CAROTID PLAQUE MRI CHARACTERISTICS AS A MARKER OF SEVERE CORONARY ARTERY DISEASE.

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Introduction: Carotid intima-media thickness as measured by ultrasound is an established marker of coronary artery disease (CAD) in healthy individuals without symptomatic CAD (1). However, fewer data of the usefulness are available in patients with established vascular disease (1). There is little data comparing carotid plaque imaging in patients with more advanced coronary arterial disease. We hypothesized that carotid MRI plaque characteristics predict the severity of CAD in high-risk patients with established CAD.

Methods: Forty-three patients (men, 36, women, 7) with effort angina scheduled for percutaneous coronary intervention or coronary artery bypass surgery were included. All the patients were asymptomatic for cerebrovascular ischemic disease. Consent forms were obtained from all the patients. Subjects' demographic data (sex, age, body mass index, hyperlipidemia, hypertension, diabetes mellitus, current statin use and smoking) were collected. All the subjects underwent a bilateral carotid MR scan on a clinical 3.0T scanner (Philips) with a two-channel surface coil. Multi-contrast carotid MRI protocol included 5 different weightings: 3D TOF, pre-contrast T1W, T2W, magnetization prepared rapid acquisition with gradient echo (MPRAGE) and CE-T1W performed 5-minutes after intravenous infusion of 0.1 mmol gadolinium contrast media per kilogram of body weight. Details of MRI parameters were: T1W and CE-T1W, motion-sensitive driven equilibrium (MSDE) (2), 3D Volume Isotropic TSE (VISTA), TR/TE = 565/13.7 msec, ETL=13; T2W, MSDE, 3D VISTA, TR/TE = 3000/70 msec, ETL=26; 3D TOF, TR/TE = 20.8/4.8 msec, flip angle = 20°, and MPRAGE, TR/TE = 6.5/3.3, flip angle =12°. Fat suppression was used for MPRAGE, T1W, CE-T1W and T2W images to reduce signals from subcutaneous fat. Images were acquired in the axial plane and centered to include bilateral carotid bifurcations. All the images were obtained with a field of view of 15 to 16 cm, matrix size of 256 x 204 to 304x290, reconstruction matrix size of 512 x 512 and slice thickness of 2 mm with interval of 1mm.

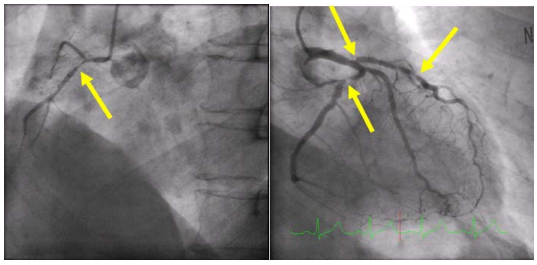
Two reviewers interpreted carotid imaging through consensus agreement based on published criteria that have been validated by histology (3-5). The reviewers were blinded to coronary angiography findings and subjects' demographic characteristics. The extracranial carotid bifurcation level was used as a landmark for matching the five different weightings. Presence of complicated American Heart Association type VI (AHA type VI: plaques with luminal surface defect, hemorrhage/thrombus, or calcified nodules, (6)) was documented. Maximal carotid wall thickness was also obtained using an imaging analysis tool for carotid plaque MRI (MRI-Plaque View; VP Diagnostics, Seattle, Wash). This software allows semi-automated measurement of carotid wall thickness that has been highly correlated with ultrasound measurement of intima-media thickness (7). An angiographer, blinded to the carotid MRI, interpreted findings of coronary angiography. Patients were classified into three groups as having >50% stenoses of three major coronary arteries (1VD, 2VD and 3VD groups).

The associations between carotid MRI findings and the number of diseased coronary arteries were examined using univariate and multivariate ordinal logistic regression analyses. Variables with $p<0.20$ in univariate models were included in multivariate models as potential confounders. $P<0.05$ was designated as statistical significance.

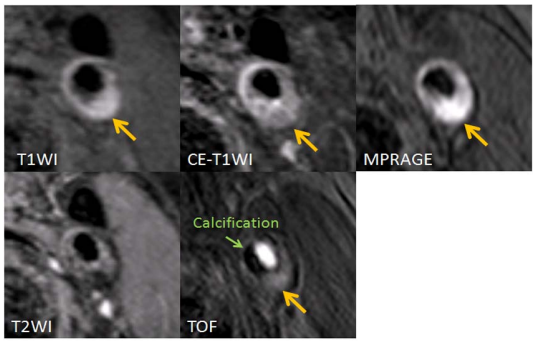
Results: Distributions of the 43 patients were 13, 9, and 21, for 1VD, 2VD and 3VD groups, respectively. Among subjects' demographic characteristics, male sex ($p=0.06$), older age ($p=0.01$) and diabetes mellitus ($p=0.07$) were included in the multivariate models as potential confounders to evaluate association of carotid MRI findings with higher number of diseased coronary arteries. Prevalence of AHA type VI in each category was 15% for 1VD, 33% for 2VD and 62% for 3VD, respectively. In the final stepwise multivariate ordinal regression model controlling for patients' demographic characteristics, presence of AHA type VI plaque was significantly associated with the higher number of diseased coronary arteries (adjusted OR, 4.2, 95%CI, 1.1, 16.4, $p=0.037$) (Case). Maximal wall thickness was not significantly associated with coronary angiographic findings (adjusted OR, 0.8, 95%CI, 0.4, 1.4, $p=0.35$).

Conclusion: In this population, AHA type VI carotid plaque identified by MRI was associated with coronary multivessel disease. Carotid plaque characteristics may play a more important role than carotid wall thickness in predicting mutlivessel coronary disease. Carotid plaque MRI may become a non-invasive marker of severe CAD in a subset of high-risk patients with established CAD.

Case: 81 y.o. male.



Multiple stenoses in the three coronary arteries (arrows)



Hemorrhagic lipid-rich/necrotic core in the left common carotid (arrows).

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