A bolus of saline injection leads to increase in coronary flow based on the viscosity reduction effect: the mechanism of saline induced Pd/Pa ratio

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Background: In conjunction with fractional flow reserve (FFR), our previous study has shown the accuracy and utility of saline induced Pd/Pa ratio (SPR) for the assessment of myocardial ischemia. However, the potential mechanism how saline injection leads to increase in coronary flow remains speculative.

Purpose: This study aimed to clarify the underlying mechanism of SPR by using swine models.

Methods: The study was conducted in four swine models, and bolus of 25°C saline, 40°C saline, and 25°C dextran was injected at rates of 40mL/5sec through a catheter inserted into the superior mesenteric artery. Its peripheral arterioles were observed and recorded by a digital microscope, and transit time of each fluid and a luminal diameter of arterioles before and after injection were measured.

Results: The result from arterioles diameters of pre- and post-injection (0.049±0.016mm vs. 0.050±0.016mm; P=0.636) indicated that luminal diameters remained unchanged regardless of fluid administration. The transit time of 25°C saline was significantly shorter than 25°C dextran (3.19±0.68sec vs. 6.15±1.19sec; P<0.0001). Although the result showed no significance, the transit time of 40°C saline with lower viscosity was shorten compared to 25°C saline (3.1±0.43sec vs. 3.65±0.46sec; P=0.088).

Conclusions: Compared to 25°C dextran (viscosity of 4.991mPa·s) having the same viscosity as 37°C whole blood, 25°C saline (viscosity of 1.012mPa·s) caused increasing to double the intravascular flow volume without dilating arterioles. The results strongly suggested that the potential mechanism of SPR was viscosity reduction effect. Combined with FFR which is based on vasodilation-mediated hyperemia, these findings may contribute to clarifying the pathophysiology and especially the microcirculation in coronary artery diseases.

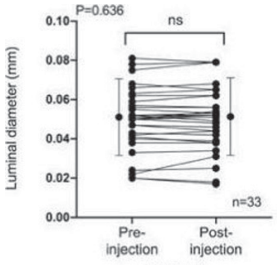

Figure 1

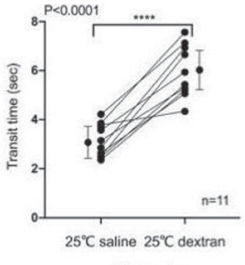

Figure 2

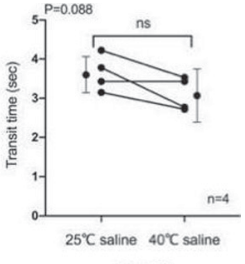

Figure 3

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