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Neuroimaging 1
Direct assessment of wall shear stress by signal intensity gradient from time-of-flight magnetic resonance angiography

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Arterial wall shear stress (WSS), the stress tangential to the arterial wall, is known to have pathophysiologic roles in endothelial function and arterial thromboembolism. Time-of-flight magnetic resonance angiography (TOF-MRA) is based on a flow enhancement, and its technique to control intraluminal saturation has been evolved and now universally applied to every subject. It means that intraluminal saturation might be variable because of individual characteristics of arterial geometry and flow velocity.

Objective: To assess patient-specific WSS directly from TOF-MRA, calculating signal intensity gradient near the arterial wall (TOF-MRA SIG).

Methods: We developed a new method to calculate the TOF-MRA SIG, and performed validation studies. A phantom study for the TOF-MRA SIG as a function of flow rate was performed. A comparison between the TOF-MRA SIG and WSS from computational fluid dynamics (CFD) was made using 3D TOF-MRA of extracranial carotid artery in 5 healthy volunteers.

Results: The phantom study showed that the TOF-MRA SIG values were significantly higher in the tube with high flow rate than with low flow rate ($p < 0.001$). The TOF-MRA SIG values were highly correlated with the various flow rates ($\beta = 0.96$, $p < 0.001$). The comparison study showed that the correlation efficient between the CFD WSS and the TOF-MRA SIG at the carotid artery was more than 0.8 in every section (all p values < 0.001).

Conclusion: The TOF-MRA SIG was dependent on flow rate, and showed highly significant correlations with the CFD WSS. The TOF-MRA SIG might provide a convenient and efficient screening measurement to assess patient-specific WSS for the risk of vascular disease.

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Neuroimaging 1
Iron in typical and atypical parkinsonism — MRI and Mössbauer spectroscopy study

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Background: Iron may play an important role in typical Parkinson's disease (PD) and progressive supranuclear palsy (PSP). In both the destruction involves substantia nigra (SN). Attempts to use magnetic resonance imaging (MRI) to assess iron in living subjects remain controversial. Objective: to compare the results of measurements of the relaxation times T1 and T2 obtained from patients with PD, PSP and controls with the concentrations of iron measured with Mössbauer spectroscopy (MS).

Material and methods: MS was performed on of 29 control 17 PD and 10 PSP SN samples. The measurements of T1 and T2 from SN were performed with the use of 1,5 T MRI with Inversion Recovery pulse sequence to measure T1 and Fast Spin Echo pulse sequence to measure T2. 46 PD, 10 PSP and 18 control patients were studied.

Results: iron concentration (ng/mg wet tissue) in SN was 177 ± 14 for controls, 177 ± 18 in PD and 301 ± 26 in PSP. T1 (ms) was 708 ± 22 for controls, 730 ± 12 for PD and 589 ± 5 for PSP. T2 (ms) was 52 ± 1 for control, 47 ± 1 for PD and 55 ± 2 for PSP.

Conclusions: T1 shortening in PSP correlates with higher concentration of iron compared to PD and control, while there is no change in T2 within limits of experimental errors. Therefore T2 must be related not only to the concentration of iron. The differences between PD and PSP results suggest that the mechanism of the neurodegeneration in the two diseases may be different.

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Neuroimaging 1
Amide-proton-transfer MRI signal as biomarker of glioma as assessed by image-guided needle biopsy

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Background: Existing clinical MRI sequences are not tissue specific. Amide-proton-transfer (APT) imaging is a novel molecular technique that gives contrast via endogenous cellular proteins.

0022-510X/$ – see front matter.