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The opened wall of a large ascending aortic aneurysm is shown in this figure. Note that the wall of the aorta has become so thin that the markings on a ruler can be read right through the aortic wall. In Laplace’s law, the thickness of a cylindrical tube contributes beneficially to dissipate wall forces generated by fluid pressure within the tube. This is why large tires need to be thick-walled. An aorta as thin as that shown in this picture faces a very high wall tension. Rupture is likely, absent surgical therapy. The current pathophysiologic understanding is that, in addition to inflammatory and apoptotic mechanisms, an imbalanced proteolytic state participates in aneurysmal deterioration of the aortic wall. This proteolytic imbalance is known to arise from an increase in the ratio of lytic enzymes (MMPs, or matrix metalloproteinases) to inhibitory enzymes (TIMPs, or tissue inhibitors of matrix metalloproteinases). Novel mechanical measures promise to allow direct calculation of aortic wall tension in ambulatory patients as a guide surgical intervention in the near future.

John Elefteriades, MD

Reference