

Carotid plaques in TIA and stroke patients: one-year follow-up study by magnetic

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Purpose. To investigate the natural course of carotid plaque progression in TIA/stroke patients by using serial multisequence magnetic resonance imaging (MRI).

Methods. Forty TIA/stroke patients with ipsilateral <70% carotid stenosis underwent MRI of the plaque ipsilateral to the symptomatic side at baseline (<3 months after TIA/stroke) and after one year. The protocol for carotid plaque MRI consisted of T1-weighted turbo field-echo (TFE), time-of-flight (TOF), T2-weighted turbo spin-echo (TSE), and pre- and post-gadopentetate dimeglumine-enhanced T1-weighted TSE images (Figures 1 and 2). For each plaque, carotid lumen volume, wall volume, total vessel volume (=carotid lumen volume+wall volume), the presence of a lipid-rich necrotic core (LRNC), fibrous cap (FC) status, and the presence of intraplaque hemorrhage (IPH) were assessed at both time points.

Results. Over a 1-year period, mean carotid lumen volume decreased with $4.8 \pm 2.0\%$ (\pm standard error) ($P=0.013$). Mean wall volume increased with $11.2 \pm 2.2\%$ ($P<0.001$). Total vessel volume did not significantly change ($P=0.147$) (Table). At baseline, there were 18 plaques with a LRNC, which also had a LRNC at 1-year follow-up. No plaque without a LRNC at baseline developed a LRNC during the follow-up period. All plaques with a LRNC had a thin and/or ruptured FC at both time points. Twelve patients had IPH both at baseline and at follow-up. In one patient, IPH disappeared, whereas in one other patient, new IPH appeared at follow-up. The presence of IPH and a LRNC with a thin and/or ruptured FC were not significantly associated with plaque progression ($P>0.05$).

Conclusions. In TIA/stroke patients with ipsilateral <70% carotid stenosis, there is inward plaque remodeling over a 1-year period, while features of plaque vulnerability generally remain unchanged.

Figure 1. Multisequence MR images (T1w TFE, TOF, T2w TSE, pre-contrast T1w TSE, and post-contrast T1w TSE) of a carotid plaque obtained at baseline (upper row) and at 1-year follow-up (bottom row). The LRNC can be observed on both the post-contrast T1w TSE images obtained at baseline and at 1-year follow-up (asterisks). Arrowheads point at the FC, which is identified as a high signal area between the LRNC and the lumen of the carotid artery. There is a disruption of the FC (arrows) and therefore the FC status was classified as “thin and/or ruptured” at both time points.

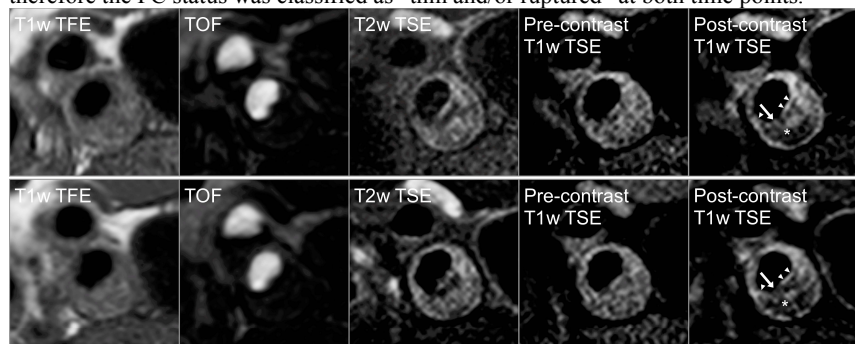


Figure 2. Multisequence MR images of a carotid plaque obtained at baseline (upper row) and at 1-year follow-up (bottom row). At both time points there is high signal intensity on the T1w TFE and TOF images (asterisks), indicating a LRNC with IPH. There is no contrast enhancement between the LRNC and the lumen on the post-contrast T1w TSE images, and therefore the FC status was classified as “thin and/or ruptured” at both time points. At both time points there are calcifications in the outer rim of the plaque, identified as hypointense areas on all MR images (arrowheads in pre-contrast T1w TSE images).

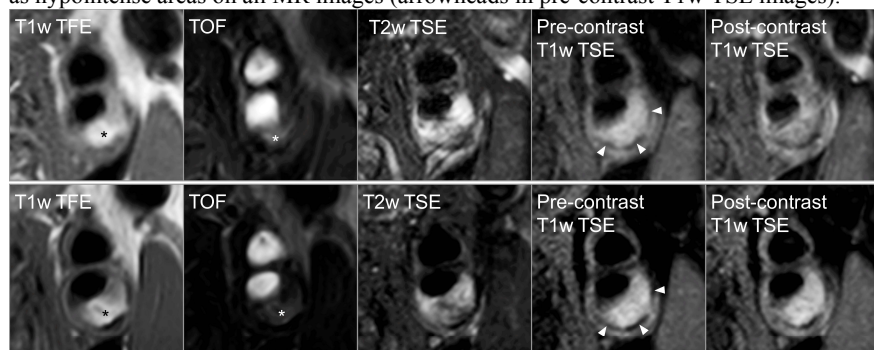


Table. MRI plaque characteristics at baseline and after one-year follow-up. Data in table represent mean values \pm standard error.

| | Baseline | One-year follow-up | Δ (%) | P-value |
|---|-------------------|--------------------|----------------|---------|
| Carotid lumen volume (mm ³) | 864.2 \pm 39.1 | 816.5 \pm 38.0 | -4.8 \pm 2.0 | 0.013 |
| Wall volume (mm ³) | 946.1 \pm 50.5 | 1040.9 \pm 51.3 | 11.2 \pm 2.2 | <0.001 |
| Total vessel volume (mm ³) | 1810.3 \pm 74.3 | 1857.5 \pm 72.6 | 3.3 \pm 1.6 | 0.147 |

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Acknowledgement

This research was supported by the Center for Translational Molecular Medicine (PARISK) and the Netherlands Heart Foundation (grant 2006B61).