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Effect of swirling flow on platelet concentration distribution in small-caliber artificial grafts and end-to-end anastomoses

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Abstract Platelet concentration near the blood vessel wall is one of the major factors in the adhesion of platelets to the wall. In our previous studies, it was found that swirling flows could suppress platelet adhesion in small-caliber artificial grafts and end-to-end anastomoses. In order to better understand the beneficial effect of the swirling flow, we numerically analyzed the near-wall concentration distribution of platelets in a straight tube and a sudden tubular expansion tube under both swirling flow and normal flow conditions. The numerical models were created based on our previous experimental studies. The simulation results revealed that when compared with the normal flow, the swirling flow could significantly reduce the near-wall concentration of platelets in both the straight tube and the expansion tube. The present numerical study therefore indicates that the reduction in platelet adhesion under swirling flow conditions in small-caliber arterial grafts, or in end-to-end anastomoses as observed in our previous experimental study, was possibly through a mechanism of platelet transport, in which the swirling flow reduced the near-wall concentration of platelets.

Keywords:

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