Depicting the Labyrinthine Artery at 7T: An Ultra-High-Resolution 3D Time-of-Flight Study

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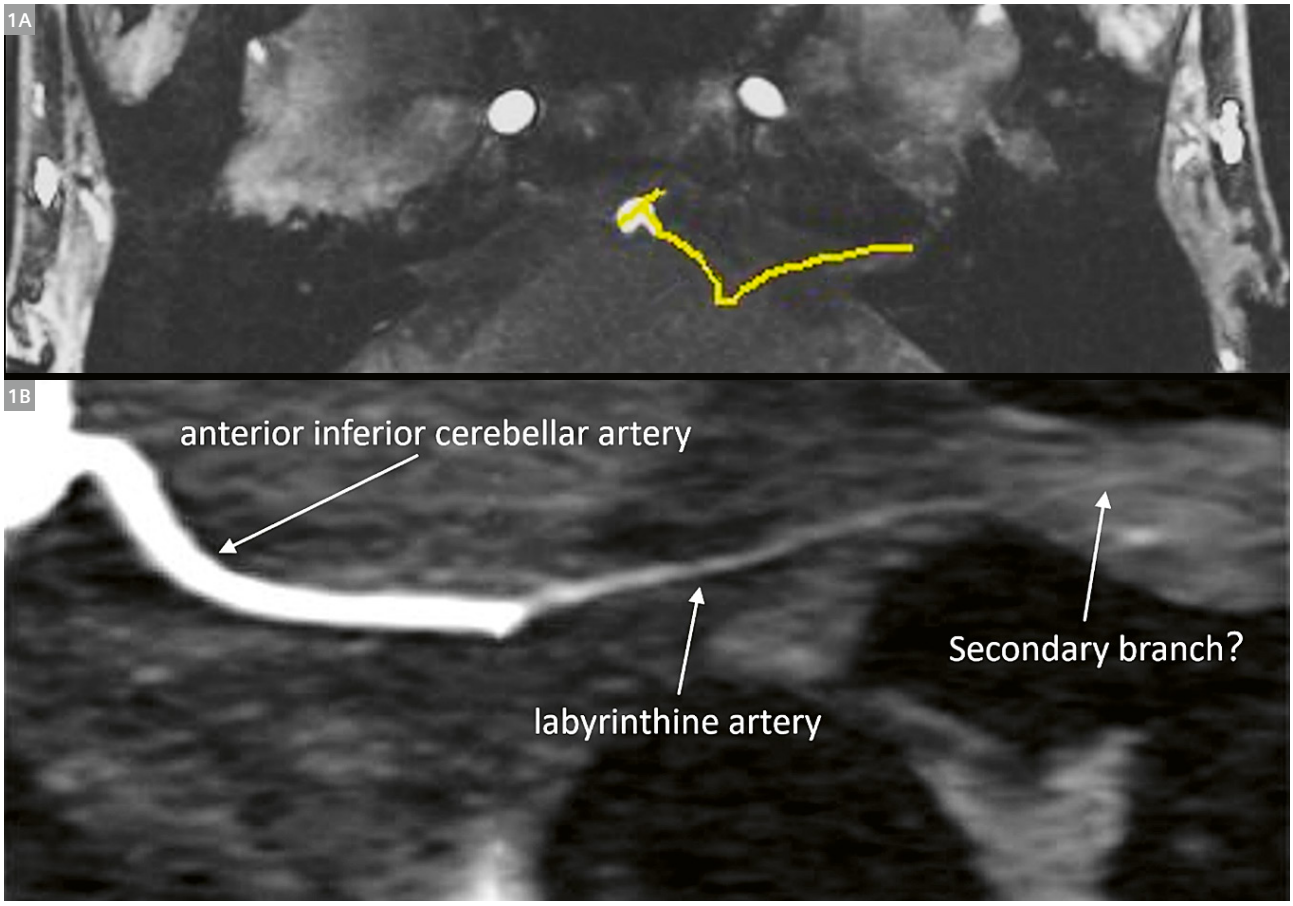
The labyrinthine artery is a small end artery that typically arises from the anterior inferior cerebellar artery (AICA) and supplies the cochlear and vestibular structures of the inner ear [1]. Imaging it directly matters clinically: Because the artery has essentially no collateral circulation, any interruption of its flow may injure the auditory and vestibular system, leading to hearing loss and vertigo [2]. Capturing it on imaging is no easy task. The labyrinthine artery runs a short course deep within the internal auditory canal, and at roughly 180 µm in diameter — barely thicker



1 Ultra-high-resolution 7T TOF-MRA of the labyrinthine artery. **(1A)** The yellow line indicates the curved reconstruction plane selected to follow the course of the target vessel. **(1B)** The curved planar reconstructed image shows the labyrinthine artery continuous with the anterior inferior cerebellar artery (AICA) and coursing toward the internal auditory canal. A small distal branch-like signal is also visible, possibly representing a secondary branch.

than a human hair (~120 µm) — it demands both extremely high-resolution and strong artery-to-background contrast [3]. This makes ultra-high-field (UHF) 7T an attractive platform [4]. Previous work has demonstrated that the labyrinthine artery can be visualized with 7T time-of-flight magnetic resonance angiography (TOF-MRA) [5], but there remains room for improved clarity. In this case, we set out to show that targeted, ultra-high-resolution 7T TOF-MRA can depict the labyrinthine artery and trace its course precisely and clearly.

The case was conducted on a 7T MAGNETOM Terra system (Siemens Healthineers, Erlangen, Germany) equipped with an 8Tx/32Rx head coil (Nova Medical, Wilmington, MA, USA). We acquired a targeted high-resolution TOF-MRA of the labyrinthine artery with the following parameters: TR/TE = 27/2.38 ms, flip angle = 32°, in-plane resolution = 0.25 × 0.25 mm², slice thickness = 0.15 mm, slab thickness = 16.8 mm, and total acquisition time = 7:15. Curved planar reconstruction was then performed to unfold the vessel along its course. The reconstruction plane is illustrated in Figure 1A, and the reconstructed image is illustrated in Figure 1B. Two physicians independently reviewed the images and identified the depicted vessel as the labyrinthine artery. The artery was clearly visualized and appeared continuous along its expected route — from the basilar arterial system, through the AICA, and toward the internal auditory canal. A small branch-like signal was also visible distally, suggestive of a secondary branch.

Being able to see the labyrinthine artery directly could give clinicians a new window into the vascular perspective when assessing inner-ear disorders. A recent case report, for example, suggested that visualization of changes in the labyrinthine artery may help identify acute labyrinthine ischemia [6]. In this study, the spatial resolution and vessel-to-background contrast of 7T were enough to depict the small artery clearly and to follow its course continuously back to the AICA. This ability to trace the arterial course opens the door to future studies examining the vascular factors in patients with hearing loss or vertigo. The next step is to test this approach in relevant patient populations to establish its clinical value.

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