Vasily Romanov
Research Assistant
Temple University
College of Engineering
1947 North 12th Street, room 209
Philadelphia, PA., 19122
Phone: 267-253-8295
Email: romanov@temple.edu

Oscillating Pressure Experiments on Porcine Aorta

Vasily Romanov[1], M.S., (Sept. '08- Aug. '10), Soroush Assari[1], M.S., (Jan. '09 – Aug. '11)
Adviser: Kurosh Darvish[1], PhD

[1]Tissue Biomechanics Lab, College of Engineering, Temple University
Presentation: Oral

ABSTRACT

This paper addresses the problem of Traumatic Aorta Rupture (TAR) that is one of the causes of fatality in motor vehicle accidents. The mechanisms that have been suggested for TAR are speculative and inconclusive and most tests performed have not been repeatable. One of the main reasons for these speculations is an incomplete understanding of the material properties of the aorta. The goal of the presented experiments is to characterize the relationship between stress and strain in the aorta wall in the biaxial pressure tests.

An experimental setup was developed where a sinusoidal pressure (between 4.5 and 74.2 kPa) was supplied into porcine aorta at frequencies ranging from .5 Hz to 5 Hz. The aorta sample, approximately 152 mm long from the descending segment (n=6), was incased inside a clear box with both ends fixed and one end attached to the inlet tube for pressurization. The sample, as well as the box, was filled with normal saline mixture. The deformation of aorta in the center of the sample was recorded using an ultrasonic pulse measurement system, while the pressure inside the aorta was recorded using miniature fiber optic pressure sensors. The experimental results are represented in the form of pressure versus volumetric strain curves which show an increase in the linear modulus with an increase in the frequency. The curves also demonstrate that the loading and unloading paths of the aorta are different. This behavior is characteristic of the viscoelastic material. The results of this study can be used to develop a material model for the aorta wall in loading conditions close to the pre-rupture state and in biaxial loading conditions as it happens physiologically.