Dietary intake enhances the visualization of MR portography using non-contrast-enhanced time-spatial labeling inversion pulse (Time-SLIP) - Evaluation of temporal change after meal to determine an appropriate examination timing -

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PURPOSE;

Time-SLIP (time-spatial labeling inversion pulse) technique is a spin labeling technique, in which the movement of labeled blood by an inversion recovery (IR) tag pulse is observed as an intrinsic endogenous contrast material after a certain inversion time (TI)(1). Usefulness of Time-SLIP to depict the portal vein has been reported (2). Portal venous flow, especially superior mesenteric venous (SMV) flow, is well known to increase significantly after food intake (3). Because visualization of vessels using Time-SLIP, in which labeled blood flows into the area suppressed by the IR tag pulse ("flow-in" method), is significantly affected by blood flow velocity, the changes of portal venous flow after meal could affect the visualization of the non-contrast enhanced MR portography.

The purpose of this study is to evaluate the visualization of sequential MR portography by using the Time-SLIP flow-in technique after food intake, and to determine an appropriate timing of the examination.

MATERIALS and METHODS

Institutional review board approval and informed consent were obtained. MR examinations were performed using a 1.5-T clinical imager (EXCELART Vantage^{TM} XGV PPP powered by Atlas, Toshiba,Japan), equipped with an Atlas SPEEDER body and an Atlas SPEEDER spine coil. Three-dimensional bSSFP was used with the following parameters: TR=5.0 msec, TE =2.5 msec, fat suppression =190 msec, matrix=256 x 128 , section thickness of 2.5 mm (with ZIP interpolation to 1.25 mm), parallel imaging factor=2.0, and field of view=40 x 20 cm. The tag pulse was applied obliquely to cover the liver so that SMV flows into the tagged region.

MR portography was performed on 5 healthy volunteers with TI = 900 msec, 1200 msec, 1500 msec before and after intake of 2 packs of CalorieMate (a nutritionally balanced food, a pack includes energy of 400 Kcal, fat of 21.9g, sugars of 41.7g, protein of 8g, Otsuka Pharmaceutical Co., Japan), at following 7 phases; pre-meal, just after meal, 30 minutes after, 1 hour after, 2 hours after, 3 hours after, and 4 hours after. The visualization of intrahepatic and extrahepatic portal branches were evaluated in all 7 phases with a 4-point grading system (4; most clearly visualized, 3; more clearly visualized, 2; fairly visualized, 1; poorly visualized). Contrast-to-noise ratio (CNR) of portal vein to hepatic parenchyma was also measured using an ROI analysis. The degree of signal suppressions was also evaluated on hepatic parenchyma and hepatic vein, and artifacts due to intestinal movement.

RESULTS

The visualization of portal vein was improved at all phases after food intake, among which the improvement on 1 hour (mean CNR=6.4) and 2 hours (mean CNR=6.5) was prominent, and the 3 hours (6.3) and 4 hours (6.3) were slightly lower than the phase of 1 to 2 hours after meal (Fig1, 2). The visualization of intrahepatic portal branches was excellent even at TI=900 msec, which was thought to be shorter under the usual fasting situation, because of high velocity of portal venous flow after food intake. The signals of hepatic parenchyma and hepatic veins were well suppressed at TI=900 msec, which permitted higher CNR of portal vein than at TI=1500 msec, in which the signals of hepatic parenchyma recovered. The image quality of portograms was not interfered by any artifacts due to intestinal peristalsis.

DISCUSSION and CONCLUSION

The visualization of extra- and intra-hepatic portal veins with Time-SLIP flow-in portography was significantly improved after food intake which increased portal venous flow. The improved visualization of portal veins was observed at just after meal to 4 hours after, especially prominent at 1 hour to 2 hours after meal, which are thought to the appropriate timing to perform Time-SLIP flow-in portogrpahy rather than during the fasting period.

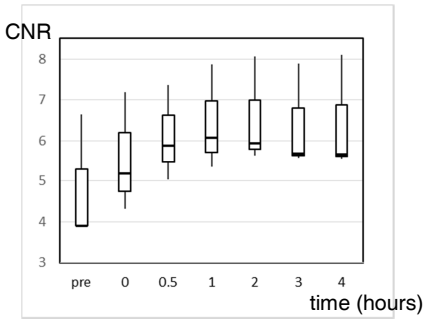

Fig1 CNR change after food intake

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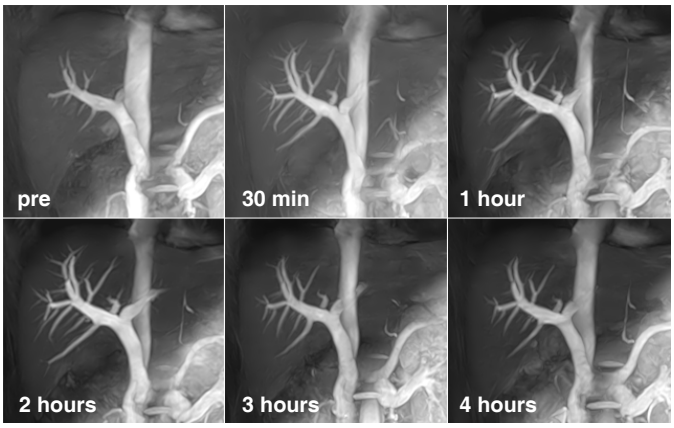

Fig 2 Time-SLIP portography before and after food intake

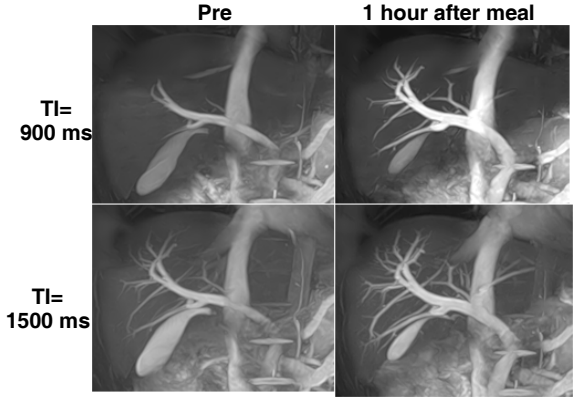

Fig 3 Comparison between TI = 900 and 1500 msec