Structural-functional Characteristics of left Ventricle Remodeling at Cardiac Chronic Failure Developed on the Background of Idiopathic Dilatative Cardiomyopathy

Nato Katamadze, Manana Kiknadze

#2 Department of Internal Medicine, Tbilisi State Medical University,Georgia

ABSTRACT

Has been studied structural-functional characteristics of left Ventricle (LV) Remodeling at Cardiac Chronic Failure (CCF) developed on the Background of Idiopathic dilatative cardiomyopathy (IDC). Has bee revealed the cascade of LV structural-functional remodeling - the reason-result correlation between an increase of LV mass and increase of LV final systolic/diastolic size/volume. Increase in one parameter results in increase of another, but both of them causes reduction of LV ejection fraction. The relative thickness of LV posterior wall is the independent marker of LV remodeling.

KEYWORDS: *idiopathic dilatative cardiomyopathy, cardiac chronic failure, left ventricle, structural-functional remodeling*

The obtained results of the 90's clinical investigations significantly changed point of view of scientists on pathophysiologic mechanisms of development of cardiac chronic failure and played the important role to establish the "myocardial theory" in this field. According to the mentioned theory, cardiac remodeling outstrips CCF development, accompanies it and independently defines patients' life quality and prognosis of the disease. It should be emphasized that CCF a later, but still develops on the background of successful medicament therapy or surgery of cardiovascular system diseases. From this point of view a dilatative cardiomyopathy is of great importance, that announces its existence by clinical manifestation of cardiac failure.

THE PURPOSE OF STUDY

Evaluation of structural-functional status of left ventricle remodeling at cardiac failure developed on the background of idiopathic dilatative cardiomyopathy.

MATERIALS AND METHODS

Have been studied 50 patients with CCF, developed on the background of idiopathic delatative cardiomyopathy, among them 11 (22%) women and 39(78%) men; with average age of 38,58±9,36. The diagnosis was made using all necessary diagnostical methods and foreseeing clinical data. CCF corresponds to the stage-D of the USA Cardiac Association/of American Cardiologic Board (2001) classification oriented on cardiac structural disturbance - that is a structural cardiopathy clinically manifested by cardiac failure.

LV systolic function is evaluated by the following parameters: thickness of intraventriclar septum (mm), thickness of LV posterior wall (mm), relative thickness of LV posterior wall (mm); the final LV systolic size (mm), index of final LV systolic size (cm/m^2), the final systolic volume of LV (ml), index of LV final systolic volume (ml/m^2), the final LV diastolic size (mm), the index of LV final diastolic size (cm/m^2), LV final diastolic volume (ml), the index of LV final diastolic volume (ml/m^2), LV ejection and shortening fractions (%); LV mass (g), index of LV mass (g/m^2), LV mass/height (g/m); stroke volume and cardiac output (ml).

LV mass calculation was performed by the Devereux's formula, and the final systole/diastolic volume calculation - by Teichholtz's one.

The control group was presented by 20 practically healthy individuals.

The obtained data has been analyzed using statistical analyze program. Has been calculated the average mathematical index and standard deviation (M±s).

Reliability was evaluated by Stiudent's criteria - t. Difference proves to be significant if P<0,05. The interdependence of parameters is analyzed by parametric method (Pirson's coefficient of correlation) and linear regression.

RESULTS

the thickness of intraventricular septum at chronic cardiac failure developed on the background of IDC was 9,93±1,7 that proved to be enough high index compared to the norm (p<0,001***). In comparison with the norm the thickness of posterior wall of left ventricle was increased but the difference was not significant (P>0,05). The relative thickness of LV posterior wall was 0,31±0,07 (<0,45). The final LV diastolic size was increased reliably in comparison with the norm and in average came up to 63,2±8,79 (P<0,001***). Significantly was increased the final LV systolic size - 47,22±8,87 (P<0,01**). The analogical results have been shown in case of systolic (116±57,64 (P<0,001***)) and final diastolic volumes (208±67,8 (P<0,01**)). All three indexes - LV mass, index of LV mass, LV mass/height, have been increased compared to the norm; The difference was distinguished by high reliability (326±83,27, P<0,001***; 166±45,87, P<0,001***; 184±49,1, P<0,001***).

LV ejection fraction significantly was decreased compared to the control index and in average it was 30,2±11,77 (P<0,001***). The average index of shortening fraction was 24,06±8,2, that is reliably low index comparing with the control one (P<0,001***). As for the stroke volume and cardiac output their indexes were reliably increased in comparison with the control ones and in average was for stroke volume - 92,2±27,19 (P<0,001***), and cardiac output - 6,7±2,7 (P<0,01**).

PARAMETERS	SIZE OF PARAMETER	
	control (n=20)	CCF (n=50)
Age		38,68±9,36
Height, cm	164±0,1	174±5,98 (P<0,001***)
Mass of body, kg	69,8±12,5	81,16±12,51
Woman	20%	11 (22%)
Man	70%	39 (78%)
Pulse	71,8±1,5	78,32±20,5 (P>0,05)
LV longitudinal section, mm	31,4±1,5	46,86±8,16 (P<0,001***)
Thickness of intraventricular septum, mm	8,0±0,2	9,93±1,7 (P<0,001***)
LV posterior wall, mm	9,8±0,3	9,85±1,35 (P>0,05)
LV posterior wall relative thickness, mm	<0,45	0,31±0,07
LV final diastolic size, mm	47,8±1,7	63,2±8,79 (P<0,001***)
Index of LV final diastolic size, cm/m^2	2,5±0,05	3,2±0,5 (P<0,01**)
LV final systolic size, mm	33,4±1,4	47,22±8,87 (P<0,01**)
Index of LV final systolic size, cm/m^2	1,9±0,6	2,5±0,5 (P<0,01**)
LV final diastolic volume, ml	129,5±5,15	208±67,8 (P<0,01**)
Index of LV final diastolic volume, ml/m^2	73,6±4,4	106,6±34,89 (P<0,001***)
LV final systolic volume, ml	55,3±4,02	116±57,64 (P<0,001***)
Index of LV final systolic volume, ml/m^2	31,4±2,5	59,14±30 (P<0,001***)
LV mass, g	208=6	326±83,27 (P<0,001***)
Index of LV mass, g/m^2	118±9,4	166±45,87 (P<0,001***)
LV mass/height , g/m	127±9,2	184±49,1 (P<0,001***)
LV ejection fraction, %	62,2±3,9	30,2±11,77 (P<0,001***)
Shortening fraction, %	32,4±1,26	24,06±8,2 (P<0,001***)
Stroke volume, ml	65,7±7,5	92,2±27,19 (P<0,001***)
Cardiac output, ml	4,8±0,87	6,7±2,7 (P<0,01**)

P<0,05 – mild reliability, P<0,01 –moderate reliability, P<0,001 – high reliability, P>0,05 – difference is not reliable

Tab.1 *Hemodynamic indexes in case of cardiac chronic failure developed on the background of idiopathic dilatative cardiomyopathy*

Has been performed correlative analysis between LV ejection fraction and all the rest of parameters. Between the parameters of LV ejection fraction and LV final diastolic size/volume was found negative correlation, i.e. an increase of one parameter causes increase of the another (r =-0,3833, P<0,01**, r =-0,4109, P<0,0**1) and a correlation had a moderate reliability regarding to the both of parameters. Between LV ejection fraction and LV final systolic size/volume was also found the negative correlation (r=-0,2936, P<0,05*, r=-0,47, P<0,001***) and the correlation regarding to LV final diastolic volume was prominent with high reliability. Between LV ejection fraction and LV mass was revealed negative correlation (r =-0,3026, P<0,05*). Between LV ejection fraction and comparative thickness of LV posterior wall was revealed direct (i.e. increase of one parameter causes increase of the another) but unreliable correlation (r = -0,2467, P>0,05). The direct correlation has been fixed between LV mass index and LV final diastolic size/volume (r = 0,6548, P<0,001***; r = 0,6603, P<0,001***); and the latter was distinguished with high reliability. There is a direct correlation between LV mass index and LV final systolic size/volume as well (r = 0,2937, P<0,05; r = 0,56, P<0,001***).

Has been performed the linear regressive analysis, the data of which is accepted as a reliable ones when $F_{res}>F_{0,05,\gamma1,\gamma2}$. Between LV ejection fraction and final diastolic size/volume has been distinguished the adequacy and reliability of linear regressive equation, i.e. one index defines another one and vice versa. The analogical state was fixed in regard to LV final systolic size/volume, shortening fraction, myocardial mass and stroke volume. As for the cardiac output, the correlation between absolute/relative thickness of LV posterior wall and LV ejection fraction appeared to be linear but unreliable ($F_{res}<F_{0,05,\gamma1,\gamma2}$). At regressive analysis on the one hand between LV mass index, and on the other hand LV final diastolic size/volume, LV final systolic size/volume, shortening fraction and stroke volume has been revealed correlation of reliable linear regressive character.

CONCLUSIONS

According to the obtained data have been revealed:

- II type of LV remodeling – eccentric hypertrophy, when LV mass indexes are increased and comparative thickness of LV posterior wall is <0,45

- LV ejection fraction and LV final systolic/diastolic size/volume are interdependent on the feedback principle and they are inter-defining parameters.
- LV ejection fraction and LV mass are interdependent on the feedback principle and they are inter-defining parameters.
- LV mass and LV final systolic/diastolic size/volume are interdependent on the direct interrelation principle and they are inter-defining parameters.
- Relative thickness of LV posterior wall and LV ejection fraction are not interconnected and inter-defining parameters.

Thus, it should be concluded that the cascade of structural-functional remodeling is stated according which there occurs the reason-result correlation between an LV mass increase and LV final systolic/diastolic size/volume enhancement – one increases in parallel to another but both of them result in reduction of LV ejection fraction. The comparative thickness of LV posterior wall is the independent marker of LV remodeling.

REFERENCES:

1. Sahrpe N., Murphy J., Smith H. et al. "Treatment 2 of patients with symptomless left ventricular dysfunction after myocardial infarction". Lancet 1988; 1: 225 - 229.
2. Pfeffer M.A., Braunwald E. "Ventricular remodelling after myocardial infarction: experimental observation and clinical implications". Circulation 1990; 81: 1161 – 1172.
3. Viorel G. Florea. "Left ventrikular remodelling: the chicken and egg story of structure and function". International Journal of Cardiology 71 (1999) 207-208.www.elsevier.com/locate/ijcard
4. Мареев В.Ю. Материалы тезисов сателлитного симпозиума KRKA "Пути преодоления сердечно сосудистых катастроф – взгляд в будушее", проходившего в рамках Национального конгресса кардиологов 10.10.2000. в г. Москве. http://www.krka.ru/enap/nauka.htm
5. Бузиашвили Ю.И., Ключников И.В., Мелконян А.М., Иноземцева Е.В., Коваленко О.А., Мамаев Х.К. "Ишемическое ремоделирование левого желудочка (определение, патогенез, диагностика, медикаментозная и хирургическая коррекция)". Кардиология, 2002; 10:88-94
6. Шипилова Т., Пшничников И., Волож О. и др. "Определение масы миокарда левого желудочка и его геометрии по данным эхокардиографии в популяционном исследовании женщин Таллина". Кардиология, 2002; 11: 52-56.
7. Бокерия А., Бузиашвили Ю., Ключников И. и др. "Эхокардиографическая оценка ремоделирования левого желудочка у больных с постинфарктными аневризмами". Кардиология, 2002; 11: 64-65.
8. Ольбинская Л. "Современное представление о патогенезе хронической сердечной недостаточности и ее лечении". Фармацевтический Вестник. №21, 172. 2000.
9. Современные подходы к диагностике и лечению хронической сердечной недостаточности (изложение Рекомендаций Американской коллегии кардиологов и Американской ассоциации сердца 2001г.) Кардиология, 6, 2002. 65-78.

Структурно-функциональная характеристика ремоделирования левого желудочка при хронической сердечной недостаточности на фоне идиопатической дилатационной кардиомиопатии

Нато Катамадзе, Манана Кикнадзе

Кафедра терапии №2 Тбилисского государственного медицинского университета, Грузия

Р Е З Ю М Е

Изучен структурно-функциональный статус ремоделирования левого желудочка (ЛЖ) при хронической сердечной недостаточности на фоне идиопатической дилатационной кардиомиопатии. Выявлен целый каскад ремоделирования левого желудочка, согласно которому между масой миокарда и конечным систола-диастолическим размером (объемом) ЛЖ сушествует причинно-следственная зависимость: увеличение одного показателя сопровождается увеличением другого, а оба вместе - являются причиной снижения фракции выброса ЛЖ. Относительная толщина задней стенки ЛЖ следует считать самостоятельным маркером ремоделирования левого желудочка.

КЛЮЧЕВЫЕ СЛОВА: *идиопатическая дилатационная кардиомиопатия, хроническая сердечная недостаточность, левый желудочек, структурно-функциональное ремоделирование*