

# CHANGES IN LEFT VENTRICULAR SIZING AND FUNCTION OVER THE 3-DAY AND 2-DAY INTERDIALYTIC INTERVALS IN HEMODIALYSIS PATIENTS

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**Introduction:** The long interdialytic interval in thrice-weekly hemodialysis is associated with increased risk of cardiovascular morbidity and mortality [1-3]. However, the mechanistic background of this adverse effect is not fully clear [4,5]. This study investigated the changes in left ventricular (LV) sizing and function during the 2-day and 3-day interdialytic intervals.

**Methods:** A total of 41 adult patients receiving thrice-weekly hemodialysis for at least 3 months participated in this study. Two-dimensional echocardiographic and tissue-Doppler imaging studies were performed with a standard cardiac ultrasound device (Vivid 7, GE, Horten, Norway) at start and end of the 3-day and 2-day interdialytic intervals. Participants were randomly assigned into two cross-over sequences of recordings; 3-day followed by 2-day interval or vice versa.

**Results:** The baseline demographic and clinical characteristics of study participants are depicted in Table (1). Study participants had a mean age of 58.7±14.7 years and were receiving hemodialysis for a mean time-period of 57.8±57.2 months. Increases in body weight were evident during both interdialytic periods. Interdialytic-weight-gain (IDWG) (3.0±1.6 vs 2.4±1.3 kg, P<0.001) was higher during the 3-day than during the 2-day interval (Table 2). Significant increases in stroke volume and cardiac output were noted during both interdialytic periods, whereas LV ejection fraction remained constant in both occasions. Interdialytic changes in indices of LV systolic function were no different between the 2 intervals studied (Table 3). A significant elevation in LV mass index (LVMI) was observed during both intervals (3-day: 124.7±57.7 vs 139.2±66.2 gr/m<sup>2</sup>, P=0.001; 2-day: 121.2±62.7 vs 136.9±60.9 gr/m<sup>2</sup>, P<0.001). This interdialytic increase in LVMI was predominantly due to LV chamber dilatation, whereas the LV wall thickness remained unchanged. With regards to LV diastolic function, peak early (E) and the ratio of peak early to late mitral inflow velocity (E/A), deceleration time (DT) of the mitral E wave, and E/Em displayed comparable increases during both interdialytic intervals (Table 3). Left atrial (LA) volume index was significantly increased between the start and end of 3-day and 2-day intervals and this increase was significantly greater during the 3-day interval (P<0.05).

**Conclusion:** This study shows LA enlargement, LV chamber dilatation and LV filling pressures elevation during the 3-day and 2-day interdialytic intervals. Larger LA sizes over the long interdialytic may act as triggering factor for arrhythmias and sudden deaths, providing one possible mechanistic explanation for the heightened cardiovascular risk of hemodialysis patients during this period.

**Table 1:** Demographic and clinical characteristics of study participants.

Characteristic	Value
N	41
Age (years)	58.7±14.7
Male, n (%)	24 (59%)
Height (m)	1.65±0.1
BMI (kg/m <sup>2</sup> )	25.2±4.8
Duration of dialysis (months)	57.8±57.2
≤ 1 year of dialysis, n (%)	11 (26.8%)
Weekly dialysis schedule, n (%)	
Monday, Wednesday and Friday	21 (51.2%)
Tuesday, Thursday and Saturday	20 (48.8%)
Cause of ESRD, n (%)	
Diabetes mellitus	10 (24.4%)
Hypertension	9 (22.0%)
Glomerulonephritis	6 (14.6%)
Polycystic kidney disease	1 (2.4%)
Obstructive Uropathy	3 (7.3%)
Unknown	12 (29.3%)

**Table 2:** Body weight, hemodynamic and echocardiographic indices of left ventricular remodeling and function during the 3-day and 2-day interdialytic intervals.

Parameter	3-day Interdialytic Interval			2-day Interdialytic Interval		P Value
	Visit 1 (post-HD, 3-day start)	Visit 2 (pre-HD, 3-day end)	P Value	Visit 3 (post-HD, 2-day start)	Visit 4 (pre-HD, 2-day end)	
Body weight (kg)	69.2±12.1	72.2±12.5	<0.001	69.3±12.5	71.7±12.5	<0.001
SBP (mmHg)	135.1±19.6	145.5±21.6	<0.001	135.9±23.5	143.1±19.8	<0.001
DBP (mmHg)	76.1±13.1	77.9±13.4	0.3	76.8±11.2	78.2±11.2	0.4
HR (bpm)	74.9±12.6	70.1±10.9	0.001	73.6±13.5	69.0±10.3	0.003
SV (ml)	68.8±21.3	80.8±18.2	<0.001	72.9±26.8	81.9±29.3	0.05
CO (l/min)	5.05±1.5	5.68±1.5	0.007	5.35±2.2	5.66±2.2	0.4
LVEF (%)	56.7±13.5	55.3±12.4	0.5	56.2±11.1	56.1±10.7	0.9
IVSd (cm)	1.27±0.2	1.29±0.2	0.4	1.28±0.2	1.29±0.3	0.2
PWd (cm)	1.43±0.2	1.45±0.2	0.5	1.42±0.2	1.43±0.2	0.7
LVEDD (cm)	4.2±1.1	4.6±1.1	0.005	4.2±1.1	4.5±1.1	<0.001
LVMI (gr/m <sup>2</sup> )	124.7±57.7	139.2±66.2	0.001	121.2±62.7	136.9±60.9	<0.001
E wave (cm/sec)	0.76±0.3	0.96±0.3	<0.001	0.75±0.3	0.92±0.2	<0.001
A wave (cm/sec)	0.84±0.2	0.85±0.2	0.5	0.85±0.2	0.84±0.2	0.6
E/A	0.97±0.5	1.18±0.5	0.001	0.94±0.5	1.17±0.5	<0.001
DT (msec)	241.2±80.9	232.1±62.9	0.5	242.9±63.3	224.8±51.5	0.02
E/Em lateral	8.8±3.5	11.2±5.1	<0.001	9.3±5.2	10.0±3.3	0.2
E/Em IVS	13.1±6.6	13.8±5.7	0.4	13.6±7.3	13.8±4.5	0.778
LVEDVi (ml/m <sup>2</sup> )	53.8±22.9	58.3±19.9	0.05	54.8±23.3	60.2±20.8	0.009
LVESVi (ml/m <sup>2</sup> )	23.6±13.8	26.2±12.9	0.05	24.1±12.8	27.1±13.5	0.004
LAVi (ml/m <sup>2</sup> )	34.9±13.8	44.6±16.0	<0.001	35.7±14.3	41.9±16.2	<0.001

**Table 3:** Comparison of the net changes in hemodynamic and echocardiographic indices of LV sizing and function between the 3-day and 2-day interdialytic intervals

Parameter	3-day vs 2-day Interval		
	Net Changes 3-day interval	Net Changes 2-day interval	P value
Body weight (kg)	3.0±1.7	2.4±1.3	0.04
SBP (mmHg)	10.4±6.2	7.3±8.3	0.06
DBP (mmHg)	1.8±11.8	1.3±9.7	0.9
HR (bpm)	-4.5±7.6	-4.6±9.2	0.9
SV (ml)	12.0±19.5	9.2±27.2	0.6
CO (l/min)	0.63±1.40	0.29±1.99	0.4
LVEF (%)	-1.4±12.7	-0.2±7.7	0.6
IVSd (cm)	0.02±0.17	0.02±0.15	0.9
PWd (cm)	0.02±0.19	0.01±0.19	0.8
LVEDD (cm)	0.3±0.1	0.3±0.06	0.9
LVMI (gr/m <sup>2</sup> )	14.5±24.4	15.7±18.5	0.8
E wave (cm/sec)	0.21±0.24	0.16±0.20	0.3
A wave (cm/sec)	0.02±0.20	-0.01±0.18	0.4
E/A	0.21±0.39	0.23±0.28	0.8
DT (msec)	-9.1±79.9	-18.2±46.9	0.5
E/Em lateral	2.4±4.2	0.7±3.3	0.05
E/Em IVS	0.7±6.0	0.2±5.6	0.7
LVEDVi (ml/m <sup>2</sup> )	4.5±13.65	5.4±11.9	0.8
LVESVi (ml/m <sup>2</sup> )	2.7±8.0	3.0±5.9	0.8
LAVi (ml/m <sup>2</sup> )	9.9±9.5	6.2±6.5	0.05

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