Opening Angle of Human Saphenous Vein

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ABSTRACT

It is well known that for instance arteries exhibit residual stresses. Artery rings cut radially spring open to release these stresses; this is the so-called opening angle method [1]. In this study, the opening angle (α) was measured for human saphenous veins. Samples from five cadavers (two male and three female; age 62±7 years) were excised during autopsies conducted at the Department of Forensic Medicine of the Third Faculty of Medicine of Charles University in Prague within 24 hours after death. Five rings were cut from each sample and placed in the physiological solution. The rings were then cut radially and left to release the residual stresses for 30 minutes. The opening angle was measured from photographs, Fig. 1 (left panel).

Observed opening angle was $43.5\pm10.5^{\circ}$, Fig. 1 (right panel). Obtained values of residual strains will be used as an input of numerical simulations of the uniform stress or strain hypothesis [1]. Zhao et al. [2] examined the biomechanical properties of human saphenous veins at supra-physiologic pressures using the distension experiment and were able to measure the zero-stress state of vein tissue by radially cutting open their specimens. They observed the residual opening angle around 120°. Similar results (opening angle from 90° to 130°) were obtained by Huang and Yen [3] for human pulmonary vein segments with diameter comparable to saphenous veins.



Fig. 1 Left – measurement of opening angle. Right – results of opening angle for five donors.

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