**Time of flight magnetic resonance angiography**

Intracranial vessel imaging by Time of flight magnetic resonance angiography (TOF-MRA) is one of the most frequently performed investigations in clinical neuroradiology. Particularly in the acute setting, fast imaging is needed for diagnostics, with a sequence ideally depicting even small vessels. The purpose of the study was to compare the image and diagnostic quality of a novel ultrashort TOF-MRA sequence accelerated by spiral imaging (TOF-Spiral-short) to a standard TOF-MRA sequence accelerated by compressed sensing (TOF-CS) and to Computed tomography angiography (CTA).

Forty-one patients (36.6% showing vessel pathologies) who had undergone TOF-CS (acquisition duration: 4 minutes 8 seconds), TOF-Spiral-short (acquisition duration: 51 seconds; spiral imaging [accelerating factor 1.3], decreased field of view [accelerating factor 1.2], and increased voxel size [accelerating factor 3.3]), and CTA were retrospectively evaluated. Assessment of image quality, diagnostic confidence, and quantification of stenosis or aneurysm diameter were performed by two readers.

Results: Image quality at the skull base was slightly reduced with TOF-Spiral-short compared to CTA and TOF-CS (P < .05). Delineation of small intracranial vessels was improved by TOF-Spiral-short compared to CTA (P < .0001). In TOF-Spiral-short, diagnostic confidence was not reduced compared to TOF-CS in patients with vessel pathologies. We observed no significant difference in quantitative pathology assessment between TOF-Spiral-short and the other two modalities. TOF-Spiral-short enabled the correct identification of all vessel pathologies.

Accelerating TOF-MRA of brain-feeding arteries by a novel ultrashort spiral imaging sequence shows adequate image quality and sufficient diagnostic performance. Thus, TOF-Spiral-short holds the potential for fast and reliable diagnostics of vessel pathologies, particularly in the acute setting 1).

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**Time of flight angiography** (TOF) is an MRI technique to visualize flow within vessels, without the need to administer contrast. It is based on the phenomenon of flow-related enhancement of spins entering into an imaging slice. As a result of being unsaturated, these spins give more signal that surrounding stationary spins.

With 2-D TOF, multiple thin imaging slices are acquired with a flow-compensated gradient-echo sequence. These images can be combined by using a technique of reconstruction such as maximum intensity projection (MIP), to obtain a 3-D image of the vessels analogous to conventional angiography.
With 3-D TOF, a volume of images is obtained simultaneously by phase-encoding in the slice-select direction. An angiographic appearance can be generated using MIP, as is done with 2-D TOF.

**Key points**

short TR image-plane kept perpendicular to flow direction Potential pitfalls slow flow or flow from a vessel parallel to the scan plane may become desaturated just like stationary tissue, resulting in a signal loss from the vessel turbulent flow may undergo spin-dephasing and unexpectedly short T2 relaxation: again resulting in a signal loss from the vessel acquisition times are relatively long. retrograde arterial flow may be obscured if venous saturation bands have been applied. artifacts: ghosting, susceptibility artifact very T1 bright signal will be visible, e.g. hemorrhage

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**Time of flight magnetic resonance angiography**, has become an important diagnostic tool to depict cerebral vasculature.

**Indications**

This non-invasive technique is now widely considered equivalent to the gold standard, digital subtraction angiography for some applications such as follow-up of coiled cerebral aneurysms.

TOF MRA seemed to be reliable in screening for aneurysm recurrence after coil embolization with Enterprise stent assistance, especially in the evaluation of the source images (SI), in addition to maximal intensity projection (MIP) images in the TOF MRA.

High spatial resolution time-of-flight MR angiography can be recommended for preoperative imaging of lenticulostriate arteries to plan the extent of neurosurgical resection in patients with glial tumors of the insular lobe.
One of the most serious complications of stereotactic biopsy is postoperative symptomatic hemorrhage due to injury to the basal perforating arteries such as the lenticulostriate arteries neighboring the basal ganglia lesions.

A new target-planning method was proposed by Sato et al. from the Kitasato University School of Medicine, Sagamihara, University of Yamanashi Faculty of Medicine, Chuo, Japan, to reduce hemorrhagic complications by avoiding injury to the perforating arteries.

Three-dimensional 3-T Time of flight magnetic resonance angiography (3D 3-T TOF) imaging was applied to delineate the basal perforating arteries such as the lenticulostriate arteries. The incidence of postoperative hemorrhage in basal ganglia cases was compared between a new method using 3D 3-T TOF and a conventional target-planning method based on contrast-enhanced T1-weighted magnetic resonance images obtained by 1.5-T scanning.

3D 3-T TOF imaging could delineate the basal perforating arteries sufficiently in target planning. No postoperative hemorrhage occurred with the new method (n = 10), while 6 postoperative hemorrhages occurred with the conventional method (n = 14). The new method significantly reduced the occurrence of postoperative hemorrhages (p = 0.017).

3D 3-T TOF MR imaging with contrast medium administration provides useful information about the perforating arteries and allows safe stereotactic biopsy of basal ganglia lesions.

Case series

Thirty-five consecutive patients with AVMs of the brain were included. Quantitative - analyses were performed by measuring both signal-to-noise ratio and contrast-to-noise ratio of the nidus. Qualitative analysis (scores 1-4) was performed by evaluating depictions of feeding arteries and draining veins independently by 2 reviewers.

Both signal-to-noise ratio and contrast-to-noise ratio in TOF-MRA were significantly higher than those in silent MRA. For both feeders and drainers, scores were significantly higher in silent MRA than in TOF-MRA for both reviewers. Interrater agreement was higher in silent MRA than in TOF-MRA.

Silent MRA visualized feeders and drainers in AVMs significantly better than did TOF-MRA. Interrater agreement was also better in silent MRA.


