The Silent Carotid Plaque Rupture -- A 70-Month Serial Follow-up Case by In Vivo High Resolution MRI

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Introduction

Rupture of the atherosclerotic carotid plaque is a very common lesion underlying the brain embolism. Pathological studies suggest, however, that some plaques may rupture silently without causing symptoms [1]. The healing procedure of the silent rupture is complicated. Recent study demonstrated that high resolution MRI is capable of detecting the ruptured fibrous cap of the atherosclerotic carotid plaque [2]. Report [3, 4] has also shown that contrast enhanced (CE) MRI could provide more information about the tissue characterization of the carotid plaque. In this study we followed up the healing procedure of a patient with silent carotid plaque rupture by the *in vivo* high-resolution MRI.

Materials and Methods

High-resolution MRI of carotid arteries of an 81-year-old male patient with left carotid stenosis >50% by ultrasonic was performed on a 1.5T GE Signa scanner with a custom-designed phased-array coil. The MR examinations were repeated 24 and 70 months after the first scan. This patient has the clinical history of hypertension, diabetes, hyperlipidemia and myocardium infarction, but he has no neurological abnormality during the follow-up. MR sequences included double inversion recovery (DIR) fast spin echo (FSE) T1WI [TR/TI/TE: 800/650/9], cardiac gated PDWI and T2WI [TR/TE: 3RR, 20/40ms], and 3D time of flight (TOF) [TR/TE: 23/3.6]. The T1WI scan was repeated ~ 10 minutes after the injection of a contrast agent (0.1mmol/kg, Magnevist, Schering). Section thickness was 2 mm in T1WI, PDWI and T2WI, and 1 mm in TOF. In-plane pixel size was 0.25x0.25 mm^2. In TOF image the rupture of the plaque appears as a region of hyperintense signal adjacent to the lumen [2]. The matched multi-contrast pre- and post-contrast images were used to evaluate the fibrous cap status and plaque components.

Results

In the first MR examination, the rupture and the hemorrhage of the carotid plaque was detected at the common carotid artery (**Figure 1**). The rupture was at the level of 10 mm below the bifurcation. Twenty four months later, the area of the subacute-stage hemorrhage (high signal in T1WI) increased and the region of the plaque rupture was filled with thrombus (**Figure 2**). The surface of the plaque is irregular. Seventy months later, the area of the subacute-stage hemorrhage decreased, but the plaque size increased while the lumen kept the same (**Figure 3**). It represented the positive remodeling. At the region of the plaque rupture, the thrombus changed to the fibrous tissue (collagen-rich) with neovasculature, which was shown as the region with strong enhancement. The surface of the plaque is smooth.

Conclusions

High-resolution MRI is capable of following up the silent plaque rupture of the carotid artery and observing the change of the plaque characteristics. It will be a useful tool to provide the information about the prevalence of silent ruptures of the carotid plaque in the clinical population in the future.

References

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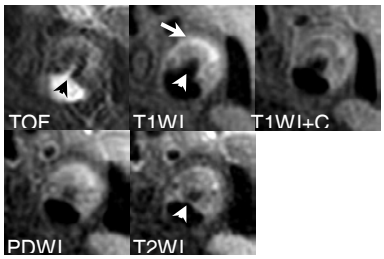

Figure 1: First time
(Plaque in the left common carotid artery)
In TOF image, the rupture appears as a region of hyperintense signal adjacent to the lumen (black triangle). In T1WI, the rupture appears as a region of defect of the plaque. The region with hyperintense (arrow) on T1WI represents hemorrhage, which is shown as the no-enhancement region in post-contrast T1WI.

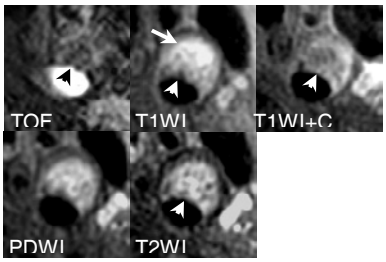

Figure 2: 24 months
The hyperintense area of subacute-stage hemorrhage (arrow in T1WI) increased. The region of the plaque rupture was filled with the tissue of long T2, iso- or short T1 and heterogeneous enhancement, which represents thrombus. The surface (black and bright triangle) of the plaque is irregular.

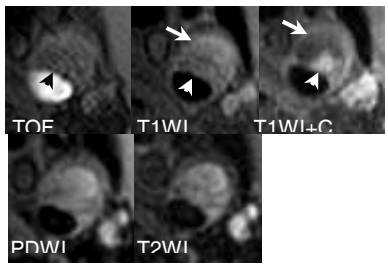

Figure 3: 70 months
The hyperintense area of subacute-stage hemorrhage (arrow in T1WI) decreased. The plaque size increased while the lumen kept the same. The region of the plaque rupture was filled with the tissue of iso- T2, iso-T1 and strong enhancement, which represents the fibrous tissue (collagen-rich) with neovasculature. The surface (black and bright triangle) of the plaque is smooth.