The application of T2 Star Weighted Angiography (SWAN) in Hypoxic-ischemic encephalopathy

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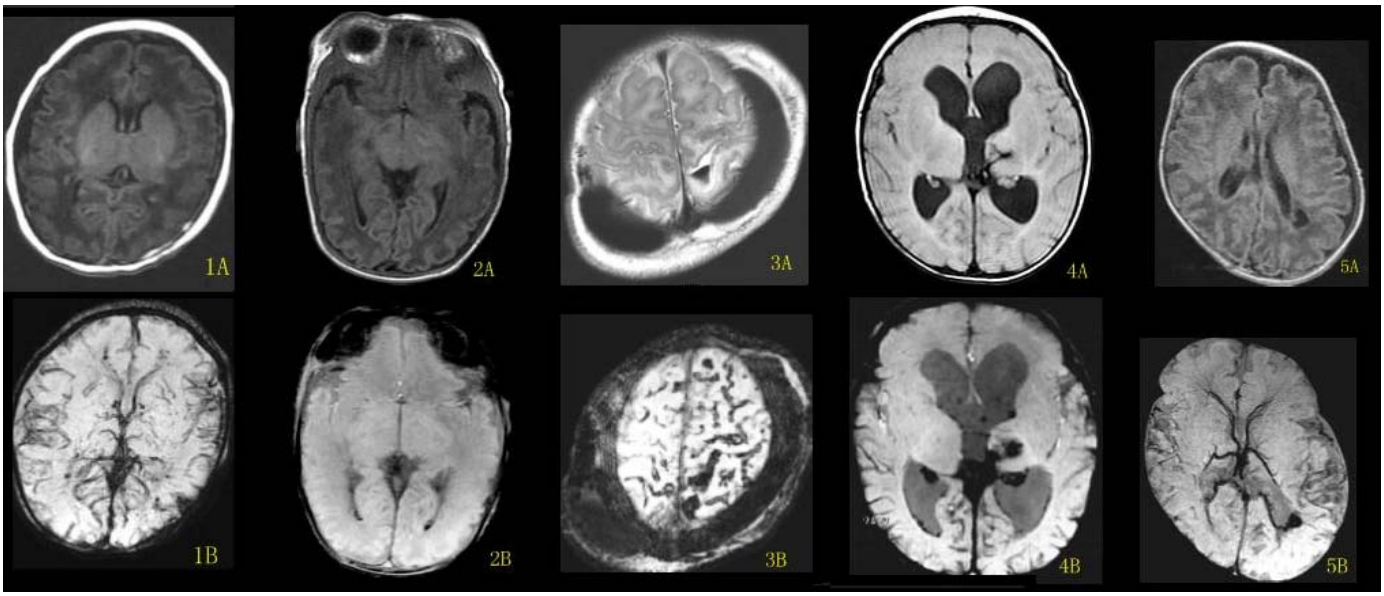
Introduction

Hypoxic-ischemic encephalopathy (HIE) is one of the most common causes of mortality in pediatric and elderly populations in developing countries. HIE with hemorrhage, especially germinal matrix and intraventricular hemorrhage, is a strong predictor for cerebral palsy and other disorders in neurodevelopment [1] .To date, there has no research about HIE demonstrated by using T2 Star Weighted Angiography (SWAN)[2]. T2 star weighted imaging has been found to provide clinically useful information that is often complementary to conventional MR imaging sequences used in the evaluation of various neurological disorders, including trauma, tumors, vascular malformations, as well as stroke[3]. SWAN is a multi-echo high spatial resolution three-dimensional gradient-recalled-echo MR imaging technique that accentuates the paramagnetic properies of blood products such as deoxyhemoglobin, intracellular methemoglobin, and hemosiderin[5]. The number and volume of SWAN hemorrhagic lesions appeared to correlate with specific neuropsychological deficits.

Materials and Methods

The institutional review board approved this retrospective study and waived informed consent.105 neonates(30 cases of term neonates, 75 cases of preterm neonates, range,35+5-42+5 weeks; mean, 39+4 weeks) who were suspected HIE underwent MR scanning at a GE HDx twin speed 3.0T MR scanner. All of these patients were evaluated with SWAN in addition to other conventional MRI techniques, including fluid attenuation inversion recovery(FLAIR), fast spin-echo(FSE), diffusion weighted imaging(DWI). SWAN parameters were: Flip angle=20°, TR=55.9ms, TE=5.2/11.7/18.2/24.6/31.1/37.5/44.0/50.5ms, FOV=18×18cm, matrix=320×256, slice thickness=1.4mm. We evaluated the value of SWAN in detecting hemorrhage lesions in HIE.



Figue1 (1) Germinal matrix hemorrhage, preventrical white matter hemorrhage, and subarachnoid hemorrhage. (2) Intraventricular hemorrhage. (3) Cortex and subcortex hemorrhage,ecchymoma. (4) Thalamic hemorrhage, choroid plexus hemorrhage, and intraventricular hemorrhage. (5) Preventricular leukomalacia with hemorrhage.

Results and discussion

Imaging finding showed that of the 105 patients, 7(6.7%) had germinal matrix hemorrhage at SWAN(fig1.1B), 17(16.2%) had intraventrical hemorrhage(fig1.2B,4B), and 29(27.6%) had other hemorrhages, including cortex and subcortex white matter(fig1.3B), basal ganglia, thalamus(fig1.4B) and brainstem, preventricle white matter(fig1.5B). Some large hemorrhagic lesions can be found in conventional sequences, especially, T2FSE(16.7%). However, 57.7% microhemorrhagic lesions can only be detected by SWAN. In our study we found that SWAN could detect more hemorrhagic lesions in HIE than conventional sequences($P<0.0001$). These findings suggested that SWAN had higher sensitivity than other sequences in detecting germinal matrix hemorrhage, intraventricular hemorrhage, which is a strong predictor for long-term neurologic and neuropsychologic outcomes. Furthermore, SWAN demonstrated that the lesions in preventricular white matter rarely contain hemorrhage.

Conclusion

SWAN has accuracy in hemorrhage detection than conventional MR imaging techniques in HIE. Given the additional information it provides to the clincian, SWAN is likely to become part of routine HIE MRI protocols.

References

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