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Longitudinal cardiac rotation abnormalities in children and young adults with end-stage renal failure undergoing hemodialysis: A pilot study

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Background: Longitudinal cardiac rotation (LR) is a movement of the apex during systole and diastole, with the heart appearing to rotate in a clockwise or counterclockwise direction. In this pilot study, we hypothesized that LR abnormalities are present in children with end-stage kidney disease (ESKD) undergoing hemodialysis (HD). We also assessed the effect of preload on LR.

Methods: Twelve patients with ESKD (58% male; aged 17.5 ± 4.4 years) were prospectively studied. Four-chamber views were acquired 1 hour before and after HD. Data were compared with 12 controls. Speckle tracking imaging was used for assessment of LR ($^{\circ}$), longitudinal strain (%), and mechanical dyssynchrony (septum-lateral delay).

Results: LR abnormalities were seen in 50% of patients (end-systolic LR $< -3.00^{\circ}$ or $> +3.00^{\circ}$). In 4 patients, LR changed in the opposite direction after HD. LR abnormalities were not seen in controls (LR between -2.00° and $+2.00^{\circ}$). Controls showed the highest mean longitudinal strain (patients: $-19.75 \pm 1.81\%$ vs controls: $-22.60 \pm 3.00\%$, $P < 0.0001$). Longitudinal strain decreased significantly after HD (preHD: $-19.75 \pm 1.81\%$ vs postHD: $-17.41 \pm 1.68\%$, $P < 0.0001$). Mechanical dyssynchrony was more pronounced in patients (patients: 140.4 ± 90.0 msec vs controls: 106.4 ± 68.9 msec, $P < 0.0001$), and increased after HD (preHD: 93.1 ± 84.6 msec vs postHD: 140.4 ± 90.0 msec, $P = 0.003$).

Conclusions: Patients with ESKD have LR abnormalities, impaired longitudinal strain and more pronounced dyssynchrony. Preload reduction acutely changed the direction of LR in $\sim 30\%$ patients.

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