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Ultrasound Shear Wave Elastography to Assess Adult Skeletal Muscles

Abstract:

A clinical unmet need in rehabilitation medicine is to develop non-invasive, quantitative, and cost-efficient techniques for quantifying the severity of the disease/disability and evaluate treatment effects. To investigate the feasibility of ultrasound shear wave elastography (SWE) for assessing the stiffness of the affected skeletal muscles and evaluating the effectiveness of treatment in rehabilitation, we performed SWE on adult patients with post-stroke spasticity and non-specific chronic neck pain after obtaining IRB approval and informed consent. Shear wave velocity (SWV, meters per second) on SWE images of the muscle was measured in patients with post-stroke spasticity and neck muscle hypertonicity before and after treatments with BoNT-A and osteopathic manipulative treatment (OMT), respectively. The difference in SWV values measured between healthy controls and patients, and before and after treatment were analyzed using two-tailed paired t-test. Intra- and inter-observer reliability of performing SWE was analyzed using intraclass correlation coefficient. In the study, we observed significant difference in SWV in hypertonic and spastic muscles compared to that in normal muscles ($p < 0.01$). We also noted significant changes in SWV in affected muscles after treatment compared to that measured before the treatment ($p < 0.001$). Intra- and inter-observer reliability of performing SWE was good. Study results suggest that SWE is feasibile to assess the change in muscle's mechanical properties associated with spasticity and hypertonicity in patients with neuromuscular disorders and chronic neck pain. SWE can also evaluate the effectiveness of treatment for those conditions. The affected muscles are stiffer in patients with stroke and neck pain compared to non-affected normal muscles. The affected muscles become softer after treatment. Ultrasound SWE provides a non-invasive and quantitative imaging biomarker to assist rehabilitation.

Keywords: Chronic neck pain; hypertonicity; post-stroke spasticity, shear wave elastography

Biography: Jing Gao is a Professor/Director of ultrasound at Rocky Vista University (RVU) and Fellow in AIUM. Dr. Gao completed her medical education in China and came to the US as a visiting assistant professor of Radiology in 1989. She participated in clinical ultrasound service and research in the Department of Radiology, Weill Cornell Medicine for 27 years. She has been awarded several research grants by the NIH, AOA, and RVU. She has published a book, 3 book chapters, and 100 peer reviewed articles. She is an editorial board member on journals of Clinical imaging and Journal of Ultrasound in Medicine.

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