Simultaneous demonstration of brain surface and cortical veins: Comparison of direct reconstruction and Combination of 3D non-contrast data and subtraction MR venography

M. Amanuma[1], N. Nishi[1], M. Yuasa[1], J. Tanaka[1], A. Heshiki[1]

[1]Radiology, Saitama Medical School, Iruma, Saitama, Japan

Introduction

Demonstration of brain surface with cortical vein is important for preoperative evaluation of brain tumor or other surgical intervention. The purpose of this study is to compare the direct reconstruction of postcontrast data and simple additive combination of precontrast data and subtracted MR angiographic data.

Materials and methods

Ten patients with known or suspected brain tumors were assessed with a 1.5 Tesla MR unit (Magnetom symphony Sonata, Siemens, Germany) with an eight-channel array coil. Pulse sequence for 3D imaging was a magnetization-prepared rapid gradient echo (MP-RAGE) with TR 1900 msec, TE 8 msec, flip angle 10 degree, and inversion time 300 msec. Water excitation technique was used to suppress the signal of cranial bone marrow. Both precontrast and post contrast data were obtained and all 3D data were transferred to the separated 3D workstation (Real INTAGE v 1.3, Kubota Graphic Technology, Japan) and processed using full volume rendering. For each patient two sets of 3D surface images were obtained: The first one was reconstructed from the postcontrast data directly (direct method). For the second one 3D brain surface image were processed from the precontrast data and vascular image were obtained from the subtracted data separately. After procession 3D images were combined by data addition (combination method). On each technique data processing time was measured and two radiologists assessed identification of gyral and venous structures using a three-point-scale. For statistic analysis Mann-Whitney test was used.

Results

Mean data processing time was 18.8 minutes for direct method and 8.9 minutes for combination method. Large venous sinuses were readily detectable on both methods. However, identification of gyrus and small cortical venous structures were more accurate and easier with the combination method ($p<0.05$). All direct sinus invasion was accurately assesses with the combination method while the one false negative case was noted with the direct method.

Discussion and conclusion

Interactive 3D image is desirable for preoperative planning of brain. Decreased marrow signal of the cranial bone enabled to reconstruct brain surface image easier, resulting in dramatically shortened processing time. 3D data subtraction also made the MR venograms easy. Simple addition of these two 3D data sets provided combined brain and cortical venous mapping with preserved high-quality contrast. On the other hand direct reconstruction from postcontrast data required fine contrast and opacity selection, which were sometimes difficult and time-consuming. In conclusion combination of precontrast 3D surface image and subtraction MR venography was fast and easy method for processing high-quality and clinically feasible preoperative brain mapping.