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Predicting the initial postoperative flow after AVF creation for hemodialysis: two modeling approaches
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Introduction
Functioning of hemodialysis arteriovenous fistula (AVF) immediately after surgical creation is mainly hampered by nonmaturation, which is characterized by insufficient flow increase and insufficient vessel remodeling. Despite available preoperative diagnostics 20-50 of all newly created AVFs fail [1, 4]. The initial postoperative flow \((pFV)\) increase is generally accepted to be indicative for proper maturation [4].

Objective
The aim of this study is to compare a lumped parameter model with a 1D-wave propagation model in their ability to predict the postoperative flow increase after AVF creation.

Methods
Vascular hemodynamics is simulated with two different modeling approaches, lumped parameter modeling [3, 5] and 1D-wave propagation modeling [2]. For both models the human vascular tree is divided into segments representing local blood and vessel wall properties (Fig. 1). All models are adapted to patient-specific conditions and results are compared with clinical measurements.

Results and discussion
Both modeling approaches were able to describe the acute hemodynamical effects associated with AVF creation and give similar results (Fig. 2,3). In both models the flow increases dramatically after RCAVF creation in accordance with duplex measurements.

Future work
- Improve the modeling of the veins and anastomosis
- Perform a parameter study
- Obtain more accurate input data: MR and US \((n=60)\)
- Determine the models predictive value

References: