Susceptibility Weighted Imaging of the Spinal Veins

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Purpose:
High resolution MR venography (MRV) of the brain has been developed by using susceptibility weighted imaging (SWI), which utilizes phase shift due to deoxyhemoglobin in the vein. It has been reported that SWI is useful in the various diseases in the brain; however, there are few studies on SWI of the spine. The purpose of this study was to evaluate visualization of normal spinal veins on SWI.

Method:
The phase images of spinal SWI were obtained on a 1.5-T MR scanner (MAGNETOM Avanto, Siemens) using 3D-FLASH (voxel size = 0.8 mm x 0.6 mm x 2.5 mm) with spinal phased array coil. The scan range was set from T9 to L2 in axial plane. Twenty healthy volunteers (ranged from 22 to 61 years, an average of 35.6 years old; 15 men and 5 women) were scanned (Fig.1). The anterior median vein (AMV), posterior median vein (PMV), right and left anterior radiculomedullary veins (ARV), and right and left posterior radiculomedullary veins (PRV) and sulcal vein (SV) were evaluated with four grading system (0: none, 1: weak, 2: moderate, and 3: prominent) at the level of Th11, Th11/12, Th12, Th12/L1, and L1, by three neuroradiologists in consensus.

Result and Discussion:
The AMV was detected in all subjects (100 %). A coronal reconstruction was used for the confirmation of the shape and continuity of these veins (Fig.2). The detection rate of other veins was smaller: PMV, 13 subjects (65 %); right ARV, 9 subjects (45 %); left ARV, 3 subjects (15 %); right PRV, 2 subjects (10 %); left PRV, 6 subjects (30 %); and SV, 0 subject (0 %). The average scores for AMV, PMV, right ARV, left ARV, right PRV, left PRV and SV were 0.98, 0.24, 0.20, 0.08, 0.08 and 0.14, respectively (Fig. 3). The detection rate of AMV was significantly higher than the other veins. This can be due to the difference in the diameter, because the size of AMV has been reported to be larger than or at least equal to that of PMV and other veins (1). However, the higher detection rate of AMV might be due to its higher concentration of deoxy-Hb than PMV, rather than its diameter, because Suh et al. reported that PMV is the largest in thoracolumbar lesion (2). It is possible that deoxy-Hb concentration of AMV is higher than that of PMV, because the oxygen consumption of anterior half of the spinal cord is expected to be higher due to a large number of neurons in the anterior horns.

Conclusion:
SWI of the spine is feasible. Without contrast materials, the extrinsic spinal veins can be visualized as in the brain.

References:
(2) Suh TH, Alexander L. Vascular system of the human spinal cord. Arch Neurol Psychiatry 1939;41:659-677