Can Critical shear stress (CSS) be an all-round player? Correlation with yield stress and RBC deformability

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Background: The blood behaves as a non-Newtonian fluid that the fluid viscosity varies with shear rate. Hemorheologic parameters including whole blood viscosity (WBV), RBC aggregability and deformability (EI) have been known as risk factor for atherosclerotic and microcirculatory disease. Disaggregating shear stress (DSS) is used for a representative of RBC aggregability. The yield stress (YS) might be an indirect representative of WBV, because it can be indirectly calculated from a function of viscosity data. While most parameters should be adjusted according as Hct or fibrinogen, there is no need to adjust for DSS, because DSS is a unique value, not effected by Hct or fibrinogen. For clinical compatibility, this study was objected to evaluate the correlation between DSS value and YS, EI.

Methods: 204 subjects were enrolled. Blood viscometer (BVD, Bio-Visco Inc., Jeonju, Korea) for blood viscosity, RBC aggregometer (Rheoscan-AnD 300, RheoMeditech, Seoul, Korea) for DSS and EI were used. YS is calculated with Casson’s equation from viscosity data, Hct-adjusted value was used, EI is used as a function with fibrinogen.

Results: DSS is highly correlated with Hct-adjusted YS (r=0.691, p<0.001), and fibrinogen adjusted EI (r=0.457, p<0.001). Patients with coronary disease showed higher DSS, YS, and lower EI.

Conclusion: DSS as a single value might be suggested to use in clinical field for evaluating the risk level for atherosclerotic cardiovascular disease.