**Evaluation of Unruptured Intracranial Aneurysms with 3 Tesla 3D Time-of-Flight MR Angiography : Comparison of 64-channel Multidetector Row CT Angiography**

**Y. Hiratsuka[1], H. Miki[1], K. Kikuchi[1], I. Kiriyama[1], T. Mochizuki[1], S. Takahashi[2], I. Matsubara[3], and K. Sadamoto[3]**

[1]Department of Radiology, Ehime University School of Medicine, Toon, Ehime, Japan, [2]Department of Radiology, Ehime National Hospital, Toon, Ehime, Japan, [3]Department of Neurosurgery, Washo-kai Sadamoto Hospital, Matsuyama, Ehime, Japan

## Background and Purpose:

Intraarterial digital subtraction angiography (DSA) is well-known and widely used as the golden standard method for detection and evaluation of intracranial aneurysms. However, angiographic examination is invasive, and it has the risks of persistent neurological deficits. MR angiography (MRA) and CT angiography (CTA) are generally utilized as the representative non-invasive methods for diagnosis of intracranial aneurysms. These modalities enable us to understand its location, shape, and the relationship to the surrounding structure without invasion. Development and improvement of the these non-invasive modalities are producing to elevate the better diagnostic quality, and are expected to change the order of imaging examinations for diagnosis of aneurysms. The purpose of this study was to compare 3D time-of-flight magnetic resonance angiography (3D TOF MRA) at 3 tesla (T) and 64-channnel multidetector row computed tomographic angiography (64-MDCTA) in the detection of angiographically proved unruptured intracranial aneurysms with a blind reader study.

## Materials and Methods:

Thirty-eight patients with 47 aneurysms and eight patients with no aneurysm underwent 3 T 3D TOF MRA, 64-MDCTA, and intraarterial DSA/ digital angiogaraphy (DA). All MR examinations were performed with a 3 T MR system by using an eight-element phased array head coil. For the 3D TOF MRA, the scanning parameters were as follows: bandwidth 31.2kHz, TR/TE 25/3.1ms, flip angle 20 degree, 512×224 matrix, 190-mm FOV with 90% rectangular FOV, sensitivity encoding (SENSE) factor 2.0, slab thickness 90 mm with a single slab section covering an area from the clivus to genu of corpus callosum, slice thickness 1mm with 0.5-mm-reconstruction, and acquisition time was 3:59. Scanned voxel volume was 0.37×0.85×1.0 mm (0.31 $mm^3$), and reconstructed voxel volume was 0.37×0.37×0.5 mm(0.07 $mm^3$). CTA was performed on a MDCT scanner with 64-channel detector rows. The scanning parameters were 120 kV, auto mA (max 500mA), 512×512 matrix, FOV 230 mm, a detector collimation of 20×0.63 mm, rotation speed 0.40sec, and pitch 0.531. Fifty ml of nonionic iodinated contrast mediums (350mgI/ml) were injected automatically with a power injector at the rate of 3.5ml/sec, and scanning was started using a bolus-tracking technique. The scan volume included the whole brain to the proximal part of internal carotid arteries, and scan time was within 10 seconds (7 to 9 sec). Voxel volume size was 0.45×0.45×0.63 mm (0.13$mm^3$). Intraarterial angiography was performed by using a 3D DA unit with a flat panel detector with a matrix of 1024×1024 pixels (resolution of 0.2 mm). Two-dimensional (2D) DSA was performed with bilateral selective common or internal carotid artery injections and either unilateral or bilateral vertebral artery. 3D DA images with unsubtracted rotational images were acquired for a selective vessel that had an aneurysm or a suspected aneurysm. X-ray parameters were 80 kV and 400 mA. Three radiologists independently reviewed CTA and MRA images in the detection of intracranial aneurysms blinded to any clinical information including angiographic results, and compared between two modalities using alternative free-response receiver operating characteristic (AFROC) analysis. For each possible aneurysms, readers recorded the location and their level of confidence with a 5-point scale. In addition, the sensitivity, specificity, positive and negative predictive value, and accuracy were also calculated. 2D DSA and 3D DA images were used as the standard of reference.

## Results:

As retrospective observation, all intracranial aneurysms diagnosed by DSA/DA images were visible clearly on MRA and CTA images, and the location and the relationship to parent arteries were also depicted accurately. On AFROC analysis, the mean area under the AFROC curve (A1) value was 0.91 on MRA (0.86 to 0.95) and 0.91 on CTA (0.87 to 0.96). On the per aneurysm analysis, mean sensitivity and specificity for detection of aneurysms was 89%, 76% on MRA and 87%, 79% on CTA, respectively. On the per patient analysis, mean sensitivity and specificity was 96%, 92% on MRA and 95%, 96% on CTA. The difference between MRA and CTA was also not significant.

## Conclusions:

3 T 3D TOF MRA and 64-MDCTA are excellent examinations with high diagnostic accuracy for detection of unruptured intracranial aneurysms. These two modalities have the almost same ability for evaluation of intracranial aneurysms, and there is no significant difference. 3D TOF MRA is free from the risks concerning the use of contrast media or the exposure of x-ray, and widely applied for the screening examination of evaluation of intracranial aneurysms. From these results, 3T TOF MRA and 64-MDCTA were suitable extremely for the detection of aneurysms as the screening examination. And with regard to the evaluation of intracranial aneurysms, improvement of diagnosis on 3 T TOF MRA will reduce the necessity for the additional CTA examination after MRA.