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Estimation of heterogeneity of scatterer densities for diagnosis of liver fibrosis

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In the quantitative diagnosis using ultrasound, existence of the high or low echo which was indistinguishable from speckle serves as an index of diagnosis. In this study, we tried to clarify the relation between the scattering condition in the tissue and the probability density function of echo amplitude. Parameters to estimate the scattering condition were derived by Q-Q probability plot at computer simulation models and the clinical data of liver fibrosis. In the simulation model of heterogeneous medium, the result of Q-Q plot became a curve and the curvature was dependent on the difference of the scatterer density of two intermingled media. In the clinical data of liver fibrosis, curvature was large when many fibers were contained. On the other hand, curvature was small when cysts or minute blood vessels were intermingled in the speckle and the whole distribution function was able to be approximated by k-distribution. Moreover, the crooked point of the Q-Q plot was changed depending on the scatterer density of a mixture part. These results show that the mixture rate and scatterer distributions of two different distribution functions can be recognized parametrically in the liver in which minute diseased tissue was intermingled.