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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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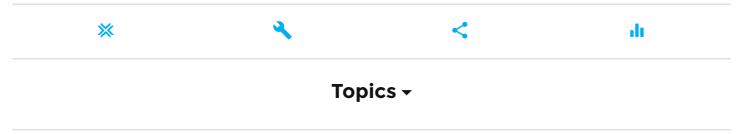
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## ABSTRACT

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 centerfrequency 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  $\pm$  8.31 dB), attenuation coefficient (0.92  $\pm$ 0.04 dB/cm MHz), Nakagami parameter (1.01  $\pm$  0.18) and entropy (6.92  $\pm$ 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 ( $2 \times 4$ mm) and fascicles for diagnosing and monitoring injury, and surgical planning.

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