Modelling and numerical simulations of the mechanics of cerebral arterial tissue: structural damage and FSI models.

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Abstract

The numerical simulations of the mechanical response of the arterial tissue under different loading configurations, physiological or pathological, can be effectively used to improve the mechanical characterization of the tissue and validate the structural damage models. This is the case for example when studying the changes of the material properties due to aging or cariovascular diseases, e.g. aneurysms. Furthermore, the coupling of the arterial tissue models with blood flows models together with the simulations of the coupled Fluid-Structure system, aims at providing a better understanding of the physiological phenomena and, moreover, it represents a flexible, reliable, and noninvasive predictive tool for medical decisions.

This work focuses on the study and characterization of structure models for cerebral arterial tissues by means of numerical simulations. We consider different constitutive laws for the modelling of the mechanics of the arteries [1, 3, 4] for which the physical data are obtained by means of experiments [1]. We analyse the mechanical response of the

arterial tissues under different loading conditions; in particular, we consider static and physiological configurations, the latter for the Fluid-Structure Interaction (FSI) coupled model. We perform the same analysis for different damage models for arterial tissues [2].

Keywords: arterial tissue modelling, fluid-structure modelling, damage.

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