

EFFECT OF HEMODIALYSIS ON SYSTOLIC AND DIASTOLIC PERFORMANCE OF RIGHT VENTRICLE IN PATIENTS WITH END-STAGE RENAL DISEASE

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Background: Among end-stage renal disease (ESRD) patients receiving maintenance hemodialysis therapy, right ventricular (RV) dysfunction is strong predictor of cardiovascular morbidity and mortality [1--3]. Volume overload is suggested as a major pathogenic mechanism of RV dysfunction [4]. However, it remains unclear whether pre-load reduction during hemodialysis culminates in improvement in RV function during systole and diastole [5].

Aim: The aim of this study was to investigate the acute changes of novel echocardiographic and tissue Doppler-derived indices of RV 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 and routine pre-dialysis biochemical characteristics 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. Between the start and end of dialysis, a significant reduction in body weight was evident (70.7 ± 12.9 vs 69.0 ± 12.5 kg, $P < 0.05$) (Figure 1). Changes in echocardiographic indices of RV function during a regular midweek dialysis session are depicted in Table 2. RV systolic pressure (RVSP) and time velocity integral of RV overflow (TRVmax) were significantly reduced during dialysis (RVSP: 41.5 ± 18.8 vs 32.3 ± 17.6 mmHg, $P < 0.05$ and TRVmax: 2.68 ± 0.5 vs 2.47 ± 0.5 cm/sec, $P < 0.001$). Right atrial volume (RAV) was significantly lower post-dialysis vs pre-dialysis (48.8 ± 22.1 vs 40.2 ± 20.3 cm, $P < 0.001$), whereas isovolumic relaxation time of RV (IVRT-RV) and E/EM ratio of RV remained unchanged (Table 2). Similarly to indices of RV diastolic function, peak systolic RV velocity (SM-RV) and myocardial performance index of RV (TEI-RV) were not significantly changed between the start and end of dialysis (SM-RV: 0.14 ± 0.03 vs 0.15 ± 0.04 cm/sec, $P = 0.20$ and TEI-RV: 0.65 ± 0.6 vs 0.62 ± 0.6 , $P = 0.88$).

Conclusion: This study showed that hemodialysis procedure acutely reduces loading in pulmonary circulation, without affecting the systolic and diastolic performance of RV. Prospective studies are warranted to fully elucidate the significance of intradialytic changes in RV function for cardiovascular risk prediction in dialysis.

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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
Hb (g/dl)	11.2 ± 1.3
Glucose (mg/dl)	98.6 ± 35.7
Urea (mg/dl)	138.3 ± 37.3
Creatinine (mg/dl)	8.3 ± 2.9
Potassium (mmol/l)	5.3 ± 0.8
Sodium (mmol/l)	140.6 ± 3.2
Calcium (mg/dl)	9.0 ± 0.8
Phosphate (mg/dl)	4.7 ± 1.1

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

Parameter	Before HD	After HD	P Value
RVEDD	3.42±0.9	3.11±0.9	<0.001
SM RV (m/sec)	0.14±0.03	0.15±0.04	0.20
EM RV (m/sec)	0.12±0.04	0.11±0.04	<0.05
AM RV (m/sec)	0.15±0.05	0.15±0.04	0.59
EM/AM RV	0.94±0.6	0.75±0.4	<0.05
E/EM RV	8.0±2.3	7.7±2.8	0.69
IVCT RV (sec)	0.07±0.02	0.07±0.02	0.63
ET RV (m/sec)	0.32±0.09	0.29±0.06	0.07
IVRT RV (sec)	0.10±0.13	0.11±0.13	0.42
TEI RV	0.65±0.6	0.62±0.6	0.88
TVR max (cm/sec)	2.68±0.5	2.47±0.5	<0.001
PGr TVR (mmHg)	29.9±13.0	25.6±12.0	<0.001
RAP (mmHg)	0.61±2.7	0.68±2.4	<0.05
RVSP (mmHg)	41.5±18.8	32.3±17.6	<0.05
RAV (ml)	48.8±22.1	40.2±20.3	<0.001

Figure 1: Change in body weight during a mid-week dialysis session

