

Intraportal venous flow distribution: Evaluation with unenhanced oblique trueSSFP MR angiography perpendicular to portal vein using a selective IR tagging pulse

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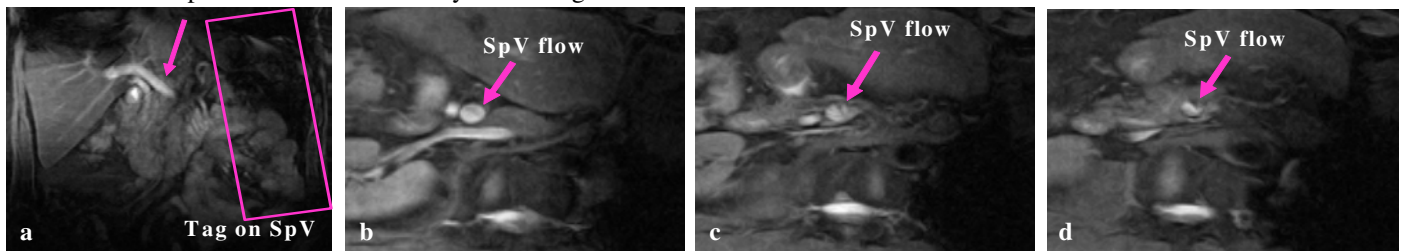
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Purpose: The distribution of the blood flow from the splenic vein (SpV) and the superior mesenteric vein (SMV) to the portal vein is not fully understood. Although the blood flow from the SMV and SpV is generally considered to be streamlined in the portal vein, the turbulent or whirling flow can occur in the main portal vein according to physiologic changes or pathologic conditions. Recently, steady-state free precession (SSFP) sequences have been introduced for abdominal MR examinations and unenhanced MR angiography. The advantages of this sequence include homogeneously bright signal in vessels, short acquisition times and high signal-to-noise ratio. This sequence allows the evaluation of three-dimensional change of intraportal flow in the oblique plane without artifacts. In this study, we evaluated three-dimensional distribution of intraportal blood flow from the SMV and SpV by means of unenhanced oblique trueSSFP MR angiography perpendicular to the portal vein using a selective IR tagging pulse under the physiological condition without administration of contrast materials.

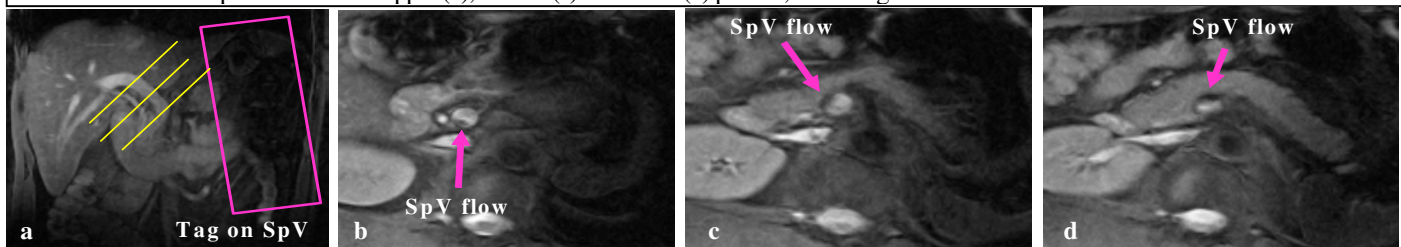
Materials and Methods: The study included 14 subjects without a history of hepatobiliary disease. All examinations were performed with unenhanced MR angiography technique using a single breathhold trueSSFP sequence with fat suppression. A selective IR tagging pulse was placed on the SMV or on the SpV in order to study the inflow correlation of tagged blood into the portal vein. Tagged blood inflow is shown as a dark signal in the bright portal vein. Location of the dark signal from the tagged blood flow in the portal vein was visually evaluated in the coronal plane and in the oblique plane perpendicular to the portal vein, respectively, at three points (lower, middle, and upper portions of the portal vein).

Result: On the coronal MR images, dark inflow signal to the portal vein from the SMV was observed in the right side of the portal vein in 86% (12/14) of the subjects while dark inflow signal from the SpV was seen in the left side of the portal vein in 57% (8/14). On the coronal MR images, the blood flow from the SMV and SpV is considered to be streamlined in the portal vein in 86% (12/14) of the subjects. On the oblique MR images perpendicular to the portal vein, dark inflow signal to the portal vein from the SMV was observed in the right side of the portal vein in 71% (10/14) at the lower portion while it was seen in the central area of the portal vein in 29% (4/14) and in the right side in 36% (5/14) at the upper portion. Dark inflow signal from the SpV was observed in the left side of the portal vein in 79% (11/14) at the lower portion while it was seen in the central area of the portal vein in 71% (10/14) at the upper portion. Whirling flow in the portal vein was observed in 57% (8/14) on the oblique MR images perpendicular to the portal vein while it was not seen on the coronal MR images.

Conclusion: Breathhold unenhanced oblique trueSSFP MR angiography perpendicular to the portal vein using a selective IR tagging pulse with fat suppression has a potential to assess correlation between the SpV and the SMV inflow to the portal vein, and to evaluate the three-dimensional distribution of intraportal venous flow caused by the whirling flow.



TrueSSFP MR angiography with a selective IR tagging pulse on the SpV. (a) Coronal MR image shows dark inflow signal (arrow) from the SpV in the left side of the portal vein. (b)-(d) Oblique MR image perpendicular to the portal vein shows dark inflow signal (arrow) from the SpV in the left side of the portal vein at the upper (b), middle (c) and lower (d) portion, indicating streamlined flow.



TrueSSFP MR angiography with a selective IR tagging pulse on the SpV. (a) On the coronal MR image, dark inflow signal from the SpV is unclear. (b)-(d) Oblique MR image perpendicular to the portal vein shows dark inflow signal (arrow) from the SpV in the dorsal side (b), right side (c) and ventral side (d) of the portal vein at the upper, middle and lower portion, indicating whirling flow.