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SETTING OF THE THINNEST SLAB FOR TIME OF FLIGHT MRA OF BRAIN

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ABSTRACT

Back Grounds: Generally, the imaging range of the brain MRA is determined in the subjectivity by the operator used by the plan image that a blood vessel is not depicted. However, a necessary blood vessel may not be often depicted by an error of the setting of the imaging area. Therefore, optimal Slab angle, thickness, distance in the setting index of the imaging range, and evaluation of the contrast were examined. **Material & Methods:** The brain MRA of 14 subjects was imaged in a wide area parallel to an OM line. The line which linked the arteria vertebral (the first cervical vertebrae curved section) to anterior cerebral artery (A3) was determined with an optimal slab base line, and the angle with the OM line was evaluated. The distance from the inferior margin of pons to the Slavic bottom end was measured as far as a cerebral aneurysm predilection blood vessel was included. Furthermore, the cerebrovascular contrast by the slave angle was compared. **Results:** The slave setting of the range was recommended in brain-MRA as an angle was 34.3 degrees, and the thickness was 63.5mm, and, as the distance from the inferior margin of pons was 33.9mm. The cerebrovascular contrast of the optimal slab base line angle did not have a significant difference for an OM-line.

KEYWORD: Time-of-flight; cerebral aneurysm; magnetic resonance angiography; thinnest slab.

1. INTRODUCTION

Cerebrovascular magnetic resonance angiography by the 3-dimensional time of flight (3D-TOF) is widely used as a noninvasive cerebrovascular screening examination. Cerebrovascular disease becomes the fourth position of the main cause of death following a malignant neoplasm, heart disorder, pneumonia,[1] and it is important that early detection of a cerebral aneurysm and the vasoconstriction site or follow improves by imaging the brain MRA as a screening test.[2] Generally, the brain MR imaging is often assumed the image for the planning image used by the vascular depiction image using the 2D-phase contrast method of around dozens of seconds.(Figure 1) Therfore, in the operator with a little of the imaging experience, it takes the wrong setting of the imaging range, and it often occurs that a necessary blood vessel is not depicted. The blood vessel that depiction is required in the brain MRA of the screening study is the cerebrovascular aneurysmal frequent following blood vessels.[3-5] Specifically, it is internal carotid artery C1, and C2 part (30%), an anterior communicating artery (30%), arteria cerebri media (20%), arteria basilaris (7%) particularly vertebra arteria cerebelli inferior posterior bifurcation (2%).[3-5] The imaging slab superior border has to put the anterior communicating artery of the anterior cerebral artery in the imaging range surely and thinks that it is uneventful when we enter to divergence of A2-A3. Also, in the imaging slab inferior margin, a little more cerebrovascular aneurysms thought about a point to occur, and included arteria cerebelli inferior posterior bifurcation (vertebral artery-posterior inferior cerebellar artery, VA-PICA) in the imaging range and did what it was included in to the atlas curved section of the arteria vertebralis with basics. A purpose of this study is the Slavic angle that the cerebral aneurysm common site mentioned above is included in in the shortest time and thickness and the thing that on your mark we examine. In addition, the effect of signal of blood for the slab setting by this examination was evaluated because the signal intensity by the inflow effect changed by a Slavic aspect and a vascular angle in the MRA using the TOF method.

2. MATERIAL AND METHODS

2-1. A use device and imaging method

The MRI device used a head array coil of 15ch in Ingenia1.5T made in philips company.

2-2. The imaging subject

We obtained approval of the Ethical Review Board before hand on conducting this study. The imaging subject intended for the volunteer of 14 men and women (age 21-53 years old) without the disease that obtained consent after an open call for participants.

2-3. Imaging

AT first, It was imaged a cephalic positioning image（Figure 1, and next, an imaging was performed by the TOF method of 3D-MRA. The imaging range (slab) of the widespread head MRA set it with orbitomeatal line (OM line,[5] which bound root of nose part and Hashimoto part together) to become parallel, and the inferior part did it with lower 40mm, upper 60mm from an orbit-meatal base line **(**OM line). The imaging condition assumed it 10min by the 3D-fast-SPGE method for TR23ms, TE6.91ms, FOV200 *200mm, slab thickness 99mm (slice thickness 0.3mm, number of slices 330 pieces, multi slab10, overlap0.19mm of 1 slab), Frequency matrix320, Phase matrix184, number of FA17°, addition one time, imaging time. Also, magnetization transfer contrast (MTC) and ramped radio frequency were used together. 2-4. The positional setting of Angle, thickness, and positional for thinnest slavic setting.

With the head MRA image of the healthy volunteer, we displayed lateral projection using maximum intensity projection and examined the angle of an OM line and the thinnest slab base line and Slavic thickness and a position for 14 MRA using zio station (3D picture processing of biomedical images work station, Zio soft Co., Ltd., (Tokyo) in the smallest imaging range within a necessary blood vessel. We demanded an angle with OM line where there was many what was used even for a line (thinnest slab base line) and the MRI that bound anterior cerebral artery (A3) and the arteria vertebralis (the first cervical vertebrae curved section) located nearest of Slavic top and bottom ends together among purpose blood vessels as a base line first to show it in Figure 2. And a mean and the standard deviation of the above angle of 14 people were calculated. which set the slab which a purpose blood vessel (arteria cerebri media, anterior cerebral artery, internal carotid, arteria basilaris, arteria vertebralis, posterior communicating artery) was included all in than MIP lateral projection by the widespread head MRA for the vascular evaluation, and measured the length (Figure 3).

In addition, the above imaging condition is a thing when we took the imaging range enough widely not to take off a purpose blood vessel.

We show the image which stacked a cerebral aneurysm common site to the slab which we determined in Figure 4. Also, we pulled a perpendicular line to do it with a Slavic aim when we set it by a clinic to cross at 90 degrees from inferior part of ponce to the bottom end of slab and measured the distance. About a Slavic thickness and the distance from inferior part of ponce, we calculated a mean and the standard deviation of 14 people .Also, we pulled a perpendicular line to do it with a Slavic aim when we set it by a clinic to cross at 90 degrees from inferior part of ponce to the bottom end of slab and measured the distance.Also, we pulled a perpendicular line to do it with a Slavic aim when we set it by a clinic to cross at 90 degrees from the under a bridge part (the most bottom end) to the bottom end of slab and measured the distance. About a Slavic thickness and the distance from the Hashimoto part, we calculated a mean and the standard deviation of 14 people.

2-5. The effect for a setting slab angle to vascular signal intensity.

The signal intensity in the blood vessel may be different in the brain - MRA imaging using the TOF method by a vascular angle to flow in in a slab.

Therefore we measured a change of the signal intensity when we changed a setting slab angle on the basis of OM-line.

We imaged the MRA for three subjects about 3 patterns when we put it together to the thinnest slab base line of 14 subjects who demanded it in above and a setable maximal angle when we put slabs together in the OM line.

In addition, three subjects are healthy subjects similar to 14 subjects mentioned above.

By the measurement of the vascular signal level of former image, we set region of interest (ROI) in the right and left internal carotid which was a cerebral aneurysm common site, the left right middle cerebral artery, arteria basilaris and the cerebral parenchyma part of each slab and measured a signal level.

We did it with alignment 25mm2 to a blood vessel diameter of the thinnest arteria cerebri media so that size of ROI did not change when we measured a signal level with each blood vessel.

Because white matter, difference in gray matter influenced a signal level, the cerebral parenchyma part set 340mm2 and ROI large a little to lower an error Figure 5.

In addition, which set ROI for the MIP treated image similarly, and measured a signal value.

The evaluation of the contrast calculated Michelson contrast10) by equation (1).

$$\text{Contrast of TOF} = \frac{\text{Signal value of vascular} - \text{signal valuel of cerebral parenchyma}}{\text{Signal value of vascular} + \text{signal valuel of cerebral parenchyma}} \cdot \cdot (1)$$

Significant difference authorization was practiced by test software of Kruskal-Wallis for the contrast.

3. RESULTS

3-1. The positional setting of Angle, thickness, and positional for thinnest slavic setting.
Angle for ideally Slavic setting, thickness, thinnest slab base line of each subject of 14 positional measurement and angle with the OM line, slab thickness and distance from the inferior margin of the bridge to the bottom end of slab and numerical average, standard deviation (S.D.) are shown in Table 1. As a result, the thinnest slab base line and the angle with the OM line were 34.3 degrees on the average. Also, even if the slab thickness was lowest, 60.7mm was necessary, and the distance from the Hashimoto relationship to the bottom end of slab was an average of 33.9mm.

3-2. The effect for a setting slab angle to vascular signal intensity
The right and left internal carotid with three former images in the case that we put together to the maximal angle that is setable when we put it together in an ideally Slavic base line in TOF when we put slabs together in the OM line and, the left right middle cerebral artery, five places of signal intensity of the arteria basilaris blood vessel and the contrast with the cerebral parenchyma signal are shown in Figure 6.

Where the significant difference was not found in an OM line and the ideally Slavic base line, but a decrease of the contrast was significantly found in an OM line and the maximal angle ($p<0.01$).

We show each vascular signal contrast after the MIP treatment in Figure 7.

Where the significant difference was not found in the image after the MIP treatment in the optimal Slavic base line and OM line either, but contrast significantly decreased in the maximal angle and OM line($p<0.01$).

However, the significant difference was not found in contrast in an OM line and the optimal Slavic base line in the image with the TOF former image after MIP either.

4. DISCUSSIONS

We examined a Slavic angle and position of the smallest thickness including a cerebrovascular aneurysmal frequent blood vessel in brain We evaluated the optimal Slavic setting by the change of the Slavic angle in a scan of the head MRA in this study.

As a result, we were able to find a conditional optimal value when we set a slab.

It will become the index of alining it in future when we photograph TOF-MRA. MRA.

The results showed it as above, but thought that it was appropriate to set 3 standard deviation (3SD) about a mean, the thickness to take off a purpose blood vessel even if small even if big about an angle and the distance to depict all a purpose blood vessel because an angle, the thickness of the head MRA base line, which case of the distance had some variability in each subject to apply to a clinic.

The average of the Slavic angle was 34.3 degrees, and the mean of the distance from 63.5mm, the Hashimoto relationship to the bottom end of slab did 33.9mm with the optimal value that was equal to a purpose of this study about the Slavic thickness in consideration of a range of 3SD.

We show a slab suitable for these conditions and the image which we imaged in Fig.8,9.

We did the imaging condition of this time by the 3D-fast-SPGE method with 3min35sec for TR23ms, TE6.91ms, FOV200 *200mm, slab thickness 65mm (slice thickness 0.5mm, number of slices 130 pieces, multi slab5, overlap0.25mm of 1 slab), Frequency matrix308, Phase matrix177, number of FA17 °, addition one time, imaging time.

About the reduction in TOF contrast by increasing a Slavic angle, in the case of the maximal angle that a device permitted, contrast significantly decreased as compared with an OM line, but the OM line and the significant difference were not found in the optimal slab base line even if contrast slightly decreased.

Therefore we think that it is not the thing which affects the detectability such as the cerebral aneurysms in the clinic even if we set a Slavic angle in an ideally Slavic base line.

Because it is rarely said that they perform only the imaging of the MRA image in MR imaging in the clinic, and other images are imaged, it is undesirable to spend much time on one imaging.

Therefore we think that the results of this study to be the smallest imaging time are clinically useful.

However, it is necessary to increase the number of the evaluations with a real clinical image to raise precision about an age group and the subjects more, and to test it because we evaluated it only in healthy subjects in this study.

5. CONCLUSION

We examined optimal Slavic setting in a scan of the head MRA in this study. As a result, we were able to find a conditional optimal value when we set a slab.

We may show it for an index of alining it in future when we photograph TOF-MRA.

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Figure legends

Fig. 1: The imaging plan of the brain MRA. Generally, the imaging range of the brain MRA is determined in the subjectivity by the operator used by the plan image that a blood vessel is not depicted.

Fig. 2: A cerebral aneurysm common site and Slavic thickness setting.

Fig. 3: Setting method of the slab angle

Fig. 4: A cerebral aneurysm common site and Slavic thickness setting.

Fig. 5： Box and whisker plot of brain vessels contrast caused by difference of slab angles. The significant difference was not found between an OM line and recommended slab angles.

Fig. 6： Slavic setting with the optimum.

Fig. 7: Brain MRA image with the optimum.

Table 1: The values of slab angle(°), thickness(mm), distance(mm), mean, standard deviation for slab setting.