Clinical application of susceptibility weighted imaging (SWI) in cerebrovascular disease

W. Zhu[1]

[1]Radiology, Tongji Hospital, Huazhong University of Science and Technology, Wuhan, Hubei Province, China, People's Republic of

Introduction and purpose

SWI is a new technique to exploit the magnetic properties of the tissue through detecting blood products or iron content, etc. It uses apparent phase contrast by means of phase mask to enhance the contrast-to-noise ratio in the magnitude image, so SWI sequence enables to increase the conspicuity of the veins and other sources of susceptibility effects. The purpose of this study is to assess clinical application value of SWI in cerebrovascular disease (CVD).

Materials and methods

23 patients with CVD were investigated including 7 cases of cavernoma, 4 venous hemangioma, 2 small AVM, 1 Sturge-Weber Syndrome, 2 thrombosis of venous sinus, 5 cerebral infarction and 2 cerebral hemorrhage. All patients underwent standard MRI and SWI on GE 1.5 Tesla HDMR system, most of them also underwent enhanced T1WI, T2*WI, DWI and MRA. High resolution SWI method was used based on 3D-SPGR sequence and data were analysed with Functool. The corrected phase value (CP) was obtained of the lesions and contral areas.

Results

⑴The CP values had significant difference between the lesions and the control areas, $p<0.05$. ⑵ In 7 cases of cavernoma , range of the lesions in SWI was larger than in T2WI or T2*WI and the cavernoma and hemorrhage within lesions could be differentiated too. Moreover, multiple microcavernomas were detected on SWI. ⑶ In 4 venous hemangioma, SWI detected spider-like lesions with more hair-thin pulp veins close to the dilated draining vein than contrast MRI and MRA. ⑷ In 2 small AVM, SWI displayed more advantages than MRA in clearly detecting the feeding artery and the draining vein. ⑸In 1 Sturge-Weber Syndrome, SWI demonstrated large areas of calcification and the abnormal vessels on the cerebral surface and the deep part of the cerebrum at the same time. ⑹ In 2 thrombosis of venous sinus, SWI showed the deep draining veins and superficial venous rete were generally dilated and winding, and the hemorrhagic lesions were detected earlier than conventional MR images. ⑺ In 5 cerebral infarction, latest hemorrhage (n=2) and remote hemorrhage (n=3) were clearly displayed within lesions. ⑻ In 2 cerebral hemorrhage suspected of tumors, benign hemorrhagic lesions with homogeneous hypointensity were depicted.

Fig1

Fig2

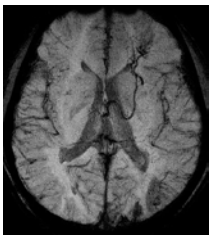

Fig3

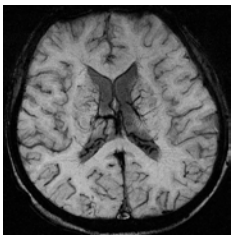

Fig4

Fig5

Fig1-2. Venous hemangioma. SWI detected spider-like lesions with more hair-thin pulp veins close to the dilated draining vein than enhanced T1WI.

Fig3. Sturge-Weber Syndrome, SWI demonstrated large areas of calcification and the abnormal vessels in the left occipital lobe, the abnormal vessels on the left frontal lobe and the deep part of the cerebrum too.

Fig4-5. Thrombosis of superior sagittal sinus. SWI displayed the dilated deep draining veins and superficial venous rete, and the early hemorrhage in the right parietal lobe too.

Conclusion

Our study demonstrated that SWI has more predominant advantages than conventional MRI and MRA on identification of microbleeds, displaying the low-flow cerebral vascular malformations, differentiating the benign hemorrhage from the hemorrhagic tumors, and cerebral infarction accompanying hemorrhage, etc. We believe this method will have potential applications in the near future.

Reference

1. Sehgal V, Delproposto Z, Haacke M, et al. Journal of Magn Reson Imaging, 2005,22:439-450.
2. Rauscher A, Sedlacik J, Barth M, et al. AJNR, 2005, 26:736-42.
3. Noebauer-huhmann IM, Pinker K, Barth M, et al. Invest Radiol. 2006, 41: 249-55.