THE INFLUENCE OF VIBRATION FREQUENCY AND IMAGING PLANE ON STIFFNESS MEASUREMENTS IN RENAL MAGNETIC RESONANCE ELASTOGRAPHY

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TARGET AUDIENCE: MRE community (radiologists and clinical scientists)

PURPOSE: To evaluate the influence of vibration frequency and imaging plane on stiffness measurements in renal magnetic resonance elastography (MRE)

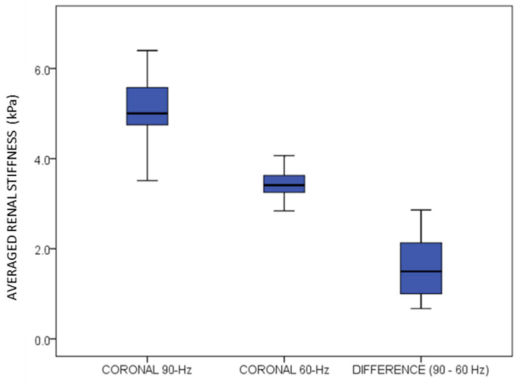
METHODS: Institutional review board approval was granted for this prospective study and all participants provided written informed consent. There were 12 patients (10 males and 2 females) with a median age of 54.5 years (age range 20 to 61 years). All patients had normal renal function.

Coronal 90-Hz and 60-Hz, sagittal 90-Hz and axial 90-Hz spin-echo echoplanar MRE sequences of the kidneys were performed on all patients using the same 1.5-T MRI system. The MRE measured renal stiffness performed on different vibration frequencies ('90-Hz' versus '60-Hz') and different imaging planes ('coronal' versus 'sagittal oblique' versus 'axial' projection) were compared to determine the influence of these variables.

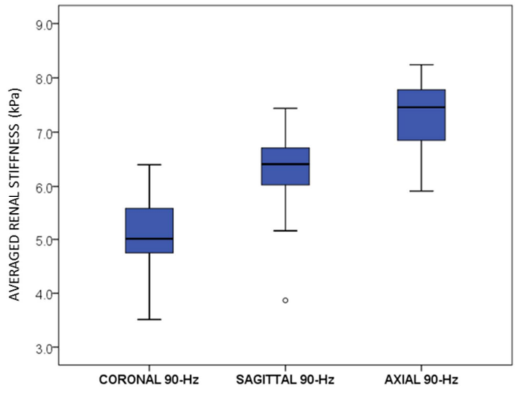
RESULTS: A significant difference in the MRE measured renal stiffness was noted between vibration frequencies ($p = 0.003$) and between imaging planes ($p < 0.001$). Values were expressed as median and interquartile range. The averaged renal stiffness was 5.01 (0.85) kPa and 3.41 (0.46) kPa on coronal 90-Hz and 60-Hz, respectively. The averaged renal stiffness on 90-Hz was highest on the axial plane (7.46 (1.05) kPa), intermediate on the sagittal plane (6.41 (0.71) kPa) and lowest on the coronal plane (5.01 (0.85) kPa).

DISCUSSION: The study findings suggest that vibration frequency and imaging plane are technical parameters that can influence the MRE measured renal stiffness

CONCLUSION: Vibration frequency and imaging plane are technical parameters that merit consideration when planning and interpreting a renal MRE examination. The relationship between stiffness (μ) and frequency (f) obeys the formula, $\mu = \rho\lambda^2 f^2$ (where λ is wavelength of the shear wave). The variable renal stiffness on different imaging planes may be secondary to the anisotropic properties of the kidneys.



Boxplots show the effect of vibration frequency on the MRE measured averaged renal stiffness



Boxplots shows the effect of imaging plane on the MRE measured averaged renal stiffness