【P-2】

Shear Stress Induced pH Increase in Plasma is Mediated by PCO2 Decrease and pH Increase Alone Can Enhance Shear Stress Induced P-selectin Expression in Platelets

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To investigate shear stress-induced platelet activation, the cone-plate viscometer or couette rotational viscometer has been widely used. In previous report, it was shown that shearing platelet-rich plasma (PRP) using couette rotational viscometer can increase the pH of PRP. In this study, we examined whether shearing plasma only, using cone-plate viscometer can also induce pH increase and investigated the causes of the pH changes by directly measuring total CO2 (Tco2) and CO2 tension (Pco2). When human plasma was sheared using cone-plate viscometer, pH of the human plasma was increased time- and shear rate-dependently. Although Tco2 of human plasma was not affected, Pco2 was decreased by shearing with cone-plate viscometer indicating that the decreased Pco2 is involved in pH increase of plasma. In addition, the pH of bicarbonate-containing suspension buffer was also shown to be increased by shearing with cone-plate viscometer suggesting that the platelet studies using suspension buffers containing bicarbonate could be affected. The effects of pH changes on shear stress-induced platelet activation were also investigated. While shear stress-induced platelet aggregation was not affected by the pH changes, P-selectin expression was significantly increased in accordance with the pH increase. In conclusion, shear stress using cone-plate viscometer induces pH increase in plasma or bicarbonate containing platelet suspension buffer through PCO2 decrease and the pH changes alone can contribute to platelet activation by enhancing shear stress induced P-selectin expression.

Keyword : Platelets, Sheer stress, pH change, CO2 tension