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High-frequency quantitative ultrasound and B-mode analysis for characterization of peripheral nerves including carpal tunnel syndrome

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ABSTRACT

We investigated the use of high-frequency quantitative ultrasound (QUS) and B-mode texture features to characterize ulnar and median nerve fascicles using a clinical scanner (Vevo MD) and a 30-MHz center-frequency probe. US correlation with histology was first investigated in the ulnar nerve *in situ* in cadaveric specimens. 85 fascicles were matched in B-mode images and the histology sections. Collagen and myelin concentrations were quantified from trichrome labeling, and backscatter coefficient (-24.89 ± 8.31 dB), attenuation coefficient (0.92 ± 0.04 dB/cm MHz), Nakagami parameter (1.01 ± 0.18) and entropy (6.92 ± 0.83) were calculated from ultrasound data. B-mode texture features were obtained via the gray-level co-occurrence matrix algorithm. Combined collagen and myelin concentration were significantly correlated with the backscatter coefficient (R = -0.68), entropy (R = -0.51), and several texture features. For the median nerve, we measured backscatter and morphology in 10 patients with carpal tunnel syndrome and 21 healthy volunteers. Significant differences (<0.01) between patients and controls and AUC 0.89–0.94 for QUS biomarkers were observed. Our study indicates that QUS may potentially provide useful information on structural components of even very small nerves (2 × 4 mm) and fascicles for diagnosing and monitoring injury, and surgical planning.

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