection. After this time, it remained nearly constant at a high level. Gd-BOPTA produced a peak signal difference at 40 minutes post-injection slightly greater than that of Gd-EOB-DTPA, followed by a decrease to a plateau at less than half of the signal difference for Gd-EOB-DTPA.

Discussion: The earlier onset and longer duration of a high difference in signal intensity between CBD and liver parenchyma for Gd-EOB-DTPA facilitates examination of hepatobiliary excretion. The image contrast is retained for a long time (≥5 hours). With Gd-BOPTA, a slightly greater difference in signal intensity between liver and CBD might be obtained within a short time window. In clinical practice, hepatobiliary imaging may be performed in a shorter time when using Gd-EOB-DTPA compared to Gd-BOPTA.

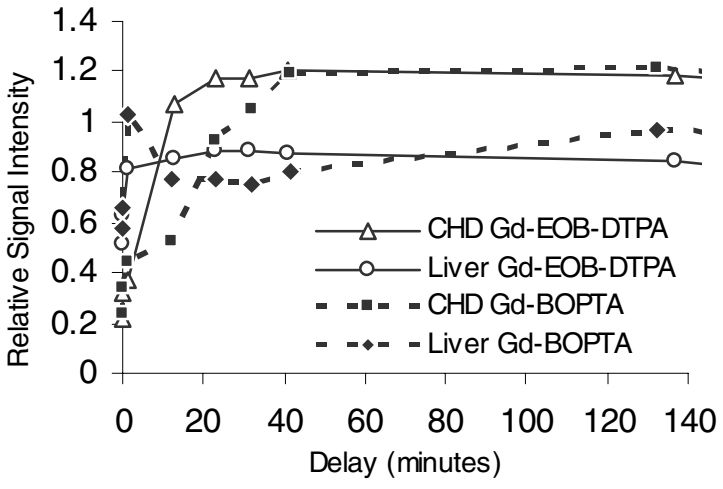

Fig. 1. Normalized relative signal intensity of CBD and Liver with Gd-EOB-DTPA and Gd-BOPTA at 0–130 min delay.

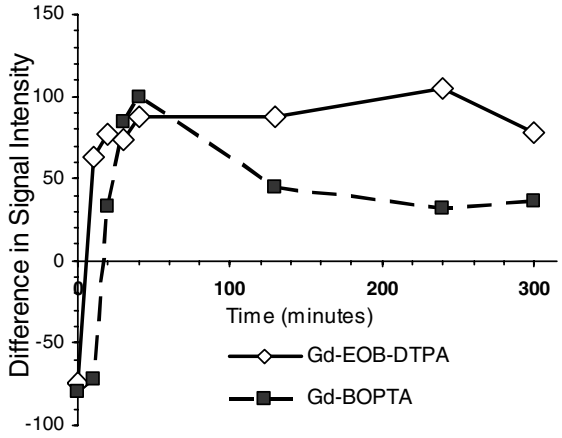

Fig. 2. Signal intensity difference between the CBD and liver parenchyma 0–300 minutes after injection of contrast medium.