

**Abstract:**

**AIMS:** Central venous catheter (CVC) related thrombosis is a major cause of CVC dysfunction in patients under hemodialysis. Our study aims to investigate the influence of central venous catheter (CVC) insertion on the hemodynamic environment in the central veins and to see what hemodynamics changes due to the implantation of CVC might be related to thrombus formation.

**METHODS:** Patient-specific models of the central veins before and after the insertion of CVC were rebuilt on the basis of computed tomography. Flow patterns in the vein were numerically simulated to obtain hemodynamic parameters including time-averaged wall shear stress (TAWSS), relative residence time (RRT), oscillating shear index (OSI) and normalized transWSS under pulsatile flow condition.

**RESULTS:** The placement of CVC makes significant changes on the hemodynamic environment in the central veins. A great disturbance and increase of velocity can be observed in central veins after the insertion of CVC. As a result, TAWSS and transWSS were markedly increased, but most parts of OSI and RRT decreased. Comparing with the clinical data, it's revealed that thrombosis mainly occurred at sections with elevated normalized transWSS.

**ONCLUSIONS:** It is concluded that the flow disturbance especially the flow multi-directionality induced by the CVC might be the decisive factor to initiate thrombosis after CVC implantation. Accordingly, approaches to reduce the flow disturbance in the CVC placement might help to restrain the thrombosis. More case study with pre-operative and post-operative modeling and clinical follow-up should be carried out to verify these findings.

**Reference:**

Park, M., Qiu, Y., Cao, H., Ding, Y., Li, D., Jiang, Y., Peng, L. and Zheng, T. (2020) Influence of Hemodialysis Catheter Insertion on the Hemodynamics in the Central Veins. *Journal of Biomechanical Engineering*. February 2nd. doi: 10.1115/1.4046500. (Epub ahead of print).