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MEETING ABSTRACT **Open Access**

Influence of outflow cannula geometry on hemodynamics in patients with partial circulatory support: A computational fluid dynamics (CFD)-study

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Background/Introduction
Partial circulatory support is a new option of treatment for heart-failure patients. The Circulite Synergy Micro-Pump is a partial support device where the inflow cannula is connected to the left atrium and the outflow cannula to the right subclavian artery (RSA). Computational fluid dynamics (CFD) simulations can be used to demonstrate changes in hemodynamics post treatment.

Aims/Objectives
To investigate the influence of the outflow cannula geometry on hemodynamics in the aorta and supra-aortic vessels in patients with a Circulite Synergy Micro-Pump.

Method
Lumina of the aorta and supra-aortic vessels of nine patients were segmented from computed tomography angiographic (CTA) image data. Computational polyhedral meshes were created to conduct CFD-simulations (STAR CCM+) for diastolic flow conditions (turbulent flow model, diastolic heart flow velocity 0.25 m/s). To quantify effect of partial circulatory support, two simulations per case were carried out (with only native cardiac output and with the Circulite support device added, flow velocity 1 m/s).

Velocity magnitudes, velocities in inferior-superior direction (vz) and wall shear stresses were averaged in the innominate artery and descending aorta.

Cases were divided into two groups: Outflow cannula placed orthogonal to the RSA (n = 5, group 1) angle between the cannula and the RSA distal to the anastomosis site smaller than 90° (n = 4, group 2).

Results
Geometry of the outflow cannula affected vz of the RSA and the innominate artery significantly ($p < 0.05$), but not in the descending aorta.

Increase of velocity in the descending aorta was similar in both groups (group1: 37.27%; group 2: 41.01%).

Wall shear stress in the innominate artery did not change in group 1(-6.06%), but increased in group 2(+334.12%). The difference was not significant.

Discussion/Conclusion
Angle between SA and outflow cannula in patients with the Circulite Synergy Micro-Pump causes significant alterations in the subclavian and innominate arteries at diastole, but not in the descending aorta.

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