CHARACTERISTICS OF THE CAROTID ATHEROSCLEROTIC PLAQUE CLASSIFIED BY NIHSS IN ISCHEMIC STROKE

Xiao Gao[1], Shengzhang Ji[1], Jinyu Song[1], Xihai Zhao[2], Haiman Bian[1], Yu Zhang[3], Yingyin Feng[1], and Shengli Chen[1]
[1]The 4th center hospital of TianJin, TianJin, TianJin, China, [2]Tsinghua University School of Medicine, Beijing, China, [3]Philips Healthcare, Beijing, China

Target audience:
Radiologist and Neuorologist interested in plaque imaging.

Purpose:
The score of NIHSS indicates the cerebral function due to the change of arterial blood flow. Carotid Plaque especially vulnerable plaque could lead to the cerebral blood flow change and cerebral infarction [1], and the components of plaques now can be reliably identified using high resolution in 3.0-Tesla MR[2], though the characteristics of the carotid plaques with different NIHSS score are not clear. This study sought to investigate the relationship between vulnerable components and cerebral function by analyzing the plaque characteristics according to NIHSS score.

Methods:
Informed consent was obtained for each subject under an IRB approved protocol. 55 patients (mean age=67) with ischemic stroke in the anterior circulation were recruited in this study. All patients underwent NIHSS evaluation and carotid artery imaging within 2 weeks after onset of symptoms. The carotid MR imaging was performed on a 3.0T MR scanner (Achieva TX, Philips Healthcare, Best, the Netherlands) with an eight-channel phased-array carotid coil, centering on the bifurcation of the symptomatic carotid arteries, which are defined as the arteries responsible for the neurological symptoms. We acquire the cross-sectional carotid MR images with the following parameters: (1) 3D time of flight (TOF): TR/TE=20/5.1 ms, flip angle= 20°; (2) quadruple inversion-recovery T1W sequence, TSE, TR/TE= 800/10 ms; (3) T2W sequence with multi-slice double inversion recovery, TR/TE=4000/50 ms; and (4) 3D MP-RAGE sequence, IR TFE, TR/TE =9.2/5.5 ms, flip angle= 15°. All carotid MR axial images were acquired with a FOV = 14× 14 cm, slice thickness = 2 mm, acquisition matrix = 256 × 256, and longitudinal coverage =32 mm (16 slices). NIHSS score was evaluated by two neurologists with 5 years experience. All recruited subjects were divided into three groups according to NIHSS score (A:0-1score, 29 patients, B:2-4score, 18 patients, C:5-15score, 8 patients) . We analyzed the occurrence of the plaque components for each group based on NIHSS score, and compared the difference among these three groups through variance analysis method by using IBM SPSS Statistics 17.0 (Armonk, New York, USA) and $p<0.05$ indicated a significant difference.

Results:
Distribution of fibrous cap (FC), lipid-rich necrotic core (LRNC), intraplaque hemorrhage (IPH) and calcification (CA) with different NIHSS score was shown in Figure 1-2. Significant difference was found in different group with LRNC occurrence between group A and C. There was statistic difference between group B and C in CA and no clear statistic difference was found among different groups in FC, IPH.

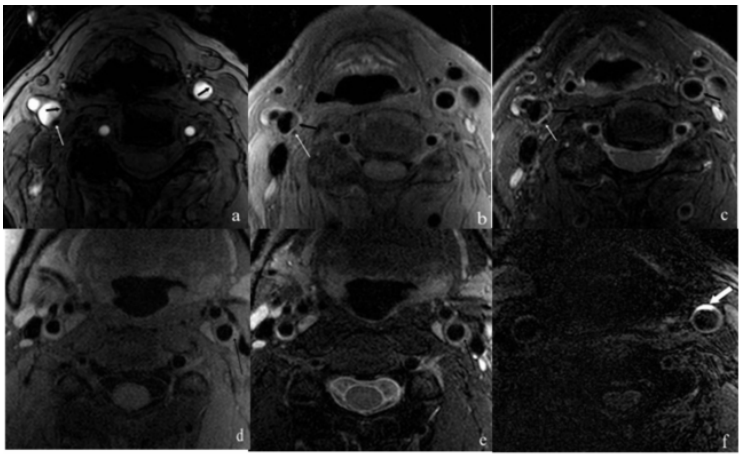

Figure 1. a:3D TOF, b,d:T1WI, c,e:T2WI, f:MP-RAGE, the vulnerable plague components, FC (black arrow in a,b,c), LRNC (black arrow in d,e) ,IPH (white arrow in f), CA (white arrow in a,b,c)

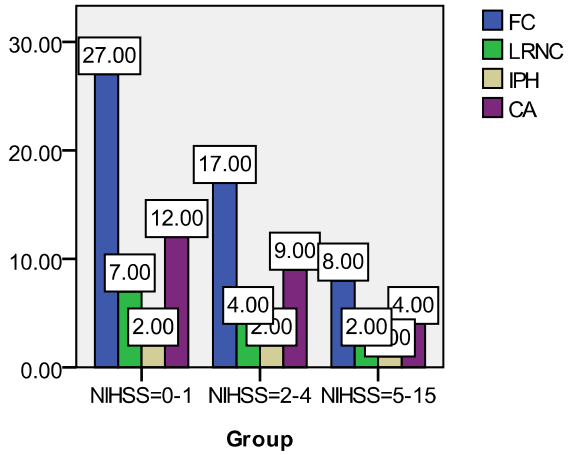

Figure 2. Distribution of FC,LRNC,IPH,CA with differente NIHSS score

Discussion:
Due to the difficulty of completing MR examination for subjects with NIHSS score, the number of subjects in higher NIHSS score group was relatively less than the one in lower score group. Patients with NIHSS score >15 were excluded in the study because they were unable to complete the carotid artery MR examination. Compare to FC and IPH, LRNC and CA occurrence is higher with NIHSS score increasing. These two components play a more important role in vulnerable plaque and the ischemia of distal brain.

Conclusion:
This study indicates that LRNC and CA are more likely to cause brain function change compared to FC and IPH.

References
1. Zhao H,et al. European Journal of Radiology 2013;82(9):e465-70
2. Laurence Gury-Paquet,et al. Magnetic Resonance Imaging 2012;30(10) :1424-1431