Abstract: Beyond the medical history, the clinical exam and lab findings, non-invasive ultrasound parameters such as kidney size and Doppler values (e.g. the resistive index) are important tools assisting clinical decision making in the monitoring of renal allografts. The gold standard for the diagnosis of renal allograft dysfunction remains the renal biopsy; while an invasive procedure, the justifiable necessity for this derives from its definitive nature a requirement beyond the synopses of all non-invasive tools. "Acoustic Radiation Force Impulse Imaging"(ARFI)-quantification is a novel ultrasound-based technology measuring tissue elasticity properties. So far experience related to this new method has not been reported in renal transplant follow-up. The purpose of this study was to evaluate changes in ARFI-measurements between clinically stable renal allografts and biopsy-proven transplant dysfunction. We employed "Virtual Touch(TM) tissue quantification" (Siemens Acuson, S2000) for the quantitative measurement of tissue stiffness in the cortex of transplant kidneys. We performed initial baseline and later disease-evaluative ultrasound examinations in 8 renal transplant patients in a prospective study design. Patients were first examined during stable allograft function with a routine post-transplant
renal ultrasound protocol. A second follow-up examination was carried out on subsequent presentation with transplant dysfunction prior to allograft biopsy and histological evaluation. All patients were examined using ARFI-quantification (15 measurements/kidney). Resistive indices (RI) were calculated using pulsed-wave Doppler ultrasound, and transplant kidney size was measured on B-mode ultrasound images. All biopsies were evaluated histologically by a reference nephropathologist unaware of the results of the ultrasound studies. Histopathological diagnoses were based on biopsy results, taking clinical and laboratory findings into account. Finally we calculated the relative changes in ARFI-quantification, resistive indices and the absolute change of kidney size on a percentage basis at these defined assessment times and compared the results with the final pathologic diagnosis. Histological results enumerated five cases of acute T-cell-mediated rejection, one case of calcineurin inhibitor toxicity and two cases of acute tubular necrosis. Calcineurin inhibitor toxicity and acute tubular necrosis were subsumed as "other pathologies". Mean ARFI-values showed an average increase of more than 15% percent in transplants with histologically proven acute rejection whereas no increase was seen in transplants with other pathologies. Mean RI-values showed no increase either in the diagnostic group of acute rejection, nor in the group with other pathologies. Kidney size showed a mean absolute increase of 0.5 centimetres in allografts with acute rejection, whereas a mean decrease of 0.17 centimetres was seen in the group with other pathologies. As shown before in other studies, RI values and kidney size are of doubtful utility in the evaluation of kidney allograft dysfunction. ARFI-based elasticity measurement shows promise as a complementary non-invasive parameter in follow-on diagnosis of renal allograft rejection.

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