

CORRELATION BETWEEN E/VP AND E/E' IN LEFT VENTRICULAR FILLING PRESSURE MEASUREMENT AMONG PATIENTS WITH DILATED CARDIOMYOPATHY

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ABSTRAK

Disfungsi diastolik meningkat ventrikel kiri (VK) mengisi tekanan dan merupakan mekanisme utama yang bertanggung jawab atas temuan klinis gagal jantung. Saat ini, doppler echocardiography adalah alat yang paling berharga untuk evaluasi noninvasif fungsi diastolik. Beberapa pendekatan atas dasar new doppler modalities (color M-mode Doppler dan Doppler tissue imaging) baru diusulkan sebagai metode yang berguna untuk evaluasi relaksasi VK. Tujuan penelitian ini adalah untuk mengetahui korelasi antara E/Vp dan E/ E' dalam pengukuran tekanan pengisian VK antara pasien dengan dilatasi kardiomiopati. Penelitian ini merupakan penelitian analitik observasional dengan menggunakan pendekatan cross sectional. Populasinya pasien dilatasi kardiomiopati yang menjalani pemeriksaan echocardiography di Departemen Penyakit Kardiovaskular Dr. Soetomo pada Maret-Juni 2011. Hasil penelitian menunjukkan ada 36 pasien dengan dilatasi kardiomiopati, 14 perempuan dan 22 laki-laki yang berpartisipasi dalam penelitian ini. Sembilan pasien dengan hipertensi, 7 diabetes, 7 penyakit jantung koroner dan 13 pasien dengan penyakit lain (penyakit ginjal kronis, stroke, peripartum cardiomyopathy). Rasio rata-rata E/Vp meningkat 2,28, namun tekanan pengisian tidak mengalami peningkatan. Rerata E/E' menunjukkan peningkatan hasil 23.82. Hasil uji statistik menunjukkan bahwa ada korelasi positif yang lemah tetapi tidak signifikan antara E/Vp dan E/E' dalam pengukuran tekanan pengisian VK antara pasien dengan dilatasi kardiomiopati. Kesimpulan yaitu ada korelasi positif yang lemah tetapi tidak signifikan antara E/Vp dan E/E' dalam pengukuran tekanan pengisian VK antara pasien dengan dilatasi kardiomiopati. (FMI 2014;50:30-33)

Kata kunci: dilatasi cardiomyopathy, E/Vp, E/E'

ABSTRACT

Diastolic dysfunction increases left ventricular (LV) filling pressure and is the primary mechanism responsible for clinical findings of heart failure. Currently, doppler echocardiography is the most valuable tool for noninvasive evaluation of diastolic function. Several approaches on basis of new doppler modalities (color M-mode Doppler and Doppler tissue imaging) have been recently proposed as useful methods for evaluation of LV relaxation. The purpose of this study was to determine the correlation between E/Vp and E/E' in LV filling pressure measurement among patients with dilated cardiomyopathy. This study was an observational analytic study using cross sectional approach. Population were dilated cardiomyopathy patients who underwent echocardiography examination at the Department of Cardiovascular Diseases Dr. Soetomo during March-June 2011. The result showed there were 36 patients with dilated cardiomyopathy, 14 women and 22 men who participated in this study. Nine patients with hypertension, 7 diabetes, 7 coronary heart disease and 13 patients with other diseases (chronic kidney disease, stroke, peripartum cardiomyopathy). The mean ratio E/Vp was increased 2.28, but filling pressure had not increased. The mean E/E' showed increasing results 23.82. Statistical test result showed that there is a weak positive correlation but not significant between E/Vp and E/E' in LV filling pressure measurement among patients with dilated cardiomyopathy. In conclusion there is a weak positive correlation but not significant between E/Vp and E/E' in LV filling pressure measurement among patients with dilated cardiomyopathy. (FMI 2014;50:30-33)

Keywords: Dilated cardiomyopathy, E/Vp, E/E'

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INTRODUCTION

Left ventricular pump function and myocardial contractility can be assessed while evaluating left ventricular systolic function. Ejection fraction that was taken from the left ventriculography is routinely used as a guidance of pump function. Active relaxation of the left ventricle during early diastolic and passive filling of left ventricular or elasticity of the left ventricle during

the mid-late diastole is an important factor in assessing left ventricular diastolic function (Ho 2007). Some of the reasons why the diastolic function is important: (1) 30-40% of patients with congestive heart failure have a normal left ventricular pump function (2) transmitral flow velocity patterns using pulsed Doppler method as a non-invasive evaluation of left ventricular diastolic function (Nagueh et al 2009, Nagueh et al 2011). Several echocardiographic modalities were used to

measure left ventricular filling pressure, some of them are (1) the ratio between peak early mitral inflow velocity to early diastolic mitral annular velocity (E/E') and (2) the ratio of peak early mitral inflow velocity by color M-mode flow propagation velocity (E/Vp) (Bhella et al 2011).

Tissue Doppler Imaging (TDI) is used to evaluate myocardial motion velocity quantitatively. Ratio of transmittal E velocity and E' (E/E') can be used to measure the filling pressure. Study by Nagueh et al (1997) shows that the ratio of E/E' > 10 indicate a pulmonary capillary wedge pressure (PCWP) > 12 mmHg with sensitivity 91% and specificity of 81%. In the other words, the echocardiographic measurement of E/E' is a non-invasive left ventricular filling pressure measurement method. The ratio between transmittal E wave velocity and color M-mode flow propagation (E/Vp) is another parameter that can assess diastolic function and left ventricular filling pressure (Ho 2007). Due to a few study about the correlation between E/Vp and E/E' in left ventricular filling pressure measurement, we were interested to investigate the correlation between E/Vp and E/E' in left ventricular filling pressure measurement among patients with dilated cardiomyopathy at Dr. Soetomo Hospital Surabaya. We expect that E/Vp can be an alternative way of left ventricular filling pressure measurement among patients with dilated cardiomyopathy.

MATERIAL AND METHODS

Data from patients with dilated cardiomyopathy that meet inclusion and exclusion criteria were recorded as samples from medical records during March - June 2011. We enrolled 36 dilated cardiomyopathy patients,

who met inclusion and exclusion criteria. Recording includes: subject identity and the echocardiography result. The collected data will be analyzed and reported. The study was performed with GE Medical System Vivid 7 Pro Class I type CF and GE Medical System Vivid 7 Dimension Class I type CF. Study design was cross sectional. Data were analyzed descriptively, which consist of baseline characteristics of research subjects and the results of echocardiography measurements. Categories data will be presented as frequencies and percentages, while the numerical scale data will be presented as mean \pm standard deviations or median (minimum and maximum value). According to the hypothesis, the statistics analysis used Pearson Correlation Test for normal distribution data and Spearman Correlation Test for abnormal distribution data. Limit of significance were $\alpha = 0.05$ and $\beta = 80\%$. The whole process of analysis using SPSS for windows version 20.0.

RESULTS

There were 36 patients with dilated cardiomyopathy, 14 (38.9%) women and 22 (61.1%) men who participated in this study. Nine (25%) patients with hypertension, 7 (19%) diabetes, 7 (19%) coronary heart disease and 13 (37%) patients with other diseases (chronic kidney disease, stroke, peripartum cardiomyopathy). There were no drop out samples. The mean age was 50.19 years, with the youngest age was 22 years old and the oldest was 75 years. LVIDd measurement results were 5.25 to 7.0 cm, mean of LVIDd was 5.66 cm. It showed dilated left ventricle. The mean ratio E/Vp was increased 2.28, but filling pressure had not increased (E/Vp > 2.5).

Tabel 1. Baseline characteristics and echocardiographic parameter of study participants (n=36)

Variables	Mean	SB	Median	Minimum	Maximum
Age (year)	50.19	12.1	50.0	22	75
LA major (cm)	6.30	0.9	6.35	3.7	9.0
LA minor (cm)	3.95	0.7	3.9	2.4	5.73
RA major (cm)	5.69	0.9	5.7	3.5	8.5
RA minor (cm)	3.65	0.8	3.6	2.3	5.6
L	3.3	0.7	3.2	2.1	5.5
LVIDd	5.66	0.4	5.5	5.2	7.0
E (m/second)	0.79	0.2	0.8	0.4	1.21
E/A	1.95	0.95	1.8	0.56	3.98
E' (m)	0.04	0.02	0.04	0.01	0.09
E/E'	23.82	12.0	24.2	6.17	59.38
Vp (m/second)	0.4	0.2	0.35	0.2	1.19
E/Vp	2.28	0.98	2.1	0.56	5.06
EF by teich (%)	33.91	8.3	34.0	17.0	52.0
EF by biplane (%)	34.49	9.4	33.6	17.0	54.0
TAPSE	1.85	0.4	1.8	1.2	2.70

The mean E/E' showed increasing results 23.82. Four (11.1%) patients had normal E/E' (<8), while 27 (75%) patients had an increasing E/E' (>15). E/A ratio results showed: 7 (19.4%) patients had E/A <1, and 29 (80.6%) had E/A ≥ 1. The entirely systolic function are decreased, which were assessed by the mean ejection fraction (EF) by Teich 33.91% and by Biplane methods is 34.49%). Statistical test result showed that there is a weak positive correlation but not significant between E/Vp and E/E' in left ventricular filling pressure measurement among patients with dilated cardiomyopathy ($p > 0.05$, $r = 0.140$).

DISCUSSION

Cardiac performance was assessed from systolic function and diastolic function. Diastolic function affects preload, afterload, and also play a role in heart disease morbidity and mortality. Impaired diastolic function characterized by increased filling pressure, with the symptom shortness of breath either at rest or during exercise (Carroll & Hess 2005). In 1997 the American College of Cardiology and American Heart Association (ACC/AHA) published guidelines regarding the use of echocardiography in clinical trials. Echocardiography can be used as a non-invasive method of measuring diastolic function and filling pressure, although intraventricular pressure measurement by angiography examination is the gold standard (Armstrong 2005).

The ratio between transmitral E wave velocity and color M-mode flow propagation (Vp) (E/Vp) is another parameter that can assess diastolic function and left ventricular filling pressure. E/Vp > 2.5 describes an increased filling pressure and can predict PCWP > 15 mmHg. E/Vp > 1.5 is a strong predictor of in hospital heart failure and of 1–3 months mortality ($p < 0.0001$) (De Boeck et al 2005). Tissue Doppler Imaging (TDI), ratio of transmitral E velocity and E' (E/E') was used to measure the filling pressure. This is supported by Nagueh et al (1997), that E/E' > 10 shows an increasing pulmonary capillary wedge pressure (PCWP) > 12 mmHg with sensitivity 91%, specificity of 81%. The ratio of septal E/E' < 8, shows normal ventricular filling pressure and E/E' > 15 shows increasing filling pressure.

In this study, mean ratio E/Vp was increased 2.28, this value is greater than the normal range (more than 1.5), indicating the presence of diastolic dysfunction leads to increased filling pressure despite increased filling pressure if E/Vp > 2.5. The mean E/E' was increased 23.82. Four (11.1%) patients had normal E/E' (<8), while 27 (75%) patients had an increasing E/E' (>15).

Statistical test result showed that there is a weak positive correlation but not significant between E/Vp and E/E' in left ventricular filling pressure measurement among patients with dilated cardiomyopathy ($p > 0.05$, $r = 0.140$). The value of positive correlation was interpreted as when the E/E' increased, the E/Vp also increased. The limitation of study are the echocardiographic data were taken from secondary data, which is the examination was performed by a single person and intraobserver variability was not assessed, although echocardiographic examination was performed by residents who have been trained to perform echocardiographic examinations among patients with cardiomyopathy.

CONCLUSION

In this study the entirely systolic function are decreased, which is assessed by the (mean ejection fraction (EF) by Teich 33.91% and by Biplane methods is 34.49%). Diastolic function in this are measured by E/A, E/Vp and E/E'. The mean ratio E/Vp 2.28 and E/E' 23.82. The E/E' measurement results showed an increase in left ventricular filling pressure. A weak positive correlation but not significant between E/Vp and E/E' in left ventricular filling pressure measurement among patients with dilated cardiomyopathy.

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