



ACOUSTIC RADIATION FORCE IMPULSE IMAGING FOR THE EVALUATION OF THE RENAL PARENCHYMAL STIFFNESS IN NATIVE KIDNEY - PRELIMINARY RESULTS

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Objectives:

Ultrasound elastography reached nephrologists attention in recent years as potentially valuable noninvasive tool for assessing renal fibrosis. Studies conducted until present report promising and reliable results especially for transplanted kidney. Exploring the native kidney with elastography methods encounters several difficulties due to the complex anatomy of the kidney and its profound location, and extensive studies in this matter are lacking. The aim of the study was to evaluate the shear wave velocity (SWV) in native kidney cortex in patients with and without chronic kidney disease (CKD) using acoustic radiation force impulse imaging (ARFI).

Methods:

In 50 CKD patients (stages 1-5D, 20 women, 30 men, age between 37-79y) and 18 controls (8 women, 10 men, age between 22-68y), SWV of cortex were measured, using ARFI method, by two operators, in the same session, in two sites of the right kidney: mediorenal and inferior pole, subcapsular. Each operator performed 3 exams in the two sites of examination and the average of the measured values was used for statistical analysis. Examinations were performed with Siemens Acuson S 2000 ultrasound system. Gender, age, body mass index (BMI), serum creatinine, albumin, total calcium, phosphate and hsCRP were measured in all patients; GFR was calculated with MDRD formula.

Results:

In CKD cases, the average value of SWV in medio-renal cortex was 2.484m/s for observer 1 (limits 1.96-3.95m/s), and 2.552m/s for observer 2 (limits 1.53-4.03m/s), at an average distance from source to target (depth) of 6.64cm for observer 1 and 6.61cm for observer 2. In control cases, the average values of SWV in mediorenal cortex varied between 2.032m/s for observer 1 (limits 0.81-3.17m/s) and 1.904m/s for observer 2 (limits 0.9-3.8m/s) at an average depth of 6.25cm for observer 1 and 6.34cm for observer 2 respectively. The average level of cortical SWV in inferior pole varied in CKD cases between 2.422m/s for observer 1 (limits 0.59-4.6m/s) and 2.527m/s for observer 2 (limits 0.73-3.98m/s) at a median depth of 6.51cm for observer 1 and 6.64cm for observer 2. In controls, the average level of cortical SWV in inferior pole was 1.945m/s for observer 1 (limits 1.23-2.65m/s) and 2.229 m/s for observer 2 (limits 1.32-3.68m/s) at an average depth of 6.06cm in observer 1 and 5.8cm in observer 2. Intra-observer variation coefficient was 24% for observer 1 and 25% for observer 2. Inter-observer agreement (intraclass coefficients correlation) was 0.62. We revealed significant higher SWV values in CKD when compared with controls, for every stage of CKD ($p < 0.001$), but there was no significant difference between the different stages of CKD. Also it resulted a significant positive correlation between SWV values and age, and BMI respectively ($r = 0.22163$ for age, and $r = 0.384593$ for BMI), both in CKD and in controls, and a significant direct relationship between serum albumin and SWV in CKD cases ($r = 0.549573$, $p < 0.001$). No relation between SWV values and calcium, phosphate or hsCRP levels was present. Significant higher SWV values were observed in men versus women.

Conclusions:

Elastography is a promising tool for assessing kidney fibrosis; further studies are needed to establish standardized technique method and also normal and pathological reference values.