Hemorrhage in Carotid Plaque Is Not a Predictive Marker of New Cardiovascular Events in Asymptomatic Individuals—A High-Resolution MRI Study

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INTRODUCTION:

It has been well known that leading to carotid plaque instability are large lipid core, thin fibrous cap, neovasculature and intraplaque hemorrhage (IPH), etc. Recent researches have indicated that some risk factors of vulnerable carotid may predict new cardiovascular events in individuals without previous cardiovascular diseases [1, 2]. However, the association between carotid IPH and prospective cardiovascular events is not yet studied. In the present cohort study, our main aim was to evaluate potential correlation between carotid IPH and clinical new cardiovascular events.

MATERIALS AND METHODS:

Between January 2003 and June 2008, high-resolution MRI examinations were given to 393 men and women who were 60 to 84 years old and free of clinically apparent cardiovascular disease in our hospital. Of 393 patients, 56 were definitely diagnosed as fresh bleeding[3], at least in unilateral carotid plaque, and enrolled into case group (mean age, 72±9years; 47 male, 11 female). Sixty patients from random samples of patients definitely without bleeding in bilateral carotid plaques were recruited into control group (mean age, 74±7years; 54 male, 10 female). Subjects were excluded from the study for any of the following reasons: disruption of fibrous cap, and previous operation on carotid artery. As baseline data, each participant accepted a pre and post contrast-enhanced carotid MRI scan, and then consecutive pre and post MRI examinations every 6-9 months. MRI examinations were performed on 1.5-T or 3.0-T MRI scanner (GE Medical Systems). A bilateral 4-channel phased-array surface coil was used. A standardized protocol was used to obtain 4 different precontrast MR images: (1) double-inversion-recovery T1W (DIR T1W); (2) proton density-weighted (PDW); (3) T2-weighted (T2W); and (4) 3D time-of-flight (3D-TOF) MR angiography. All images were obtained with the following parameters: field-of-view of 14 cm, matrix size of 256-256, slice thickness of 2 mm, and longitudinal coverage of 20 to 24 mm. The center level was at the common carotid bifurcation. In case group, two were excluded due to bad image quality during the follow-up. And in control group, one was excluded due to the same reason. The normal test and Gaussian distribution was applied to estimate the latent-period from fresh IPH to new cardiovascular events. The Pearson's chi square test was used to calculate the RR value (Relative Risk value) and assess the association between carotid IPH and the occurrence of new cardiovascular diseases. Calculations were performed with statistical software (version 15.0, SPSS).

RESULTS & DISCUSSION:

The median follow-up was 2.7 years (maximum, 4.2 years). There were 28 (24.8%) of 113 studied patients who suffered from new cardiovascular events including 15 anginas, 9 myocardial infarctions (MIs), and 4 cardiovascular deaths. In case group (n=56), there were 15 (26.8%) new cardiovascular events. In control group (n=57), there were 13 (22.8%) new cardiovascular events. The latent-period, from onsets of intraplaque hemorrhage to occurrence of new cardiovascular events in case group, demonstrated a non-Gaussian distribution (D=0.286, see Figure 1). The non- Gaussian distribution in case group indicates that there was no a time sequencing relationship between carotid IPH and onset of new cardiovascular events. By using the Pearson's chi square test, we obtained the RR value (RR=0.81; P=0.624; 95% CI, 0.34~1.90). The RR value and the range of 95% CI suggested that the carotid IPH do not correlate with the risk of the new cardiovascular events. After adjusting for other risk factors, including blood cholesterol levels, hypertension, diabetes mellitus, smoking, there wasn't any correlation too (RR=0.7; P=0.429; 95% CI, 0.28–1.71).

CONCLUSION:

The results of this study indicate that no correlation could be

established between hemorrhage in carotid plaque and new cardiovascular events. It suggested that carotid IPH can not help to identify patients at risk for future cardiovascular events.
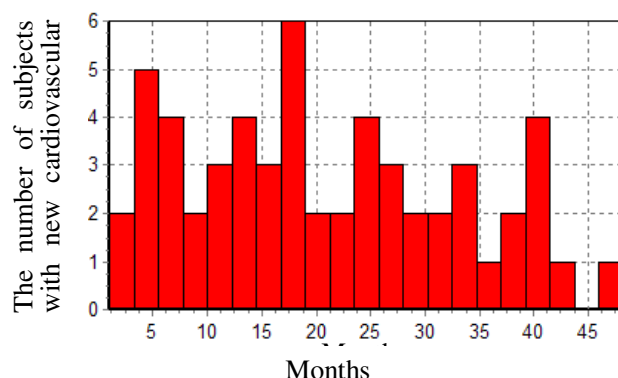

Figure 1. The Number of New Cardiovascular Events According to Latent-period. The Latent-period shows a non-Gaussian distribution.

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