The characteristics of left ventricular filling in ischemic cardiomyopathy and idiopathic dilated cardiomyopathy: a pulsed Doppler echocardiographic study

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In order to identify left ventricular filling characteristics in ischemic and idiopathic dilated cardiomyopathy, mitral flow velocity patterns were examined in patients with ischemic cardiomyopathy (n=18), patients with idiopathic dilated cardiomyopathy (n= 12) and normals (n=30) by pulsed Doppler echocardiography. All patients underwent coronary angiography and contrast ventriculography. None had significant mitral regurgitation. Left ventricular ejection fraction did not show significant difference between two groups (27±8%, 25±8%, p>0.05). Higher left ventricular end diastolic pressure was seen in ischemic cardiomyopathy compared to idiopathic dilated cardiomyopathy (25±7 mmHg, 18±6 mmHg, p<0.05). Left ventricular diastolic functions had significant changes in ischemic cardiomyopathy. Isovolumic relaxation time (IVRT) was higher (99±23 msec, 81 ±6 msec, p<0.05), peak early filling velocity (PE)/peak atrial filling velocity (PA) ratio was lower (0.87+0.4, 2.1+1.2, p<0.001) in ischemic cardiomyopathic patients than in idiopathic dilated cardiomyopathy group. Both group had increased atrial contribution and shortened deceleration time in comparison with normals. IVRT and PE/PA ratio were not different in patients with idiopathic dilated cardiomyopathy from normals. These differences of left ventricular diastolic function parameters may be important to distinguish ischemic cardiomyopathy from idiopathic dilated cardiomyopathy noninvasively. [Turk J Med Res 1995; 13(1): 12-15]

Keywords: Cardiomyopathy, Diastolic function

Ischemic cardiomyopathy and idiopathic dilated cardiomyopathy have similar clinical features such as cardiomegaly, congestive heart failure, chest pain and electrocardiographic abnormalities (1-3). However patients with ischemic cardiomyopathy show a worse prognosis than patients with idiopathic dilated cardiomyopathy (4,5). Coronary angiography has been used to differentiate these two conditions (2,3).

Various noninvasive techniques (electrocardiography, echocardiography, thallium myocardial perfusion scintigraphy) were tried to distinguish ischemic and idiopathic dilated cardiomyopathy (6-8). But the precise differential diagnosis of these diseases have still troublesome with noninvasive techniques.

In this study, left ventricular systolic and diastolic functions in ischemic and idiopathic dilated cardiomyopathic patients were assessed in order to differentiate these two diseases.

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MATERIALS AND METHODS

Thirty patients who had signs and symptoms of congestive heart failure were enrolled in this study. Coronary angiography and contrast ventriculography were performed and left ventricular end diastolic pressure was taken before ventriculography in all patients. Left ventricular diastolic functions were evaluated by pulse Doppler echocardiography. According to the presence of significant coronary artery lesions, the patients were divided as follows:

1. Ischemic cardiomyopathy group: Eighteen patients (17 male, 1 female) were identified in this group according to these criteria: a) left ventricular ejection fraction less than 40% established by left ventriculography, b) greater than 70% narrowing of one or more major coronary arteries demonstrated by coronary angiography. The mean age was 56±19 years.

2. Idiopathic dilated cardiomyopathy group: This group consisted of 12 patients (4 male, 8 female). The definite diagnostic criteria were given as follows: a) left ventricular ejection fraction less than 40% established by left ventriculography b) normal coronary arteries demonstrated by coronary angiography. The mean age was 49±8 years.

Table 1. Left ventricular diastolic function parameters in patients with ischemic cardiomyopathy, idiopathic dilated cardiomyopathy and in normals

	PE (m/sec)	PA (m/sec)	PE/PA	IVRT (m/sec)	DT (m/sec)	AC %
Normals (n=30)	0.72±0.14"	0.40+0.10[t+]	1.9±0.6[++]	76±11	179+20[§]	25±5[+t]
Ischemic CMP (n=18)	0.56±0.15*	0.61 ±0.20*	0.87±0.4[+]	99±23*	143±61	50±12*
Idiopathic dilated CMP (n=12)	0.75+0.24	0.42±0.22	2.1+1.2	81 ±6	148+27[tt]	32+22[t]

Probability of versus ischemic CMP group: [§]p<0.01, "p<0.001, [++]p<0.0001
Probability of versus dilated CMP group: *p<0.05, [+]p<0.001
Probability of versus normal group: 'p<0.0S, "pO.OI

CMP: cardiomyopathy, PE: peak early filling velocity, PA: peak atrial filling velocity, IVRT: isovolumic relaxation time, DT: deceleration time, AC %: percentage of atrial contribution

Coronary angiography and left ventriculography: This procedure was performed using Judkins technique. Left ventriculography at both right and left anterior oblique positions and coronary angiography at several positions were carried out using General Electric LU-A Adventx digital angiography. None had severe mitral regurgitation. Ejection fraction was measured by the area-length method. Left ventricular end diastolic pressure was recorded before ventriculography by Siemens-Micor pressure recording system.

Analysis of left ventricular diastolic functions: Pulsed Doppler imaging of mitral inflow was done at the immediate ventricular site of the mitral anulus from an apical four chamber view using Toshiba, SSH-160 A echocardiography machine. Pulsed Doppler imaging of the aortic valve and left ventricular outflow was carried out from an apical five chamber view. The sample volume cursor was placed in an intermediate position between the outflow tract and the mitral valve to obtain left ventricular outflow and inflow velocities. Mitral Doppler recordings yielded parameters of diastolic filling as follows:

1) Peak early (PE) and peak atrial (PA) filling velocities, 2) PE/PA ratio, 3) Percentage of atrial contribution (AC%), 4) Deceleration time of early filling (DT). Isovolumic relaxation time (IVRT) was measured from the end of left ventricular outflow to the beginning of inflow.

Control group consisted of 30 healthy subjects.

Statistical analysis: All data were presented as the mean value±SD. Comparisons between patient groups and normals were undertaken using Student's t test.

RESULTS

The mean age in patients with ischemic cardiomyopathy was higher than in idiopathic dilated cardiomyopathy group (56±19 years, 49±8 years p<0.05). Left ventricular ejection fraction did not show significant difference between two groups (27±8%, 25±8% p>0.05). Higher left ventricular end diastolic pressure was seen in ischemic cardiomyopathy compared to idiopathic dilated cardiomyopathy (25±7 mmHg, 18±6 mmHg, p<0.05).

Left ventricular diastolic functions had significant changes in ischemic cardiomyopathy (Table 1). IVRT was higher (99±23 msec, 81 ±6 msec, p<0.05), PE/PA ratio was lower (0.87±0.4, 2.1 ±1.2, p<0.001) in ischemic cardiomyopathic patients than in idiopathic dilated cardiomyopathy group. However, both group had increased atrial contribution and shortened deceleration time in comparison with normals. IVRT and PE/PA ratio were not different in patients with idiopathic dilated cardiomyopathy from normals.

DISCUSSION

Left ventricular diastolic dysfunction is recognized as a significant cause of cardiac symptoms even in patients with apparent normal systolic ventricular function (9,10). The clinical presentations of patients in this study were similar regardless of etiology of cardiomyopathy and they had high degree of left ventricular systolic dysfunction. Patients with ischemic cardiomyopathy showed important hemodynamic decompensation compared to those with idiopathic dilated cardiomyopathy. Previous studies have documented the same results and it was suggested the poorer prognosis associated with ischemic cardiomyopathy and left ventricular filling pressures correlated with survival (2,5). Abnormal early diastolic relaxation and compliance of left ventricle are observed in many cardiac disease, including coronary artery disease and dilated cardiomyopathy (3,11,12). Left ventricular filling is influenced by multipl factors. Patients with coronary artery disease who had lower pulmonary wedge pressure usually have a prolonged isovolumic relaxation time, a reduced ratio of peak early and atrial mitral flow velocity and prolonged deceleration time. In patients who were more symptomatic, increased filling pressures were present. They had impaired left ventricular relaxation. However, the normal or short isovolumic relaxation time and normal or increased peak early mitral flow velocity suggests an elevated left atrial pressure normalized or increased the early diastolic transmitral pressure gradient and masked the expected effect of the relaxa-

tion abnormality on this gradient and Doppler variables (11). Some patients with a reduced rate of left ventricular relaxation had a moderate increase in pulmonary wedge pressure and relatively normal appearing mitral flow velocity pattern. The modest increase in left atrial pressure in these patients masked a relaxation abnormality by normalizing the early diastolic transmitral pressure gradient. Patients with relaxation abnormality regardless of its origin, may exhibit different mitral flow pattern depending on a dynamic combination of myocardial properties and hemodynamic factors (11). In a previous study, isovolumic relaxation time was found shorter than that in normal controls in idiopathic dilated cardiomyopathy, while in ischemic cardiomyopathy it was significantly more prolonged than that in normal controls. In dilated cardiomyopathy pulmonary wedge pressure was higher than those in ischemic cardiomyopathy (3).

Our results showed that isovolumic relaxation time was prolonged in ischemic cardiomyopathy. Idiopathic dilated cardiomyopathy did not associate with relaxation abnormality and mitral flow velocity changes. Because of relaxation abnormality, although left ventricular end diastolic pressure was high, PE/PA ratio was low in ischemic cardiomyopathy.

In dilated cardiomyopathy peak left ventricular filling rate in early diastole has been reported as normal in some individuals. Although it has reported that mitral regurgitation can result in an increase in mitral flow velocity (13) there was no correlation between severity of regurgitation and peak early mitral flow velocity (11). In another study, dilated cardiomyopathic patients with mitral regurgitation did not have different diastolic filling from normals. In the absence of mitral regurgitation early peak mitral velocity was lower than normals and patients with mitral regurgitation. Isovolumic relaxation time was not assessed in this study and deceleration time was shortened only patients with mitral regurgitation (12). Our cases did not have severe mitral regurgitation, so results were considered independent from it.

Endomyocardial biopsy studies demonstrated higher prevalence of replacement fibrosis and lesser degree of myocyte hypertrophy in patients with ischemic as compared with idiopathic cardiomyopathy (2). Probably, these myocardial structural changes may explain the difference in diastolic functions of two types of cardiomyopathies.

İskemik kardiyomiyopati ve idiopatik dilate kardiyomiyopatide sol ventrikül doluş özellikleri: Pulsed Doppler ekokardiyografik çalışma

iskemik ve idiopatik dilate kardiyomiyopatilerde sol ventrikül doluş özelliklerini belirlemek amacıyla, pulsed Doppler ekokardiyografi ile mitral akım örnekleri iskemik kardiyomiyopatili 18 hastada, idiopatik dilate kardiyomiyopatisi olan 12 hastada ve 30 sağlıklı kişide incelendi. Bütün hastalara koroner anjiografi ve kontrast ventrikülografi yapıldı. Hiçbir hastada önemli mitral yetmezliği yoktu. Sol ventrikül ejeksiyon fraksiyonu beriki kardiyomiyopati grubunda da düşüktü (%27±8, %25±8 mmHg, p>0.05). İskemik kardiyomiyopatide sol ventrikül diastol sonu basıncı idiopatik dilate kardiyomiyopatiye göre daha yüksekti (25±7 mmHg, 18±6 mmHg, p<0.05). İskemik kardiyomiyopatide sol ventrikül diastolik fonksiyonlarında belirgin değişiklikler izlendi, idiopatik dilate kardiyomiyopatiye göre izovolumetrik relaksasyon zamanı (İVRZ) daha uzun (99±23 ms, 81 ±6 ms, p<0.05), PE/PA oranı daha düşük (0.87±0.4, 2.1 ±1.2, p<0.001) bulundu. İki tip kardiyomiyopatide de normallere göre atrial katkıda artma ve deselerasyon zamanında kısalma saptandı, idiopatik dilate kardiyomiyopatide İVRZ ve PE/PA oranı normalden farklı değildi. Sol ventrikül diastolik fonksiyon parametre/erindeki bu değişiklikler iskemik ve idiopatik dilate kardiyomiyopatinin invaziv olmayan bu yöntemle ayrımında önemli olabilir.
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REFERENCES

1. Burch GE, Tsui CY, Harb JM. Ischemic cardiomyopathy. Am Heart J 1972; 83:340-50.
2. Hare JM, Walford GD, Hruban RH et al. Ischemic Cardiomyopathy: Endomyocardial biopsy and ventriculography evaluation of patients with congestive heart failure, dilated cardiomyopathy and coronary artery disease. J Am Coll Cardiol 1992; 20:1318-25.
3. Sekiya M, Hamada M, Kokubu T. Clinical significance of early diastolic time intervals for the differentiation of idiopathic dilated cardiomyopathy from ischemic cardiomyopathy. Clin Cardiol 1987; 10:303-8.
4. Yattenau RF, Peter RH, Behar VS et al. Ischemic Cardiomyopathy: The myopathy of coronary artery disease. Natural history and results of medical versus surgical treatment. Am J Cardiol 1974; 34:520-25.
5. Franciosa JA, Wilen M, Ziesche S et al. Survival in men with severe chronic left ventricular failure due to either coronary heart disease or idiopathic dilated cardiomyopathy. Am J Cardiol 1983; 51:831-6.
6. Corya BC, Feigenbaum H, Rasmussen S et al. Echocardiography features of congestive cardiomyopathy compared with normal subjects and patients with coronary artery disease. Circulation 1974; 49:1153-9.
7. Dunn RF, Uren RF; Sadick N et al. Comparison of Thallium-201 Scanning in idiopathic dilated cardiomyopathy and severe coronary ar-tery disease. Circulation 1982; 66:804-10.
8. Gau GT, Goodwin JF, Oakley CM. Q vave and coronary arteriography in cardiomyopathy. Brt Heart J 1972; 34:1034-41-
9. Hirota Y. A clinical study of left ventricular relaxation. Circulation 1980;62:756-63.

10. Aroesty JM, McKay RG, Heller GV et al. Simultaneous assessment of left ventricular systolic and diastolic dysfunction during pacing induced ischemia. Circulation 1985; 71:889-900.

11. Appleton CP, Hatte LK, Popp RL Relation of transmittal flow velocity patterns to left ventricular diastolic function: New insights from a combined hemodynamic and Doppler echocardiography study. J Am Coll Cardiol 1988; 12:426-40.

12. Takenaka K, Dabestani A, Gardin JM et al. Pulsed Doppler echocardiographic study of left ventricular filling in dilated cardiomyopathy. Am J Cardiol 1986; 58:143-7.

13. Rokey R, Kuo LC, Zoghbi WA et al. Determination of parameters of left ventricular diastolic filling with pulsed Doppler echocardiography: Comparison with cineangiography. Circulation 1985; 71:543-50.