The role of biomechanics in aortic aneurysm management: requirements, open problems and future prospects

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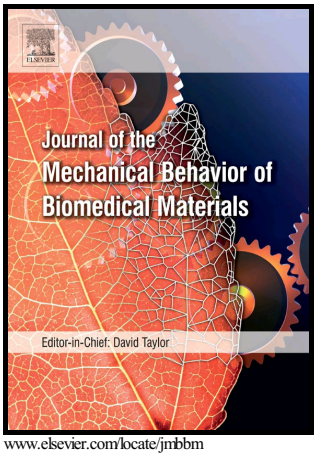

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The role of biomechanics in aortic aneurysm management: requirements, open problems and future prospects.

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Abstract

Wall stress estimation through biomechanical simulations represents a promising tool to support aneurysm risk stratification and has the potential to provide a more individual risk assessment. Accurate computation of the stress field necessitates the use of robust and biofidelic models based on patient-specific information. A multidisciplinary approach is required to obtain this information, which comprises geometry, boundary conditions, and material properties. The entire workflow encompasses many aspects, ranging from data collection to clinical interpretation of the obtained biomarkers. This review article summarizes and critically analyses the different aspects of the full clinical workflow as they have been described in the latest literature. As such, a critical assessment is provided on where we stand in the process of bringing biomechanical simulations for rupture risk assessment into broad clinical practice. Open problems are discussed and future possibilities identified.

Keywords: Biomechanics, Aneurysm, Rupture Risk Assessment, Finite Element Modelling

1. Introduction

An aortic aneurysm is a chronic degenerative disease. The condition is usually symptomless but can rupture or dissect if left untreated, with a high mortality rate. The treatment of choice is elective surgery, and the clinical decision is normally based on the diameter of the aneurysm and the growth rate thereof [1, 2]. The limited reliability of these criteria, however, has a cost in terms of

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