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(U*) (POS-59) Using Ultrasound Imaging for Quantifying Kidney Fibrosis

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Chronic Kidney Disease (CKD) affects ˜10% of the world population. There is no cure for CKD and kidney transplantation remains the only option. However, the donor pool is very small compared to the number of patients on the waiting list. This small donor pool consequentially leads to patients receiving older, less healthy kidneys with pre-existing fibrosis. Fibrosis is characterized by the accumulation of extracellular matrix proteins, which impairs kidney function. As tissue microstructures cannot be easily identified through non-invasive imaging tools, biopsies are considered the gold standard of assessment. This method however does have limitations as the small biopsy sections are not representative of the total fibrotic burden on the kidney.

In this project, we are working towards exploring whether ultrasound (US) imaging can detect and quantify kidney fibrosis. US imaging is a non-invasive alternative to a renal biopsy, can assess the full kidney, and it is also widely accessible. Using signal analysis techniques on B-mode US images of murine kidneys, this work aims to find differences in US imaging for varying degrees of renal fibrosis with comparisons to acquired histological data.

As there are 59 US frames in a single acquisition (5 Hz frame rate), the signal analysis technique employed compares the signal amplitude values for each pixel in the kidney ROI of the B-mode images for each frame relative to the first acquired frame. This method found that during 12 seconds of US acquisition, pixel signal amplitudes within the kidney fluctuate by amounts as large as 8500 (a.u.), especially in kidneys with fibrosis. Additionally, the deviation of pixel signal amplitude values from those in the first acquired frame increases as high as ±200 (a.u.) as imaging time progresses, especially for kidneys with fibrosis.

These temporal changes in pixel signal amplitudes during US image acquisition suggest that this method could be the new standard for the non-invasive quantification of kidney fibrosis.

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