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Analysis of Wall Deformation of the Arterial Plaque Models: Effects of Viscoelasticity

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Abstract : Viscoelastic wall properties of the arterial plaques change as the disease progresses, and estimation of wall viscoelasticity can provide a valuable assessment tool for plaque rupture prediction. Cross section of the stenotic coronary artery was modeled based on the IVUS image, and the finite element analysis was performed to get wall deformation under pulsatile pressure. The effects of viscoelastic parameters of the plaque on luminal diameter variations were explored. The result showed that decrease of viscous effect reduced the phase angle between the pressure and displacement waveforms, and phase angle was dependent on the viscoelastic properties of the wall. Because viscous effect of tissue components could be identified using the phase angle difference, wall deformation waveform analysis may be applied to predict plaque wall composition change and vascular wall disease progression.

Keywords : atherosclerotic plaque, diameter variation, finite element method, viscoelasticity
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