MEASUREMENT OF COMPRESSIVE BEHAVIOR OF SWINE BRAIN TISSUE

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Introduction: Virtual Reality in surgical simulation requires the mechanical property of human organs, e.g., the liver, brain. However, previous works were not adequate for this purpose. We obtained strain-stress curves of swine brain tissue under compression *in vitro*.

Method: Cylindrical (Φ≈30, h≈10 mm) specimens were extracted from *non-frozen* swine brains*. It was a composite of the Arachnoid membrane, gray and white matters. Each specimen was axially compressed by a constant compression rate until the strain reached to about -0.5. The axial load, the axial and radial displacement were recorded. Three compression rates were examined: $5x10^{2}$, $5x10^{1}$, $5x10^{-3}$ mm/min (V1,2,3).

Results: For each rate, 11, 13, 5 cases were acquired respectively. Averaged stress-strain curves are shown in Fig. 1. The curves are concave upward containing no linear portion. The stress shows strong dependence on strain-rate (compression rate).

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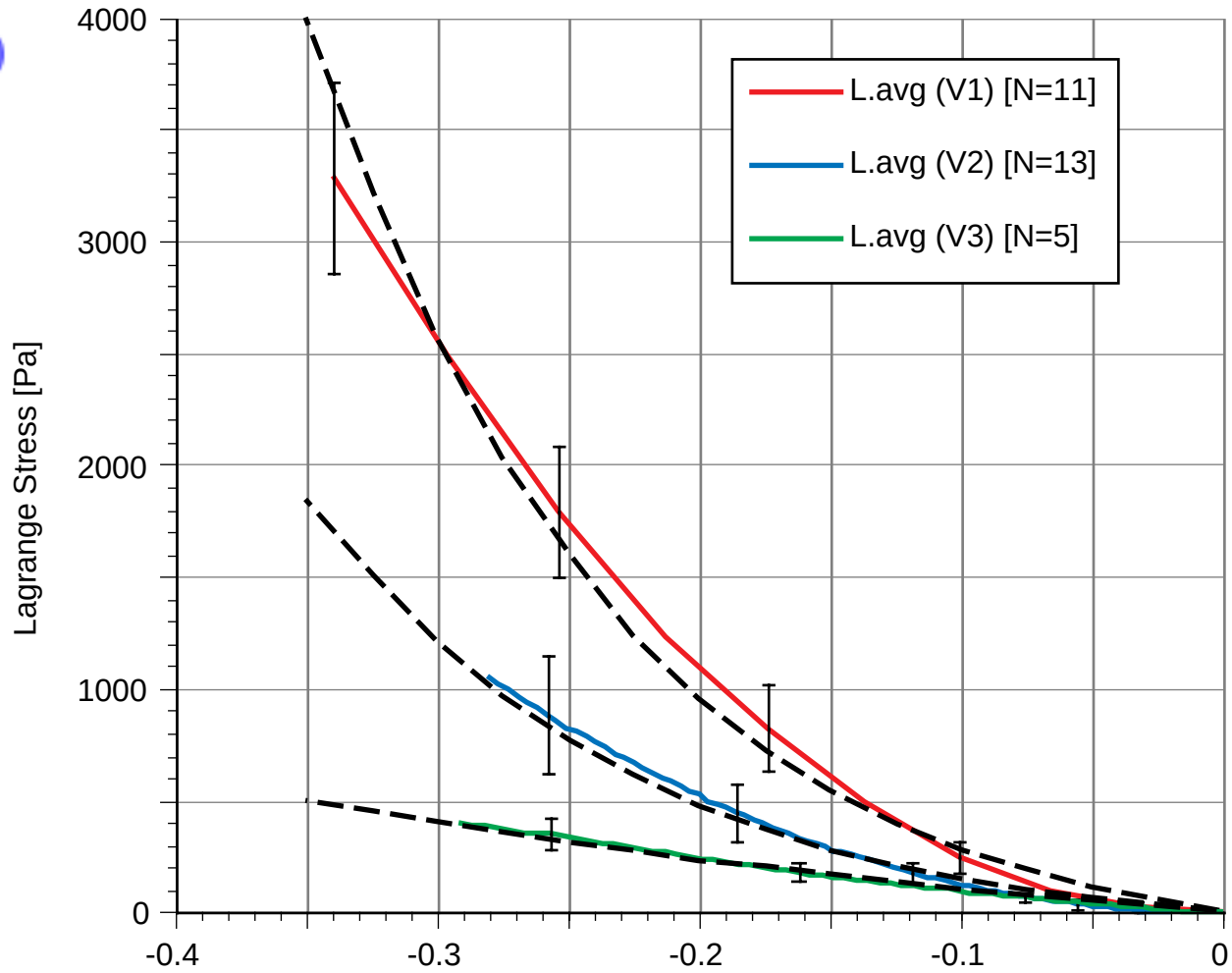
Discussion: The standard bi-phasic model faces a serious problem: strong stress – strain-rate dependence can not be easily explained. Therefore, the single-phase, non–linear, viscoelastic model approach is suggested.

Conclusions: 1) Stress-strain curves of swine brain tissue are obtained. 2) Stress is non-linear, highly stress-rate dependent. 3) Single-phase, non–linear, viscoelastic model is suggested.

Reference: K. Chinzei, K. Miller, “Compression of Swine Brain Tissue; Experiment In Vitro”, *J Mech Eng Lab*, 50-4, pp. 19-28, 1996

* Swine brains were collected from slaughtered pigs sacrificed according to the proper procedures

K. Chinzei, K. Miller, "Measurement of Compressive Behavior of Swine Brain Tissue," in Proc. World Congress on Medical Physics and Biomedical Engineering, p.288, 1997.



(This pictures was not included in this proceedings) The averaged strain-stress curves from the experiment (three color continuous lines) with numerically obtained curved (dotted lines) from our novel constitutive equations, described in [2].

[2] K. Miller, K. Chinzei, "Constitutive Modeling of Brain Tissue: Experiment and Theory," J. Biomech, vol. 30, No. 11/12, pp. 1115-1121, Nov. 1997

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