Effect of Muscular Component on Residual Strains in the Healthy Aorta

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The presence of residual strains in arteries is demonstrated by the tendency of aortic rings to open when they are cut radially. Residual strains are believed to be determined by shape, size and activity of cellular and extracellular components. The goal of our study was to determine the contribution of muscle cells.

The ascending portion of the thoracic aorta was collected from adult New Zealand wild rabbits and kept in a storing solution. Half of the rings obtained from the aorta were cut radially without any further treatment while the other half were perfused with a contraction-inhibiting solution containing EGTA before the radial cutting. The opening angle was measured and the opening velocity was estimated for all the rings.

When two 3 mm-thick rings are compared, the ring in the storing solution shows an opening angle of 100°, while the opening angle for the ring in the contraction-inhibiting solution is 77°. Also, the "opening velocity" was estimated to be 1.5 times less in the case of contraction-inhibiting solution. The muscular cells contribution to the opening angle appears to increase with slice thickness, with the 5 mm ring being characterized by an opening angle of 144°.
In conclusion, since the opening angle and the opening velocity decrease as the muscular contraction is inhibited, we argue that in physiological conditions the cellular component generates a non-negative active stress in the arterial wall, in addition to what is generated by collagen and elastin fibers.