

Pre- and Post-Prandial Alterations of Intraportal Venous Flow : Evaluation with Unenhanced MR Angiography during a Single Breathhold using 3D FSE with a Selective IR Tagging Pulse

K. Ito¹, T. Tsukuda¹, A. Shimizu¹, K. Sasaki¹, M. Hayashida¹, M. Tanabe¹, N. Matsunaga¹

¹Radiology, Yamaguchi University School of Medicine, Ube, Yamaguchi, Japan

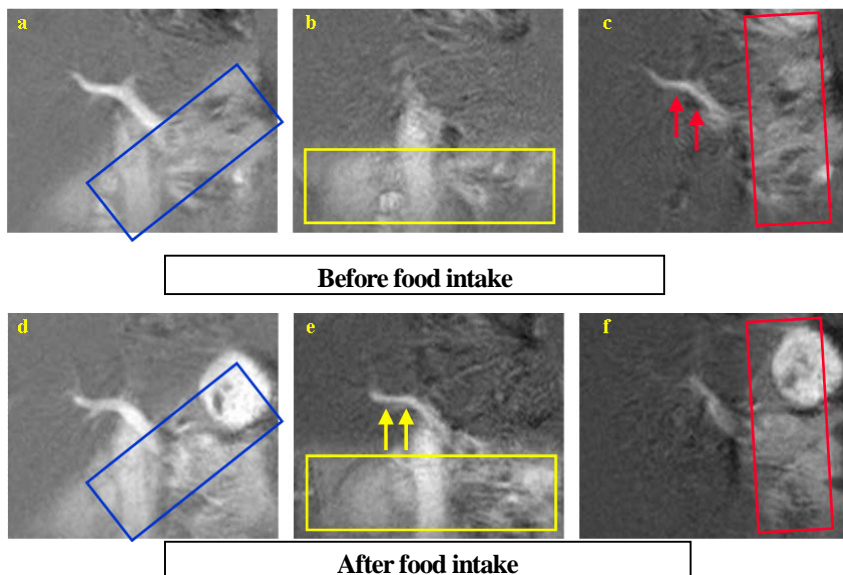
Purpose: Food intake could change portal venous circulation compared to fasting state. However, the effects of food intake on the portal venous inflow from the superior mesenteric vein (SMV) and the splenic vein (SpV) are not well understood. We evaluated the influence of fasting and food intake on the portal venous inflow from the SpV and/or the SMV by means of unenhanced MR angiography using a single breathhold 3D FSE sequence with a selective IR tagging pulse under the physiological condition without administration of contrast materials.

Materials and Methods: The study population included 29 subjects without a history of hepatic and pancreatobiliary disease. All examinations were performed with unenhanced MR angiography technique using a single breathhold 3D FSE sequence. A selective IR tagging pulse was placed on the SMV or on the SpV in order to study the inflow correlation of tagged blood into the portal vein. MR imaging was performed before and 60-90 min after taking the food. Inflow blood signal from each vein was evaluated on subtracted MR images derived from simultaneously acquired tag-off and tag-on images. (Subtracted images without misregistration show tagged blood flow in to the PV as a bright signal.)

Alterations of the blood flow signal from the SMV and SpV before and after food intake were visually evaluated by using the following 3-point response scale: 3=increase, 2=almost no change, 1=decrease. Predominance of the blood flow signal from the SMV and SpV into the PV was also visually evaluated using the following 3-point predominance scale: 3=SMV predominant, 2=almost no predominance, 1=SpV predominant.

Result: Bright inflow signal to the portal vein from the SMV or SpV was clearly observed on subtracted MR images in all 29 subjects. On MR images obtained after food intake, the blood flow signal from the SMV increased compared with MR images obtained before the meal in 97% (28/29) of the subjects. Conversely, the blood flow signal from the SpV decreased in 41% (12/29), increased in 31% (9/29) and showed almost no change in 28% (8/29) of the subjects, after food intake. The averaged response scale of the SMV (2.9 +/- 0.4) was significantly higher than that of the SpV (1.9 +/- 0.9) ($p < 0.001$), indicating significant increase of the blood flow from the SMV after meal. Regarding the predominance of the blood flow signal from the SMV and SpV into the portal vein, the portal blood flow signal was predominated by the blood flow signal from the SpV in 59% (17/29) of the subjects or showed no predominance in 31% (9/29) of the subjects before the meal, while it was predominated by the blood flow signal from the SMV in 76% (22/29) of the subjects after the meal. The averaged predominance scale after the meal (2.7 +/- 0.7) was significantly higher than that before the meal (1.5 +/- 0.7) ($p < 0.0001$), indicating that the portal blood flow is predominantly perfused by blood flow from the SMV after the meal compared to the fasting state.

Conclusion: A single breathhold 3D FSE sequence with a selective IR tagging pulse has a potential to assess correlation between the SpV and the SMV inflow to the portal vein after fasting and food intake, and to evaluate the alteration in intraportal venous flow before and after meal.



Pre- and Post-Prandial Alterations of Intraportal Venous Flow

(a)-(c) Images obtained before food intake. (a) Tag-on source image (tagging pulse on both SMV and SpV) shows the portal vein (PV) as high signal. (b) Tag-on source image (tagging pulse on SMV) shows faint high signal of tagged SMV flow in PV, probably due to decreased SMV flow by fasting. (c) Conversely, tag-on source image (tagging pulse on SpV) shows predominant high signal of tagged SpV flow in PV (red arrows).

(d)-(f) Images obtained after food intake. (d) Tag-on source image (tagging pulse on both SMV and SpV) shows high signal of PV similar to that in **a**. (e) Tag-on source image (tagging pulse on SMV) shows increased high signal of tagged SMV flow (yellow arrows) in PV due to increased SMV flow, compared with **b**. (f) Tag-on source image (tagging pulse on SpV) shows decreased high signal of tagged SpV flow in PV, compared with **c**.