TRANCE technique optimizes non-CE MR angiography

Hyogo Brain and Heart Center uses TRANCE for MRA of lower extremities

Hyogo Brain and Heart Center (Himeji, Hyogo, Japan) opened in April 1981 with 350 beds. With specialists in cardiology and neurology and a critical care center that supports the Hyogo prefecture, the Center sees more than 1800 outpatients every week. The Center has been using an Achieva 1.5T and an Achieva 3.0T scanner for MRI examinations and developed the TRANCE technique for non-contrast enhanced MR angiography, with very good results.

Kazunari Ishii M.D., Ph.D., Director of the Department of Radiology and Nuclear Medicine at Hyogo Brain and Heart Center, says the Center scans seven or eight patients in a week using the TRANCE technique, mainly for the lower extremities.

Non-contrast enhanced MR imaging gained more clinical interest among physicians because of concerns regarding gadolinium-based contrast agents and their relation to nephrogenic systemic fibrosis (NSF). For patients who are at risk for NSF, such as those with renal insufficiency, MR imaging without gadolinium-based contrast agents is preferred.

“We saw a clinical need for implementing a non-contrast enhanced (non-CE) imaging technique for our patients with peripheral arterial disease (PAD) and contraindications for the use of contrast medium, for instance because of a decline in kidney function or renal artery stenosis.”

TRANCE optimized for best performance

Hyogo Brain and Heart Center pioneered the TRANCE technique for non-CE MR angiography. With TRANCE, two high-resolution images are acquired, one in diastole and one in systole. In systole, arterial blood flows quickly, causing dephasing of signal. This leads to flow voids, so arteries are black. In diastole, arterial blood flow is slower, so the signal does not dephase and arteries are bright. TRANCE subtracts systolic from diastolic images resulting in a high-resolution, 3D dataset of bright arteries and dark background.

Bilateral superficial artery stenosis

In this 80-year-old male with bilateral stenosis of the superficial artery, 1.5T TRANCE visualization of the arterial stenosis and collateral vessels is equivalent to CTA.
The TRANCE technique

Philips TRANCE (Triggered Angiography Non-Contrast Enhanced) is a cardiac triggered 3D TSE technique that subtracts images from different phases in the cardiac cycle to obtain high resolution arterial images with bright vessels and dark background.

TRANCE makes use of signal intensity differences in the arteries due to flow changes throughout the cardiac cycle. During systole, signal intensity within the arteries drops because blood acceleration causes flow voids due to dephasing. At the same time, signal intensity within veins is preserved because that flow is much lower. During diastole, signal intensity is high in both the arteries and the veins.

The TRANCE technique uses cardiac triggering to enable data acquisition during systole and during diastole. Using ImageAlgebra, the TRANCE technique subtracts these two high resolution datasets, resulting in only arterial signal as the bright signal of the veins is cancelled out. Thus flow changes throughout the cardiac cycle are used to better differentiate arteries from background tissue without using a contrast agent.

TRANCE is compatible with large FOV’s (380 to 450 mm) and high matrix sizes with scan times in the range of 2:15 to 5:10 seconds per phase.

The subtracted dataset can be further processed with VolumeView. For bright arteries, Maximum Intensity Projections (MIP) can be made.

“TRANCE background suppression is mostly excellent and we can easily see collateral blood circulation. We can use a large FOV in the coronal plane, and scan time is faster than TOF.”

<table>
<thead>
<tr>
<th>Left poplitial artery stenosis</th>
<th>3.0T TRANCE</th>
<th>3.0T 2D TOF</th>
<th>3D CTA</th>
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<td>In this 59-year-old male patient with stenosis to the left poplitial artery, TRANCE at 3.0T produces significantly better images than 2D time-of-flight MRA, and visualizes arterial stenosis and collateral vessels as in CTA.</td>
<td><img src="image1" alt="3.0T TRANCE image" /></td>
<td><img src="image2" alt="3.0T 2D TOF image" /></td>
<td><img src="image3" alt="3D CTA image" /></td>
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### Left common iliac artery stenosis

In this 65-year-old female, TRANCE at 3.0T demonstrates the stenosis of the left common iliac artery as clearly as DSA.

![3.0T TRANCE](image1)

![DSA](image2)

### Bilateral superficial artery stenosis

TRANCE at 3.0T provides image quality comparable to CE-MRA in this 63-year-old female with stenosis of the bilateral superficial artery.

![3.0T TRANCE](image3)

![3.0T CE-MRA](image4)

### Right iliac artery stenosis and left iliac artery occlusion

CTA shows severe calcification of the iliac artery in this 72-year-old female, but stenosis cannot be seen. DSA and TRANCE provided excellent images that demonstrate stenosis of the right iliac artery and left iliac artery occlusion. TRANCE enables a larger FOV, which gives a broader overview than DSA.

![3.0T TRANCE](image5)

![DSA](image6)

![3D CTA](image7)

"We believe this non-invasive technique will gain much importance in diagnosis of peripheral arterial disease."
“We have carefully optimized our scan parameters, for instance, the refocusing angle and flow compensation in particular at 3.0T,” Dr. Ishii explains. “A higher refocusing angle yields higher signal intensity, but SAR limitations need to be taken into account. We found that using flow compensation in the diastolic phase yields the brightest signal in the arteries. Adding sensitized flow compensation in the systolic phase provides the lowest signal in the arteries because of flow voids.” Takeshi Ishimoto, R.T., technologist at Hyogo Brain and Heart Center, says TRANCE is easy to use. “The TRANCE technique doesn’t require any specific system type, field strength or gradient.” Together with the Philips Japan team they built a TRANCE ExamCard, that performs the subtraction automatically. We often use inverted display of TRANCE images to make the image appearance similar to DSA. TRANCE is completely non-invasive, and it is used for almost all patients.

**TRANCE provides fast, high quality MRA**

Dr. Ishii prefers TRANCE over time-of-flight (TOF) MR angiography as TRANCE images show better vessel conspicuity. “Because TRANCE is a subtraction technique, background suppression is mostly excellent, and better than with TOF. We can easily see collateral blood circulation,” he says. “We can use a large FOV in the coronal plane, and the scan time is faster than with TOF.”

“While TRANCE is used most often for imaging of the lower extremities, the simplicity and flexibility of this technique make it attractive to explore its use in other anatomies,” says Dr. Ishii. “In diagnosis of peripheral arterial disease, however, we believe this non-invasive examination technique will gain much in importance.”

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