# NON-CONTRAST-ENHANCED MR ARTERIOGRAPHY WITH BALANCED STEADY-STATE FREE-PRECESSION SEQUENCE AND TIME-SPATIAL LABELING INVERSION PULSES: VISUALIZATION OF THE LEFT GASTRIC VEIN WITH INFORMATION OF FLOW DIRECTION TO PREDICT DEVELOPING ESOPHAGEAL VARICES

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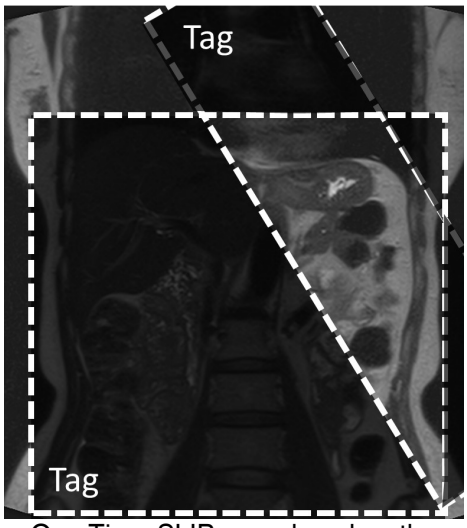
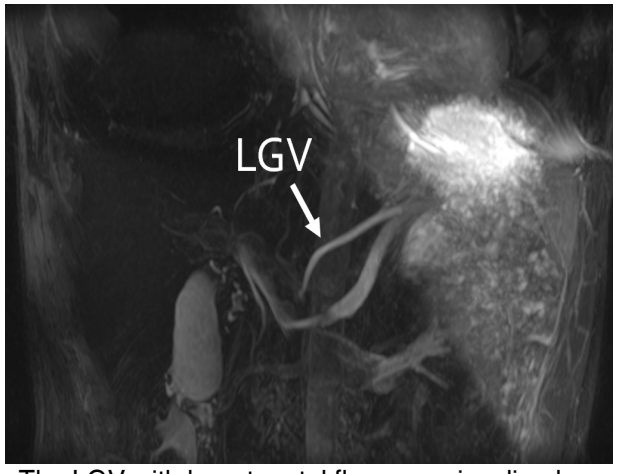
**PURPOSE:** Esophageal variceal hemorrhage is the second most common cause of death in cirrhotic patients with a reported mortality rate of 20%–35% and it develops at a rate of 10%–30% in patients with varices. Esophageal varices are mainly supplied by an enlarged left gastric vein (LGV). During the development of portal hypertension, the LGV transforms to a portal systemic shunt by changing their flow direction from normal to reversed, and esophageal varices are gradually formed. But, esophageal varices may not necessarily develop in various collateral circulation ways progressing for the portal hypertension, and the reason remains unknown. If flow direction change of the LGV can be caught at early point, it might be able to be foreseen developing esophageal varices. The ability of non-contrast-enhanced MR angiography to depict various vessels selectively has been demonstrated with the combined usage of a respiratory-triggered three-dimensional (3D) balanced steady-state free-precession (bSSFP) sequence and a time spatial labeling inversion pulses (Time-SLIP)(1). Also, this technique of a Time-SLIP has a potential to demonstrate the flow direction change of LGV under physiologic conditions. The purpose of our study was to selectively visualize the LGV containing information of flow direction on MRI using bSSFP sequence with Time-SLIPs in healthy volunteer with no portal hypertension on the base of the ultrasonography (US) and to determine the optimal protocol for its visualization.



One Time-SLIP was placed on the whole abdomen. The other Time-SLIP was placed on spatial area from gastric fornix to upper body.

**METHODS:** Twenty-eight healthy volunteers were examined using respiratory-triggered 3D bSSFP at a 3T MR unit (Vantage, Toshiba Medical Systems Co, Otawara, Japan). A respiratory triggered 3D bSSFP imaging sequence with fat saturation was performed with the following parameters: TR/TE/FA = 4.8 msec/2.4 msec/90°, receiver bandwidth = 781 Hz/pixel, FOV = 330 × 200 $mm^2$, matrix size = 256 × 256, slice thickness = 2 mm, number of slices = 38-50 without a gap, and number of acquisitions = 1. The parallel imaging was applied in the phase direction with a factor of 2. Application of Time-SLIP was as follows: one Time-SLIP was placed on the whole abdomen to suppress signals using TI=1,513msec. The other Time-SLIP was placed on spatial area from gastric fornix to upper body to recover signals and thorax to suppress signals of the heart and thoracic descending aorta. The TI was 1,500 msec. The detectability of the LGV on MRI and US was evaluated. Hepatopetal flow, toward the portal vein, of the LGV was defined by visualization of the LGV on MRI. The flow direction of the LGV was investigated by US color doppler examination. It was estimated whether the visualized vessel on MRI was in agreement with US.



The LGV with hepatopetal flow was visualized.

**RESULTS:** The LGVs with hepatopetal flow in all volunteers were detected on MRI. The LGVs in twenty-one volunteers (75%) were detected on US, and a flow direction in the LGV was hepatopetal. All visualized vessels on MRI were in agreement with the detected LGVs using US (n=21).

**CONCLUSIONS:** The LGV with information of flow direction was able to be visualized on MRI using bSSFP sequence with Time-SLIPs.

**REREFENCE**
1. Shimada K, et al. Eur J Radiology 70:111-117, 2009.