Reduced Shear Stress and Large Shear Stress Gradient Cause Coronal Aneurysm and Thrombus Formation in Children With Kawasaki Disease

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We tested whether reduced shear stress (SS) and large shear stress gradient could be caused coronary artery aneurysm (AN) formation at coronary branching site and thrombus formation in AN in patients with Kawasaki disease (KD). 139 children (2-16 y) who had coronary abnormality revealed by 2-D echo were subjected. All patients had different sized AN without any significant stenoses in proximal and distal portion of AN and were divided into four groups by the maximum diameter of AN; Group S: < 1.5-fold the diameter of the adjacent non-aneurysmal vessel, n=34; Group M:1.5 < r < 4.0-fold, n=31, Group L: r > 4.0-fold, n=29, Group N: normal-looking vessels by CAG, n=45. All patients had Aspirin and/or Warfarin. The averaged peak velocity (APV) was measured at the middle of ANs in groups L, M, and S, at the branching site of segment 5-6-11 in group N, and at the normal-looking proximal lesion of AN in all groups. SS was calculated by the simplified formula as: shear stress = 4*APV/IR, where μ is blood viscosity. R is maximum inner diameter of AN or coronary vessel. SS gradient was calculated by the formula as: SS gradient = SS at normal-looking lesion / SS at AN or coronary branching site. Also, CAG and IVUS were performed for detection of thrombus and localization of ANs.

Results: APV in normal-looking vessel group was significantly higher than AN group (P<0.05). SS gradient was higher in AN group compared with normal-looking vessels (P<0.05). SS gradient was significantly correlated with SS in normal-looking lesions of AN (r=0.66, P<0.01).

Conclusions: Reduced shear stress and large shear stress gradient may play a critical role of giant aneurysm and thrombus formation intra coronary aneurysms in Kawasaki disease.

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