Numerical modelling uncertainty of blood viscosity effects in cerebral aneurysms

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Abstract

The human circulatory system is extremely complex and its modelling and simulation constitute a very difficult and challenging task. Namely, blood exhibits complex rheological characteristics such as its shear-thinning viscosity, viscoelasticity or yield stress [1], and non-Newtonian models should be considered. In many studies found in literature, blood flow in large arteries is modelled as a Newtonian fluid. While this might be a valid first approach in certain cases, it is clear that non-Newtonian effects can have an important role in some pato-phisiological situations. In particular, cerebral aneursysms exhibit a range of shear stresses that indicates non-Newtonian effects as very important.

It is the scope of this study to compare Newtonian and generalized Newtonian mathematical models in anatomically reallistic geometries of aneurysms reconstructed from rotational CTA. The impact of the mathematical model choice is used to gauge uncertainty in numerical simulations. The boundary conditions on artificial sections play an important role in computing the flow field [2], and sensetivity to this will also be considered.

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References

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