Ruptured Carotid Plaques as a Feature in Patients with Acute Lower Limb Arterial Thrombosis

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INTRODUCTION:

Acute lower limb arterial thrombosis (ALLAT) is an emergent and dangerous event with high morbidity (10-30% limb loss) and mortality (15-30% death) [1]. Therefore, it is very important to effectively prevent the occurrence of this cute peripheral arterial occlusive disease. In the present study, by using multi-contrast high-resolution MRI we prospectively investigated whether carotid plaque characteristics can predict ALLAT.

MATERIALS AND METHODS:

Between July 2008 and March 2011, we consecutively studied 16 carotid atherosclerotic patients with ALLAT (14 men, 2 women, 66.5±8.4 years), and 20 carotid atherosclerotic patients without ALLAT as control group (16 men, 4 women, 63.2±6.9 years). All patients with ALLAT were confirmed to be lower limb arterial occlusion by ultrasound or CT angiography in one or more lower limb major arteries. Each participant accepted a multi-contrast high-resolution carotid MRI scan centered at each side bifurcation on a 3.0-T MRI scanner (EXCITE HD, GE Healthcare, Milwaukee) within 24 hours after onset of ALLAT. A bilateral 4-channel phased-array surface coil was used. Four different contrast-weighted axial images were applied: (1) three-dimensional time-of-flight (3D-TOF); (2) quadruple-inversion-recovery T1-weighted imaging (T1WI); (3) T2-weighted imaging (T2WI); and (4) contrast-enhanced quadruple-inversion-recovery T1-weighted imaging (CE-T1WI). Sixteen slices and twelve slices were obtained for 3D-TOF and other contrast-weighted images respectively. The total acquisition time was about 20~30 min. Images of each carotid artery were analyzed on a workstation to obtain the maximal wall area (WA), total vessel area (TVA), wall thickness (WT), normalized wall index (NWI = WA/TVA), the minimal lumen area (LA), the percentage of each component (lipid-rich necrotic core, LRNC%; calcification%; intraplaque hemorrhage, IPH%) relative to the wall volume, and the presence or absence of fibrous cap rupture. Student unpaired t test and Fisher's exact test were applied to estimate the difference in risk factors between the ALLAT and non-ALLAT groups. Univariate binary logistic regression for variables of carotid arterial structure and carotid plaque characteristics was used to identify potential predictors of ALLAT. Multivariate logistic analysis was performed to assess independent predictors for patients with ALLAT.
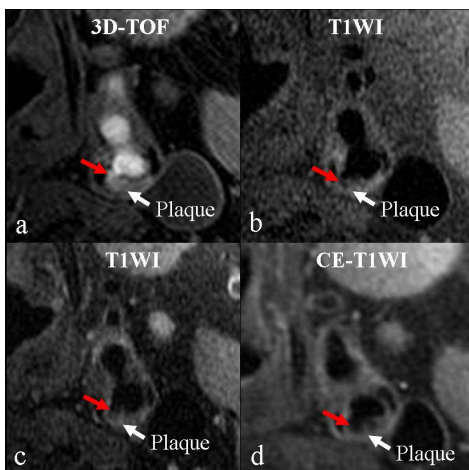
RESULTS:

The clinical risk factors of atherosclerosis did not differ between the ALLAT and non-ALLAT groups. During univariate analysis, the maximal TVA and presence of fibrous cap rupture were potential predictors for patients with ALLAT (OR=5.207, p=0.005 and OR=14.336, p=0.015, respectively), while the calcification% was potential protective factors of ALLAT (OR=0.231, p=0.027). During multivariate analysis, however, the presence of fibrous cap rupture was the strongest independent predictor of ALLAT (OR=16.325, p=0.034) (Figure), and the maximal TVA was a mild independent risk factor (OR= 1.627, p=0.022).

DISCUSSION & CONCLUSION:

Atherosclerosis is a systemic inflammatory disease. Atherosclerotic plaque instability may not be confined to the carotid arteries but may also involve other arterial districts [2]. The present study demonstrated a higher prevalence of ruptured carotid plaques in patients with ALLAT than patients without ALLAT. Moreover, the presence of ruptured carotid plaques was independently associated with ALLAT. With a multi-contrast high-resolution MRI, the ruptured carotid plaque may be a surrogate marker for identifying patient at high risk of ALLAT and may contribute to a better risk stratification of patient with atherosclerosis of lower limb arteries.

REFERENCES:

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Figure
A 70-year-old male patient had an acute right lower limb arterial thrombosis. 3D-TOF (a), QIR T1W (b), T2W (c) and CE-T1W (d) images showed a fibrous cap rupture of left internal carotid plaque (red arrow).