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Liver fibrosis identification by spectral slope of the backscattering curve

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Ultrasonic tissue characterization is primarily based on radio-frequency (RF) signals. Different studies have demonstrated that the RF signals are closely linked to tissue structures. The processing of these signals using spectral methods has shown the possibility of deriving quantitative parameters (attenuation and backscattered coefficients...) and also of providing a means to estimate the elementary properties of tissue (scatterer size, concentration, periodicity) by evaluating spectral parameters (slope, intercept etc). We have estimated the spectral slope of the average backscattering curve to test its potential in the discrimination of fibrosis stages (F0, F1, F2, F3, and F4, METAVIR scale) from 20 in-vitro human liver samples, insonified at 20 MHz. The slope estimations were (dB/MHz): 0.95,0.24 (F0), 1.15,0.43 (F1), 1.20,0.26 (F3) and 1.07,0.33 (F4). The Kolmogorov-Smirnov test ($p > 0.05$) indicated that the slope alone cannot discriminate all fibrosis groups (as well as the other mentioned parameters). When associated to integrated backscattered coefficient, discriminant analysis has correctly classified 80% of liver samples ($p < 0.0000$). The misclassification resulted from some F0 samples grouped as F4 or vice-versa, which agrees with our previous results that suggested some parameter overlapping for normal and cirrhotic hepatic tissue. Nevertheless, combination of these parameters can help the diagnosis of liver fibrosis