Multi-layer Mechanical Model of Glagov Remodeling in Coronary Arteries: Differences between In-vivo and Ex-vivo Measurements\textsuperscript{1} PAK-WING FOK, University of Delaware — When blood vessels undergo remodeling because of the buildup of atherosclerotic plaque, it is thought that they first undergo compensatory or outward remodeling, followed by inward remodeling: the lumen area stays roughly constant or increases slightly and then decreases rapidly. The second phase of remodeling is supposed to start after the plaque burden exceeds about 40%. These changes in the vessel were first observed by S. Glagov who examined cross-sections of coronary arteries at different stages of the disease. In this presentation, we use a mechanical model based on growth and elasticity theory to verify the main aspects of Glagov’s result. However, both our model and curve-fitting to the data suggest that the critical stenosis is around 20% rather than 40%. Our model and data from the PROSPECT trial also show that Glagov remodeling is qualitatively different depending on whether measurements are taken \textit{ex-vivo} or \textit{in-vivo}. Our results suggest that the first outward phase of “Glagov remodeling” is largely absent for \textit{in-vivo} measurements: that is, the lumen area always decreases as plaque builds up. We advocate that care must be taken when inferring how \textit{in-vivo} vessels remodel from data.

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