Carotid plaque characteristics at MRI and recurrent clinical cerebrovascular ischemic events:

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Carotid plaque characteristics at MRI and recurrent clinical cerebrovascular ischemic events: one-year follow-up study

Purpose. To prospectively assess the association between carotid plaque characteristics at MRI and the recurrence of ipsilateral clinical cerebrovascular ischemic events in symptomatic patients with mild to moderate carotid stenosis.

Methods. One hundred TIA/stroke patients with ipsilateral 30-69% carotid stenosis underwent carotid plaque MRI within 2-88 (mean 33) days after the initial event. MR plaque imaging 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 (Figure 1). For each plaque, vessel wall volume and volumes of lipid-rich necrotic core (LRNC), calcifications, and fibrous tissue were assessed. In addition, maximum vessel wall thickness, minimum lumen area, fibrous cap (FC) status and intraplaque hemorrhage (IPH) were assessed. Patients were followed by interviews and chart review to determine the recurrence of ipsilateral TIA and/or stroke within one year after inclusion.

Results. Twelve of hundred included patients experienced recurrent ipsilateral clinical ischemic events (11 TIAs and 1 stroke) within one year. The presence of IPH was associated with recurrence (Pearson Chi-Square= 7.531 [*P*=0.006]) (Table 1). In addition, plaques of patients with recurrent events had plaques with larger LRNC volume and larger maximum vessel wall thickness, although these findings were borderline non-significant (P=0.066 and P=0.086, respectively) (Table 3). Other MRI-based parameters were not found to be related to recurrent events (Table 2 and 3).

Conclusions. The results of this first study from mainland Europe suggest that the presence of IPH, larger LRNC volume, and larger maximum vessel wall thickness of carotid plaques are associated with the recurrence of clinical cerebrovascular ischemic events. It confirms previous studies that IPH may predict future TIA or stroke. Assessment of carotid plaque characteristics by MRI may help improving patient selection for carotid endarterectomy.

Table 1. Presence of carotid IPH and recurrent events within 1 year.

	Recurrent event ≤ 1 yr	No recurrent event ≤ 1 yr
IPH present	8	24
IPH absent	4	64

Pearson Chi-Square = 7.531 (*P*=0.006)

Table 2. Fibrous cap status and recurrent events within 1 year.

	Recurrent event ≤ 1 yr	No recurrent event ≤ 1 yr
Thin and/or ruptured FC	8	38
Thick and intact FC	4	50

Pearson Chi-Square = 2.345 (*P*=0.126)

Table 3. Quantitative plaque measurements and recurrent events within 1 year.

	Recurrent event ≤1 year	No recurrent event ≤1 year	*P*-value
Vessel wall volume (mm^3)	1113.775	999.087	0.252
LRNC volume (mm^3)	4.834	4.101	0.066
Volume of calcifications (mm^3)	37.450	48.058	0.359
Fibrous tissue volume (mm^3)	890.158	847.930	0.471
Maximum vessel wall thickness (mm)	185.425	103.175	0.086
Minimum lumen area (mm^2)	16.428	17.587	0.458

Figure. Co-registered T1w TFE, TOF, T2w TSE, pre- and post-contrast T1w TSE images of a transverse section of a carotid plaque. The right bottom panel displays the ROIs: red=lumen; green=outer vessel wall; yellow=LRNC; orange=calcifications; remaining vessel wall area=fibrous tissue. Intraplaque hemorrhage was scored as being present (asterisk in TOF image) and the FC was designated as thin and/or ruptured (arrow in post- contrast T1w TSE image).
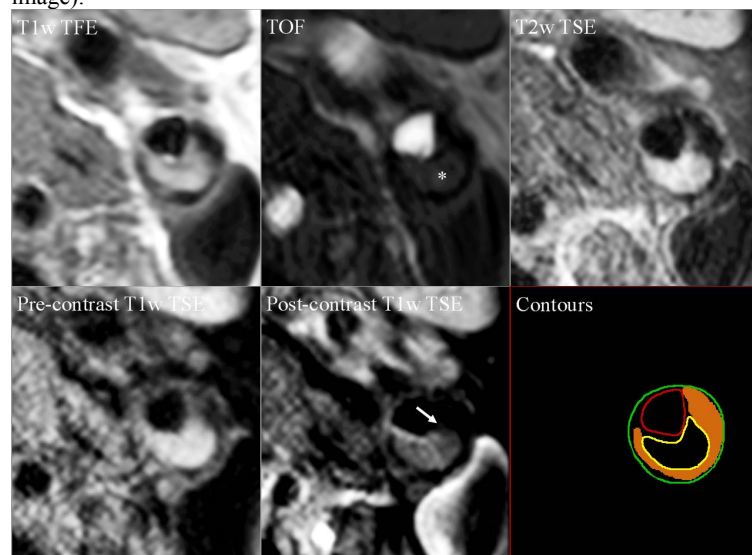
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