CFD analysis on mismatched end-to-end internal diameter of RSVG models

ABSTRACT

A digital arterial disease in upper extremity is uncommon happened compare to arterial disease in lower extremity. A surgical vein graft interposition is performed as revascularization procedure. However, mismatching between end-to-end internal diameter of reverse saphenous vein graft (RSVG) and existing digital artery cause blockage in RSVG vessel. In previous study, size discrepancy (small to large) in vessel causes the abnormal blood flow and will initiate the thrombosis formations as stated by Rory F. et al. Furthermore, their previous study is also supported by clinical theory as written in Wilmer W. et al. and Krishnan B. Chandran et al.sô text books. The main goal of this study is to analyze the relationship the patterns of blood flow through mismatching between end-to-end internal diameter of RSVG models and existing digital artery (large to small) with effect to the initiation of thrombus formation in RSVG models. A Three-dimensional Computational Fluid Dynamic (3-D CFD) method is employed to investigate blood flow velocity, blood pressure gradient and wall shear stress (WSS) on ideal straight (well matched between internal diameter of RSVG and recipient arteries) and internal diameter mismatched of end-to-end RSVG models. In this experiment, we expect that steady state laminar blood flow demonstrates abnormal flow pattern in mismatched internal diameter RSVG models compared to an ideal straight model. As conclusion, any abnormal blood flow pattern will initiate the formation of thrombus and reduce the vein graft survival.

Keyword: Computational fluid dynamics; Reverse saphenous vein graft; Digital artery; Upper extremity surgery; Vessel lifespan