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On the Opening of Thick Walled Elastic Tubes: A Fluid-Structure Model for Acid Reflux SUDIP GHOSH, JAMES BRASSEUR, The Pennsylvania State University, PETER KAHRILAS, Northwestern University — A coupled fluid-structure mathematical model was developed to quantify rapid opening of thick-walled elastic tubes, a phenomenon underlying biological flows such as gastroesophageal reflux disease (GERD). The wall was modeled using non-linear finite deformation theory to predict space-time radial distention of an axisymmetric tube with luminal fluid flow. Anisotropic azimuthal and longitudinal muscle-induced stresses were incorporated, and interstitial material properties were assumed isotropic and linearly elastic. Fluid flow was modeled using lubrication theory with inertial correction. Opening and flow were driven by a specified inflow pressure and zero pressure gradient was specified at outflow. No-slip and surface force balance were applied at the fluid-wall interface. Viscoelasticity was modeled with *ad hoc* damping and the evolution of the tube geometry was predicted at mid-layer. A potentially important discovery was made when applied to studies of initiation of opening with GERD: while material stiffness is of minor consequence, small changes in resting lumen distension ($\sim$2 mm diameter) may be a sensitive distinguishing feature of the disease.

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