Efficacy of 3-D Reconstructed Time of Flight MRA Follow-up of the Embolized Cerebral Aneurysms

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Summary

A follow-up of the embolized cerebral aneurysm with Guglielmi Detachable Coils (GDC) were performed mainly using craniograms and digital subtraction angiograms (DSA) so far. Recently, several authors have reported about efficacy of the time of flight (TOF) magnetic resonance angiogram (MRA) as a follow-up for the embolized cerebral aneurysms. In our institution, 3-D reconstructed TOF MRAs have been performed as a follow-up of the embolized cerebral aneurysms. We examined efficacy of 3-D reconstructed TOF MRA.

3-D TOF MRA was performed for a follow-up of the embolized cerebral aneurysms at our outpatient clinic in 35 patients. Morphological examination of the 3-D images between 3-D TOF MRA and 3-D DSA was performed.

Almost similar images of 3-D MRA were obtained after 3-D reconstruction as compared with those of 3-D DSA. In three cases, recanalization was suspected in the 3-D TOF MRA. And recanalization was confirmed in the 3-D DSA actually.

A quality of 3-D TOF MRA for a diagnosis of recanalization was good and practical. However, in two cases, arteries were partially disappeared in the 3-D TOF MRA. These were the artifact due to coil mass and this is a current limitation of 3-D TOF MRA.

The images of 3-D TOF MRA that were reconstructed in the 3-D workstation were very similar to those of 3-D DSA. 3-D reconstructed TOF MRA was very useful for a less-invasive diagnosis of a recanalization of the embolized cerebral aneurysms.

Introduction

A treatment of the cerebral aneurysm using a Guglielmi Detachable Coil (GDC) was widely accepted and performed all over the world. Especially, a development of the surgical devices (microcatheters and micro guide wires etc.) has made a safe surgical approach to the aneurysm possible. However, the most important issue in the post-operative follow-up of the embolized aneurysm with GDCs is recanalization due to coil compaction.

Therefore, a follow-up of the embolized aneurysm is indispensable at outpatient clinic. Usually, a follow-up of the embolized aneurysms with GDCs has been performed using a craniogram and digital subtraction angiogram (DSA). DSA has been established as a gold-standard method of a follow-up of the embolized aneurysms with GDCs. However, DSA is an invasive examination. As a non-invasive method of a follow-up of the embolized cerebral aneurysm, MR angiogram (MRA) has been performed in many institutions. A diag-

Figure 1 A) 70-year-old woman with a large unruptured ICA aneurysm. Pre-embolization image (3-D DSA) B) Coil embolization was performed with small neck remnant. (3-D DSA) C) After six months, recanalization was seen in the 3-D TOF MRA. D) 3-D DSA revealed recanalization.

nostic value of 3-D time of flight (TOF) MRA has been reported¹⁻⁴. We have been used 3-D TOF MRA images that were reconstructed in the 3-D workstation for a follow-up of the embolized cerebral aneurysms with GDCs. In this study, the post-operative images of the embolized cerebral aneurysms with GDCs between 3-D TOF MRA and 3-D DSA were compared and efficacy of the 3-D reconstructed TOF MRA was examined.

Methods

77 cases of intracranial aneurysm were treated with GDCs from March 2003 to November 2004. 3-D TOF MRA after coil embolization was performed in 35 cases. The average period from the operation to a MRA follow-up was about six months.

The parameters of TOF MRA are as follows; TR 37 m, TE 7.15 ms, slice thickness 0.85 mm,

Figure 2 A) 70-year-old man with a large A-com aneurysm. Pre-embolization image (3-D DSA) B) The aneurysm was embolized with GDCs. (3-D DSA) C) The right anterior cerebral artery was partially disappeared in the 3-D TOF MRA due to an artifact of the coils.

base resolution 512, FoV read 215mm, FoV phase 75%, slice per slab 32.

The data of the MRAs were installed into the 3-D workstation (Leonardo, SIEMENS) and re-constructed three-dimensionally. The post-operative images of the embolized cerebral aneurysms with GDCs between 3-D TOF MRA and 3-D DSA were compared.

Results

In 35 cases, both of the 3-D TOF MRA and 3-D DSA were performed. 3-D reconstructed MRA demonstrated almost similar findings as compared with those of 3-D DSA after coil embolization. In three cases, recanalization was suspected in the 3-D TOF MRA. In each case, recanalization was confirmed in the 3-D DSA actually. In two cases, partial artifact was seen. The illustrative cases are shown as follows.

Case 1

A 70-year-old woman with a large right ICA aneurysm (figure 1A). Coil embolization was

performed with a small neck remnant (figure 1B). Recanalization was suspected in the 3-D TOF MRA six months after coil embolization (figure 1C). Actual recanalization was confirmed in the 3-D DSA (figure 1D).

Case 2

A 70-year-old man with a large A-com aneurysm (figure 2A). The aneurysm was embolized with GDCs (figure 2B). The right anterior cerebral artery was partially disappeared in the 3-D TOF MRA (figure 2C). This is the artifact due to the embolized coils.

Discussion

After 3-D reconstruction, almost similar images of 3-D TOF MRA were obtained as compared with those of 3-D DSA. It was a very useful and less-invasive method for a morphological evaluation after coil embolization. And it was very sensitive for a detection of recanalization of the embolized cerebral aneurysms. However, in two cases, partial image defect due to the embolized coils was seen (Case 2). It seemed to be occurred when the aneurysm was packed densely near the neck of the aneurysm. This is a one of current limitations of 3-D reconstructed TOF MRA.

However, the image quality of 3-D reconstructed TOF MRA in the 3-D workstation was very good and practical for a detection of re-

canalization. It was almost similar to that of 3-D DSA. And it can be performed easily and less-invasively at outpatient clinic as a follow-up of the embolized cerebral aneurysms. It could be an alternative follow-up method instead of DSA after coil embolization.

Conclusions

3-D reconstructed TOF MRA was very useful to detect recanalization after coil embolization. Obtained images were very similar to those of the 3-D DSA. It could be an alternative follow-up method instead of DSA. An artifact, a partial defect of the vessel image, due to coil mass was seen. This is a current limitation of 3-D TOF MRA follow-up of the aneurysms after coil embolization.

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