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Compressive Properties and Constitutive Modeling of Different Regions of 8-week-old Pediatric Porcine Brain under Large Strain and Wide Strain Rates

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Abstract

Porcine head is often used as a human surrogate in traumatic head injury research. Extensive research on mechanical properties of adult human / porcine brain tissues has been performed previously; however, very limited data is available for children, which is particularly important for modelling the pediatric traumatic brain injury (TBI). In this study, uniaxial compression tests at strain rates of 0.01/s, 1/s and 50/s up to 50% strain were performed for the corona radiata, corpus callosum, thalamus, cortex, cerebellum and brainstem of 8-week-old piglets. No significant difference in tissue strength was found among the cerebrum regions of cortex, thalamus, corona radiata and corpus callosum. The average stress of cerebellum was approximately 21% and 15% higher than that of cerebrum at a strain of 0.25 and 0.5, respectively, but it did not reach statistical significance level than most of the cerebrum regions. Brainstem was the stiffest among these 6 regions, and it was significantly stiffer than most regions of cerebrum, with average stress of about 28% and 40% higher at a strain of 0.25 and 0.5, respectively. The strengths of all these three regions showed significant strain-rate dependent characteristics, with the strain rate increasing from 0.01/s to 50/s, the average stress of cerebrum, cerebellum and brainstem increased to approximately 4.6, 6.3 and 6.3 times, respectively at a strain of 0.25; and increased to approximately

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