

## Left ventricular diastolic dysfunction in chronic renal failure patients on chronic hemodialysis in Dr. Cipto-Mangunkusumo Hospital : the association with left ventricular mass

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### Abstrak

Empat puluh tiga kasus pasien gagal ginjal kronik (GGK) yang menjalani dialisis kronik di Divisi Ginjal Hipertensi, Fakultas Kedokteran Universitas Indonesia/Rumah Sakit Umum Pusat Nasional Dr Cipto Mangunkusumo, Jakarta, selama bulan Oktober 2003 sampai dengan bulan Februari 2004, dilakukan pemeriksaan ekokardiografi untuk melihat fungsi diastolik ventrikel kiri dan penilaian indeks massa ventrikel kiri. Disfungsi diastolik ditemukan pada 58.1 % pasien GGK yang menjalani dialisis kronik. Tidak terdapat perbedaan bermakna rerata massa ventrikel kiri pada kelompok dengan disfungsi diastolik dibandingkan kelompok tanpa disfungsi diastolik. (*Med J Indones 2006; 15:105-8*)

### Abstract

Fourty three patients with chronic renal failure undergoing chronic hemodialysis in Division of Nephrology and Hypertension, Faculty of Medicine, University of Indonesia/Cipto-Mangunkusumo Hospital, Jakarta, since October 2003 until February 2004, were examined for echocardiography (2-D, M-mode, Doppler imaging). Diastolic dysfunction was found in 58.1 % of chronic renal failure patients on hemodialysis. There was no significant difference between left ventricular mass in the group with or without left ventricular diastolic dysfunction. (*Med J Indones 2006; 15:105-8*)

**Keywords:** Left ventricular mass, diastolic function, chronic renal failure, hemodialysis

An epidemiological<sup>1</sup>, clinical and echocardiographics studies<sup>2,3</sup> showed that patients with chronic renal failure include patients with chronic hemodialysis<sup>4,5</sup> have abnormalities of both left ventricular structure and function. Cardiovascular disease is the most common cause of death in dialysis subject.<sup>6</sup>

Gagliardi GM et al<sup>5</sup>, reported prevalence of diastolic dysfunction in chronic renal failure patients on hemodialysis about 77.4 %. Left ventricular diastolic function studies in chronic renal failure patients, especially on hemodialysis in Indonesia has not been reported.

In adults with hypertension and chronic renal failure, left ventricular hypertrophy (LVH) is thought to be initially adaptive to improve contractility and lower stress in the face of increased afterload (blood pressure) and preload (volume). The progression of renal failure frequently leads to systolic dysfunction, which is associated with clinical signs of cardiac failure and decreased survival.<sup>7,8</sup>

The association between left ventricular mass and left ventricular diastolic function in chronic renal failure patients on chronic hemodialysis in Indonesia has not been reported. The aims of this study were to evaluate diastolic function in chronic renal failure patients on hemodialysis and determine the association between left ventricular mass and left ventricular diastolic function.

### METHODS

This was a cross sectional study at Dialysis Unit Division of Nephrology and Hypertension and Division of Cardiology Department of Internal Medicine Faculty

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of Medicine University of Indonesia / Ciptomangunkusumo Hospital. The study began in October 2003 and was completed by February 2004. The diagnosis of chronic renal failure was established base on creatinin clearance and ultrasonography.

All patients had a history and physical examination. Clinical data were collected on the day of the echocardiography evaluation including height, weight, body mass index, heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP) and hemoglobin.

**Echocardiography**

Echocardiograms were recorded with a commercially available ultrasound system (Apogee CX 200). Subjects were examined in the left lateral decubitus position using standard parasternal, short-axis, and apical views. All recordings and measurements were obtained by the same observer according to the recommendations of the American Society of Echocardiography.<sup>9</sup>

The measurement of transmitral blood flow velocity and Doppler pulse sample volume were put on the middle of mitral annulus. In addition, transmitral Doppler flow pattern : peak E velocity in centimeters per second (peak early transmitral filling velocity during early diastole), peak A velocity in centimeters per second (peak transmitral atrial filling velocity during late diastole). Then, the E/A ratio and deceleration time in milliseconds (time elapsed between peak E velocity and the point where the extrapolation of the deceleration slope of the E velocity crosses the zero baseline) were calculated.

Pulmonary venous flow recordings were obtained from the four-chamber view directed at the right upper pulmonary vein. Sample volume was obtained 1–2 cm into the pulmonary vein, and the following measurements were carried out: peak S wave velocity in centimeters per second (peak systolic pulmonary venous inflow velocity during ventricular systole), peak D wave velocity in centimeters per second (peak diastolic pulmonary venous inflow velocity during early phase of atrial diastole), and peak A wave velocity in centimeters per second (peak reversed systolic wave during atrial contraction).<sup>10</sup>

The definitions published by the Canadian consensus on diastolic dysfunction by echocardiography were used to classify diastolic function as follows: normal, impaired relaxation, pseudonormal, and restrictive pattern. All cardiac valves were examined to rule out significant valvular disease.<sup>11</sup>

Left ventricular mass was calculated with formula :  $LVM (g) = 0.8 \times 1.04 (LVEDD + IVST + PWT)^3 - (LVEDD)^3 + 0.6$ , LVEDD was left ventricle end diastolic internal diameter, IVST was interventricular septal thickness and PWT was posterior wall thickness.<sup>12</sup>

**Statistic Analysis**

Values are presented as mean ± SD. A 2 sample t test was used to compare mean ± SD of continuous variables. P < 0,05 was considered statistically significant.

**RESULTS**

**Patient Characteristics**

The main demographic and clinical characteristics are presented in table 1.

Table 1. Patients Characteristics

Age,y	52.09 ± 10.75
Body Surface Area (BSA)	1.6 ± 0.18
Systolic blood pressure (SBP) ( mm Hg)	154.42 ± 24.52
Diastolic blood pressure (SBP) ( mm Hg)	91.40 ± 9.15
Hemoglobin, g/dl	9.03 ± 0.95
Left ventricular mass	257.04 ± 101.63
Left ventricular mass index (LVMI)	159.97 ± 3.49
Duration of hemodialysis, y	4.12 ± 3.49

Table 2 showed clinical characteristic patients with normal diastolic function and abnormal diastolic function. There were 18 (41.86%) patients with abnormal relaxation, 6 (13.95 %) patients with pseudonormal and 1 (2.3%) patients with restrictive pattern (figure 1).

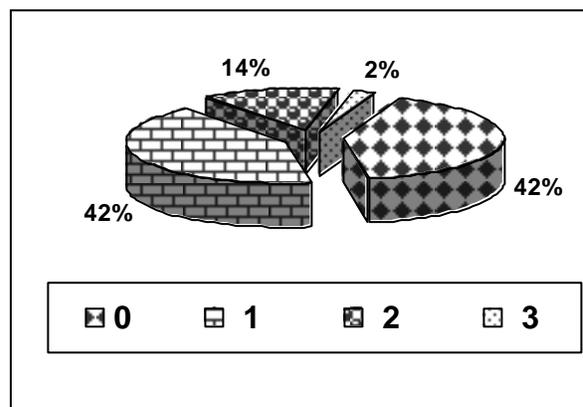


Figure 1. Distribution of diastolic dysfunction  
 0=normal diastolic function, 1=relaxation abnormality, 2=pseudonormal, 3= restrictive pattern

There were no significant difference in body surface area, systolic blood pressure, diastolic blood pressure, pulsed pressure, hemoglobin levels and duration of hemodialysis between the 2 groups. The age in group

B was higher than group A, but the ages of the all patients was < 60 y. Also there were no significant difference in LVM and LVMI between the two groups.

Tabel 2. Clinical Characteristics

	No diastolic function Group A (n=18)	Diastolic function Group B (n=25)	P
Age,y	48.06 ± 11.55	55.09 ± 1.86	0.035
Body surface area (BSA)	1.57 ± 0.19	1.62 ± 0.18	0.384
Systolic blood pressure(mmHg)	161.11 ± 26.76	149.60 ± 22.08	0.089
Diastolic blood pressure (mmHg)	92.78 ± 10.18	90.40 ± 8.41	0.357
Pulse pressure	68.33 ± 20.36	59.20 ± 20.60	0.157
Hemoglobin, g/dl	8.93 ± 0.1	9.11 ± 0.92	0.536
Left ventricular mass (LVM)	271.35 ± 123.04	246.73 ± 84.18	0.440
Left ventricular mass index (LVMI)	171.84 ± 70.79	151.43 ± 45.20	0.255
Duration of hemodialysis	3.56 ± 2.26	4.52 ± 4.16	0.301

There was no difference in left ventricular ejection fraction (LVEF) between the 2 groups ( group A LVEF 65.39 ± 12.31 vs group B LVEF 62.68 ± 14.83)

Tabel 2. Left Ventricular Diastolic Filling

	No diastolic function ( Group A ) (n=18)	Diastolic function (Group B) (n=25)	p
E velocity (cm/s)	113.33 ± 21.13	81.12 ± 28.41	0.000
A velocity (cm/s)	80.28 ± 16.14	82.32 ± 35.02	0.799
Deceleration time (DT)	211.67 ± 61.38	247.60 ± 75.29	0.104
Isovolumic relaxation time (IVRT)	108.89 ± 30.85	129.60 ± 30.34	0.003
MVa ( A wave duration )	122.22 ± 33.70	123.20 ± 26.88	0.620
PV systolic (S)	52.67 ± 9.60	44.44 ± 17.20	0.074
PV diastolic (D)	61.61 ± 18.28	38.28 ± 12.60	0.000
PVa (atrial systolic reversal)	104.44 ± 30.91	110.80 ± 24.31	0.377
PV velocity	19.94 ± 3.04	23.96 ± 5.98	0.01

As compared to group A, Group B showed a significantly lower mitral E velocity, a longer IVRT, and a higher PV velocity.

## DISCUSSION

Diastolic function study in chronic renal failure patients on hemodialysis in Indonesia has not been reported. In this study prevalence of diastolic dysfunction was 58.1 %. Gagliardi GM et al<sup>5</sup> reported prevalence of diastolic dysfunction in 31 dialysis patients (26 on hemodialysis, 5 on peritoneal dialysis ) was 77.4 %.

Left ventricular hypertrophy (LVH) is the main manifestation of uremic cardiomyopathy and predicts both cardiovascular events and death, independently of conventional risk factors. Diastolic dysfunction is often associated with left ventricular hypertrophy, and accounts for up to 30 % of heart failure. The association between LVH and left ventricular diastolic function on hemodialysis patients was reported by Gagliardi GM et al<sup>5</sup>. They showed left ventricular hypertrophy in 71 % patients (eccentric LVH 55 %, and concentric LVH in 16 % patients). Left ventricular hypertrophy is associated with diastolic dysfunction, and both cause of hypotensive episodes during dialytic treatments and heart failure in patients with normal systolic function.

In this study there was no significant differences in left ventricular mass between the groups with diastolic dysfunction and group without diastolic dysfunction. We suggested that there were many factors involved in diastolic dysfunction eg; diabetes mellitus and hypertension. Miyazato et al<sup>2</sup> studied impact of diabetes mellitus on left ventricular diastolic dysfunction in patients with non dialysis chronic renal failure, independent of LVH. They suggested that left ventricular diastolic dysfunction, independent of LVH, is specifically and makedly progressed in patients with chronic renal failure as a result of diabetic nephropathy. Another reason was the sample in this study may be to small.

This is the first study in Indonesia that reported the association between left ventricular mass and left ventricular diastolic dysfunction in chronic renal failure patients on hemodialysis. There was no significant difference left ventricular mass and diastolic dysfunction.

## CONCLUSION

Prevalence of diastolic dysfunction in chronic renal failure patients on hemodialysis was 58.1 %. There was no significant difference between left ventricular

mass in the group with or without left ventricular diastolic dysfunction. The non invasive assessment of left ventricular diastolic function would represent an important advancement in the diagnosis and prevention of heart failure in hemodialysis patients.

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