

## Cardiac Magnetic Resonance Imaging for the Assessment of Intra-dialytic Diastolic Function

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Myocardial diastolic dysfunction (DD) is an independent risk factor for morbidity and mortality in haemodialysis (HD) patients. DD often precedes systolic dysfunction and is evident in up to 50% of patients with ESKD and preserved systolic function.

Cardiac Magnetic Resonance Imaging (CMRI) is the gold standard for assessing diastolic dysfunction through assessment of left ventricular (LV) deformation and left atrium (LA) size. In this study, CMRI was used to assess changes in diastolic function during a HD treatment.

Methods: Participants underwent serial CMRI (Phillips 3T Achieva) including short-axis cine, 2 and 4 chamber views and cardiac tagging during a single HD treatment; the scans were performed pre-dialysis, during dialysis at 30, 120, 180 mins and 30 mins post-dialysis.

LV longitudinal diastolic deformation parameters of early diastolic strain rate (eDSR) and peak diastolic strain rate (pDSR) expressed as percentage per second (%.s<sup>-1</sup>) were assessed. Lower values indicate a decline in the rate of LV relaxation and therefore ventricular filling. Left-atrial volume index ml/m<sup>2</sup> (LAVI) was assessed as a chronic marker of DD with LA enlargement being an independent cardiovascular risk factor.

Results: 10 participants were studied: median age 47yrs (IQR 41 to 62), two female, three with pre-existing LVH. Median dialysis vintage was 14.5 months (4.4 to 73.5), median pre-dialysis systolic blood pressure 134 (116 to 155) mmHg and diastolic blood pressure 78 (71 to 84) mmHg.

Prior to the commencement of dialysis, all participants had lower eDSR and pDSR values than normal adult reference ranges. Median pre-dialysis values for eDSR and pDSR were 32.1 (25.5 to 38.0)%.s<sup>-1</sup> and 53.7 (40.6 to 63.6) %.s<sup>-1</sup> respectively. Median eDSR and pDSR did not change significantly across the different HD time-points, but nadir eDSR (22.4, IQR 15.9 to 31.5%.s<sup>-1</sup>, p=0.05) and nadir pDSR (40.7, IQR 27.0 to 52.9%.s<sup>-1</sup>, p=0.04) were significantly lower than pre-dialysis values. Lower eDSR values were associated with higher total ultrafiltration volume and ultrafiltration rate, at 30 minutes (r=-0.85, p=0.01 and r=-0.9, p=0.007, respectively) and nadir (r=-0.64, p=0.05 and r=-0.74, p=0.02, respectively). Neither eDSR or pDSR were affected by changes in systolic/diastolic BP.

Prior to commencement of dialysis, participants had higher LAVI values than normal adult reference ranges. Pre-dialysis median LAVI was 41.1 (35.1 to 44.2) ml/m<sup>2</sup> and declined at 120 mins to 24.5 (18.3 to 35.5) ml/m<sup>2</sup> (p=0.01) and at 180 mins to 31.7 (30.1 to 44.7) ml/m<sup>2</sup> (p=0.05) but returned to baseline values post-dialysis (31.7 (IQR 30.1 to 44.7) ml/m<sup>2</sup> (p=0.4). At 180 mins higher UF volumes were associated with lower LAVI (r=-0.67, p=0.05). LAVI was not affected by changes in systolic/diastolic BP.

### Conclusion

This is the first study to utilize CMRI to assess intra-dialytic myocardial diastolic function. Prior to dialysis all participants evidenced DD, even those with no history of cardiac dysfunction. During dialysis, diastolic dysfunction deteriorated, which was associated with ultrafiltration volume and rate. Our data add to previous studies showing that diastolic function, in addition to systolic function, is adversely affected by haemodialysis.