The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

# Analysis of wall shear stress and residence time as risk factors in stented arteries

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**Keywords**: *Blood flow, stents, wall shear stress, residence time*

Cardiovascular diseases are the most common cause of death worldwide. More specifically, 30 percent of global mortality is due to coronary artery disease [1]. Its treatment largely consists in the implantation of coronary stents with varying protrusion into the lumen. Depending on the inflammatory reaction of the artery wall, this procedure can lead to in-stent restenosis, with long term lesions in 40 percent of the cases [2], and trigger a platelet aggregation response with consequent risk of thrombosis.

To help predict and avoid side-effects of the stent implantation, blood flow dynamics are analyzed using fully resolved 3D simulations of stented arteries. In particular, low values of wall shear stress are known to be an indicator of higher inflammation and subsequent restenosis [3]. Critical areas are detected analyzing time-averaged wall shear stress, oscillatory shear index and relative residence time. High residence time can qualitatively highlight recirculation areas that are at risk of thrombosis: for this purpose the "virtual ink" method is tested [4].
These quantities are compared for different protrusion percentages and artery geometries to help predict a good or bad outcome of the stent implantation and in particular to define dangerous thresholds where the risk of in-stent restenosis and thrombosis is higher.

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