CRITICAL CONSIDERATIONS IN THE PLACEMENT OF STENTS AND FILTERS IN CORONARY AND CAROTID ARTERIES

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Introduction

Stroke and heart attack are the leading cause of mortality and morbidity in the western world.

Deposits and stenosis which can lead to stroke and heart attack are found in the trans-cerebral arteries such as the carotid bifurcation and also in coronary arteries.

In addition to surgical procedures, stents are commonly used to treat these, especially in patients with serious risk factors.

There are risks associated with the implantation of stents. Clots can be transported e. g. into the brain. One serious complication can be re-stenosis.

We studied the flow pattern of several stent,s including a Wall stent, a Self-X-expanding stent and a covered stent each placed along the common carotid artery into the internal carotid artery and compared the resulting flow pattern with the flow pattern in a model without stent. Additionally we also tested stents in coronary arteries and other arteries.

Methods

Along with flow visualization techniques (dye for steady flow and a birefringent solution with a photo elasticity apparatus for unsteady flow) we also measured the local velocities with a laser Doppler anemometer. Accurate velocity measurements are necessary to calculate shear stresses. The 1:1 true-to-scale artery models which were used have the same compliance as the real blood vessel. Some applications with stents and filters are presented.

Results

No significant change of flow rate between empty, Self-X, covered and improved covered stent could be seen.

A reduction of flow disturbances at the outflow in the improved covered stent compared to the covered stent was observed.

Discussion

The positioning of the stent has to be done very precisely. No threads should reach in the lumen. Sometime stents also move and change there position. Therefore physicians should be trained using such elastic artery models.

The wall stent and the self-X stent show macro-vortices depending on the geometry and design of the stent.

The distance of the mesh grid is important. A narrow grid distance creates more macro vortices.

Filters have to be closed during the systolic phase before they are pulled out.