

ECHOCARDIOGRAPHIC EVALUATION OF ACUTE CHANGES IN NOVEL INDICES OF LEFT VENTRICULAR SYSTOLIC AND DIASTOLIC FUNCTION DURING HEMODIALYSIS IN END-STAGE RENAL DISEASE PATIENTS

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Background/Aims: Left ventricular hypertrophy and impaired diastolic function of left ventricle (LV) are highly prevalent among hemodialysis patients and represent strong predictors of cardiovascular morbidity and mortality [1, 2]. Previous studies investigating the effect of hemodialysis on LV function gave contradictory results [3-5]. Therefore, the aim of this study was to evaluate potential acute changes in novel echocardiographic and tissue Doppler-derived indexes of LV function during a mid-week dialysis session.

Methods: A total of 42 stable patients receiving standard thrice-weekly hemodialysis for at least 3 months were included in this study. Two-dimensional echocardiographic and tissue Doppler imaging studies were performed shortly before and after the mid-week dialysis session, using a standard ultrasound machine (Vivid 7, GE, Vingmed, Horten, Norway). Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 17.0 for windows XP (SPSS Inc, Chicago, Illinois, USA). For comparisons between the start and the end of the dialysis session paired t-tests or Wilcoxon Signed Rank tests were used, according to the normality of the distribution.

Results: Baseline demographic characteristics and the primary cause of ESRD of study participants are presented in Table 1. A total of 42 hemodialysis patients (23 males and 19 females) with a mean age of 60.0 ± 14.1 years participated in this study. Body weight was significantly reduced from pre- to post-dialysis (70.7 ± 12.9 vs 69.0 ± 12.5 kg, $P < 0.05$). Changes in echocardiographic indices of LV systolic and diastolic function are depicted in Table 2. Between the start and end of dialysis, significant reductions in LV end-diastolic diameter (LVEDD) (4.62 ± 1.1 vs 4.34 ± 1.1 cm, $P < 0.001$) and LV end-systolic diameter (LVESD) (3.33 ± 0.7 vs 3.19 ± 0.8 cm, $P < 0.05$) were evident. In contrast, stroke volume, cardiac output and LV ejection fraction remained unchanged during dialysis (Table 2). With regards to LV diastolic function, ratio of early to late Doppler velocities of diastolic mitral inflow (E/A) (1.14 ± 0.5 vs 0.83 ± 0.5 , $P < 0.001$), left atrial volume (LAV) (95.8 ± 27.3 vs 64.5 ± 28.9 cm³, $P < 0.001$) and EM/AM ratios at the LV lateral and septal wall were significantly reduced between the start and end of during dialysis.

Conclusion: This study shows that volume withdrawal during hemodialysis improves sizing of LV and reduces LV filling pressures during diastole. Future prospective studies are needed to elucidate whether this dialysis-induced improvement in diastolic LV function is associated with benefits on cardiovascular morbidity and mortality in hemodialysis patients.

REFERENCES

1. Trespalacios FC, Taylor AJ, Agodoa LY, Bakris GL, Abbott KC: Heart failure as a cause for hospitalization in chronic dialysis patients. *Am J Kidney Dis* 2003; 41: 1267-1277.
2. Foley RN, Parfrey PS, Sarnak MJ: Epidemiology of cardiovascular disease in chronic renal disease. *J Am Soc Nephrol* 1998; 9:S16-S23.
3. Barberato S, Mantilla DEV, Misocami M, Goncalves SM, Bignelli AT, Riella MC et al. Effect of preload reduction by hemodialysis on left atrial volume and echocardiographic Doppler parameters in patients with end-stage renal disease. *Am J Cardiol* 2004;94:1208-10.
4. Chakko S, Girgis I, Contreras G, Perez G, Kessler KM, Myerburg RJ. Effects of hemodialysis on left ventricular diastolic filling. *Am J Cardiol* 1997;79:106-8.
5. Drighil A, Madias JE, Mathewson JW, El Mosalami H, El Badaoui N, Ramdani B, Bennis A. Haemodialysis: effects of acute decrease in preload on tissue Doppler imaging indices of systolic and diastolic function of the left and right ventricles. *Eur J Echocardiogr.* 2008; 9:530-5.

Table 1: Baseline characteristics of study participants (m±SD)

N	42
Sex (male/female)	23/19
Age (years)	60.0 ± 14.1
Dry weight (kg)	65.9 ± 15.7
Height (m)	1.65 ± 0.1
Primary cause of ESRD	
Diabetes	10/42
Hypertension	11/42
Glomerulonephritis	6/42
Polycystic kidney disease	1/42
Obstructive nephropathy	3/42
Unknown	11/42

Table 2. Changes in echocardiographic indices of left ventricular function during a mid-week hemodialysis session (m±SD).

Parameter	Before HD	After HD	P Value
IVS (cm)	1.31±0.3	1.25±0.2	<0.001
PW (cm)	1.44±1.1	1.46±1.2	<0.05
LVEDD (cm)	4.62±1.1	4.34±1.1	<0.001
LVESD (cm)	3.33±0.7	3.19±0.8	0.06
LA (cm)	5.23±7.1	4.87±6.9	<0.001
LVOT (cm)	1.97±0.2	1.97±0.2	0.96
LVOT VTI (cm)	27.2±8.9	24.1±5.9	<0.05
LVEF (%)	56.05±10.7	55.51±12.2	0.58
HR (bpm)	69.30±10.2	75.38±12.1	<0.001
SV (ml)	83.2±29.9	73.7±21.1	0.12
PVR (dyn.sec.cm ⁻⁵)	1.57±0.4	1.60±0.4	0.91
CO (L/min)	5.70±2.2	5.45±1.4	0.72
E (m/sec)	0.92±0.2	0.78±0.3	0.001
A (m/sec)	0.84±0.2	0.89±0.2	0.35
E/A	1.14±0.5	0.83±0.5	<0.001
DT (msec)	225.5±51.9	224.5±54.1	0.84
AT (sec)	0.10±0.03	0.11±0.10	0.50
SM LAT (m/sec)	0.078±0.02	0.085±0.01	<0.05
EM LAT (m/sec)	0.099±0.03	0.094±0.02	0.07
AM LAT (m/sec)	0.082±0.02	0.090±0.02	<0.05
EM/AM LAT	1.32±0.6	0.96±0.4	<0.01
E/EM LAT	10.02±3.3	9.32±4.1	<0.05
IVCT LAT (sec)	0.092±0.01	0.070±0.02	0.47
ET LAT (m/sec)	0.30±0.01	0.28±0.05	<0.05
IVRT LAT (sec)	0.07±0.02	0.07±0.02	0.71
TEI LAT	0.57±0.3	0.55±0.2	0.49
SM IVS (m/sec)	0.07±0.02	0.07±0.02	0.47
EM IVS (m/sec)	0.07±0.02	0.08±0.03	0.41
AM IVS (m/sec)	0.07±0.02	0.08±0.02	<0.01
EM/AM IVS	1.27±1.2	1.01±1.2	0.001
E/EM IVS	13.8±4.5	13.9±7.3	0.48
IVCT IVS (sec)	0.07±0.01	0.07±0.01	0.47
ET IVS (m/sec)	0.33±0.07	0.29±0.05	<0.01
IVRT IVS (sec)	0.07±0.02	0.08±0.03	0.45
TEI IVS	0.46±0.1	0.56±0.2	<0.01
IVCD (cm)	1.79±3.9	1.78±2.5	<0.05
LVEDV (ml)	109.9±38.5	103.3±39.4	0.001
LVESV (ml)	49.6±25.2	46.4±23.5	<0.05
LAV (ml)	95.8±27.3	64.5±28.9	<0.001

