

# Quantitative MRI Assessments of Kidney Disease Progression in Patients with Autosomal Recessive Polycystic Kidney Disease (ARPKD)



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## Background

Autosomal Recessive Polycystic Kidney Disease (ARPKD) is an important cause of morbidity and mortality in children with chronic kidney disease (CKD). Novel therapies have shown efficacy in ARPKD animal models, but clinical trials in ARPKD patients have not been possible due to the lack of sensitive measures of kidney disease progression. Non-invasive Magnetic Resonance Imaging (MRI) techniques, including novel MR Fingerprinting (MRF), show promise in addressing this unmet need. We previously identified MRF-based T1 and T2 mapping as potential biomarkers of ARPKD kidney disease in animal models and initial human studies. In the current study, we evaluated the relationship between these MRF-based imaging parameters as well as renal perfusion assessments with clinical assessments of renal function in ARPKD subjects.

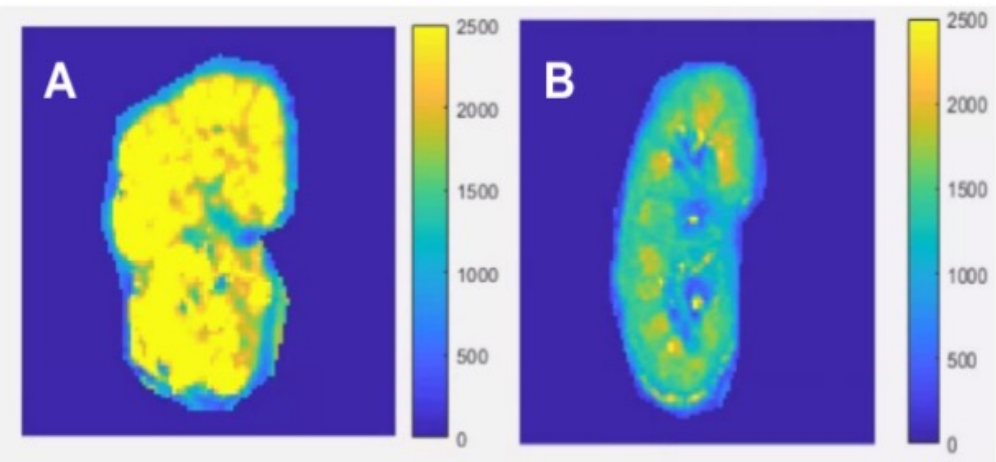


Figure 1. (A) Diseased kidney from adolescent ARPKD patient versus (B) healthy volunteer kidney.

## Goals

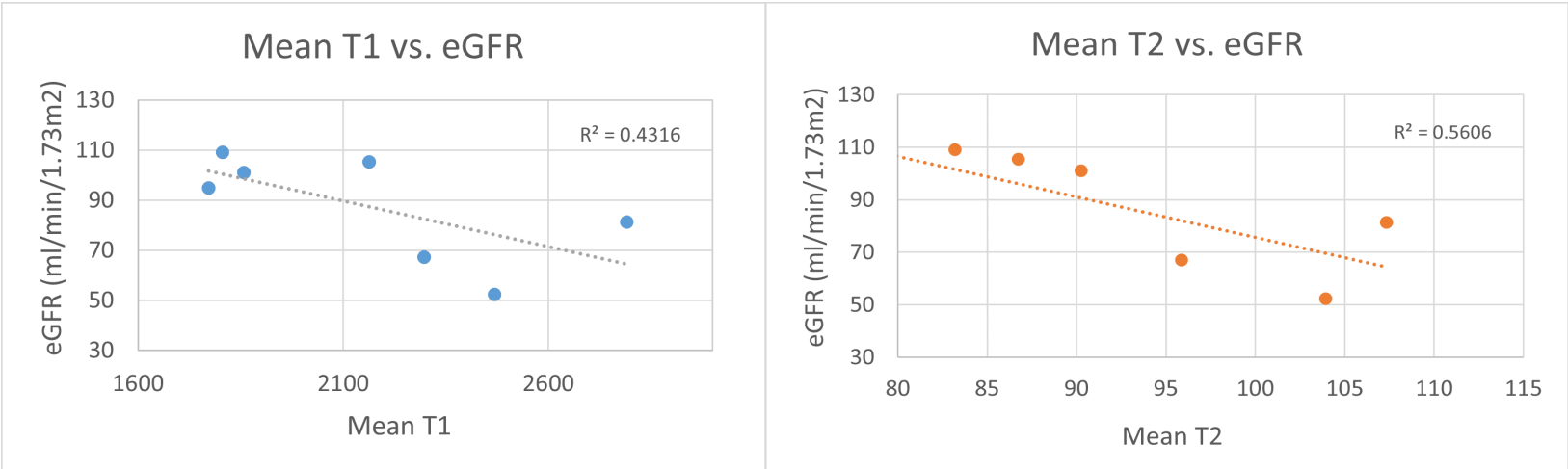
To compare novel quantitative MRI assessments with established clinical measures of kidney disease progression in subjects with ARPKD.

## Methods

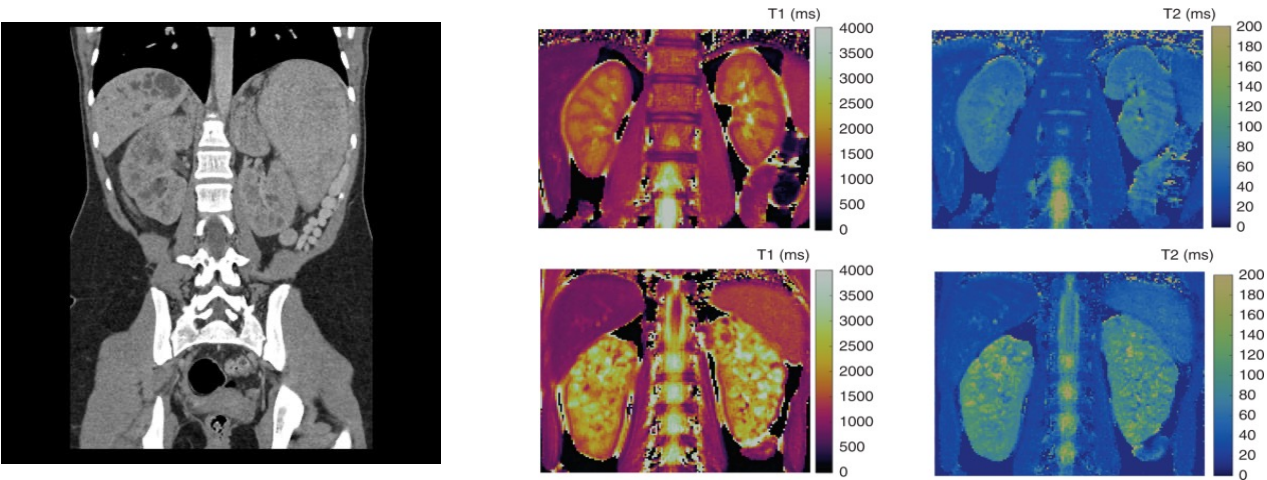
ARPKD subjects were scanned on a Siemens 3T MRI scanner utilizing novel MRF technology to simultaneously generate kidney T1 and T2 maps in 15 secs/imaging slice with no sedation or injectable contrast agent. A non-contrast kidney perfusion scan was also used to provide a quantitative assessment of renal cortical perfusion. These three MRI metrics were compared with conventional clinical assessments of estimated glomerular filtration rate (eGFR) as a measure of kidney function.

## Results

Seven subjects with ARPKD (2M/5F, age range = 06-22; eGFR range = 52-109 ml/min/1.73m<sup>2</sup>) were scanned. Mean kidney T2 values demonstrated a significant negative correlation with eGFR ( $R^2=-0.75$ ,  $p=0.052$ ). Mean kidney T1 (2162 376 msec) also showed a strong negative correlation ( $R=-0.66$ ) and did not yet reach significance ( $p=0.11$ ) either. Mean T1 and T2 values for the right and left kidneys did demonstrate a significant correlation (T1:  $R=0.99$ , T2:  $R=0.86$ ). The eGFR values are not yet significantly correlated with perfusion ( $R=0.33$ ,  $p=0.24$ ).



Mean kidney T2 values demonstrated a significant negative correlation with eGFR ( $R^2=-0.59$ ,  $p=0.043$ ). Mean kidney T1 also showed a strong negative correlation ( $R^2=-0.51$ ) but did not yet reach significance ( $p=0.07$ ).



## Conclusion

This is the first study to establish a relationship between MRI-derived imaging biomarkers (T1, T2, perfusion) and kidney function (eGFR) in ARPKD subjects. Despite the small cohort, data clearly demonstrate that mean T1 and T2 both increase with declining eGFR. These important findings suggest that MRF-based T1 and T2 mapping may provide a safe, non-invasive, quantitative, and reproducible measure of kidney disease severity to support future clinical trials to identify subjects at high risk for disease progression and monitor response to treatment.