

Assessment of fibrous cap status of carotid artery plaques by contrast-enhanced MRI

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Background and purpose

The fibrous cap (FC) is a layer of connective tissue separating the lipid-rich necrotic core (LRNC) of the plaque from the carotid artery lumen. Patients with a thin or ruptured FC may be at greater risk for future stroke. Overall reproducibility in identifying the FC by non contrast-enhanced (CE-) MRI has shown to be poor.¹ CE-MRI is capable of quantitatively measuring the dimensions of the intact FC.² The objective of this study was to assess inter- and intraobserver agreement of CE- MRI in the assessment of FC status in vivo.

Methods

The plaques of forty-five symptomatic patients with moderate (30-69%) carotid artery stenosis were imaged in-vivo by co-registered 3D T1-weighted (T1w) turbo field echo (TFE), 3D time-of-flight (TOF), and pre- and post-contrast 2D T1w turbo spin-echo (TSE) images, using a 1.5-Tesla whole-body MRI system (Intera, Philips Medical Systems, Best, the Netherlands). For each slice (3 mm thickness, 9 slices per plaque), presence or absence of LRNC/hemorrhage^{2,3} and FC status² were independently assessed by three observers, of which one also assessed all images 2 months after the first reading. Assessment criteria are listed in Figure 1. For assessment on a per-plaque basis, FC status was considered "thin or ruptured" when at least one slice was scored as being "thin or ruptured". Kappa coefficients (κ) were calculated as indicators of inter- and intraobserver agreement, on a per-slice and on a per-plaque basis. K values <0.20, 0.21–0.40, 0.41–0.60, 0.61–0.80, and 0.81–1.00 were considered to indicate poor, fair, moderate, good, and very good agreement, respectively.

Results

Interobserver agreement in FC status assessment on a per-slice basis was moderate to good (κ values of 0.58, 0.63, and 0.66; all $P < 0.05$). Intraobserver agreement on a per-slice basis was good ($\kappa = 0.79$, $P < 0.05$). Interobserver agreement in FC status assessment on a per-plaque basis was good (κ values of 0.64, 0.69, and 0.78; all $P < 0.05$). Intraobserver agreement on a per-plaque basis was very good ($\kappa = 0.99$, $P < 0.05$).

Conclusion

This study found good inter- and intraobserver agreement in assessing FC status on a per-plaque basis by using CE-MRI. Future prospective longitudinal studies can rely on CE-MRI to assess the predictive value of FC status of carotid artery plaques on the occurrence of cerebral ischemic events.

Figure 1. Criteria used to assess FC status.

