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Ultrasound assessment of mitral annular displacement in patients with coronary heart disease and its correlation with left heart function and serum indexes

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ABSTRACT

Objective: To analyze the ultrasound assessment of mitral annular displacement in patients with coronary heart disease and its correlation with left heart function and serum indexes. **Methods:** A total of 89 patients with coronary heart disease were divided into angina pectoris group 42 cases and myocardial infarction group 47 cases according to the illness, and 58 cases of healthy subjects were included in control group. Values of mitral annular displacement (MAD) parameters, left heart function indexes and serum illness-related indexes of three groups were detected, and the correlation between values of MAD parameters and values of cardiac function indexes and serum illness-related indexes were further analyzed. **Results:** MAD parameters TMAD1, TMAD2 and TMADmid values, heart function LVEF values and serum CysC level of myocardial infarction group and angina pectoris group were lower than those of control group, and cardiac function LVEDD, LVESD and A/E values as well as serum H-FABP, ICTP, Hcy and vWF levels were higher than those of control group (P<0.05); MAD parameters TMAD1, TMAD2 and TMADmid values of patients with coronary heart disease were negatively correlated with LVEDD, LVESD and A/E values as well as H-FABP, ICTP, Hcy and vWF levels, and were positively correlated with LVEF value and CysC level (P<0.05). **Conclusions:** Ultrasound assessment of mitral annular displacement in patients with coronary heart disease can early diagnose coronary heart disease and judge the disease severity, and it plays a positive role in optimizing disease prognosis.

1. Introduction

Coronary heart disease is caused by coronary stenosis or occlusion-induced myocardial ischemia hypoxia, and the myocardial ischemic manifestation differs in patients with different severity of coronary artery lesions. How to early judge coronary artery lesion severity and diagnose the disease is critical to early take intervening measures and optimize the treatment outcome. studies have shown that the left ventricular ejection fraction generated by left ventricular myocardial longitudinal contraction is about 70%, so the mitral annular motion along the left ventricular long axis can macroscopically reflect the global left ventricular systolic ability[1,2]. Mitral annular displacement (MAD) is a new index to assess left ventricular systolic function in patients with coronary heart disease, ultrasound was used in the study to assess the MAD parameters of patients with coronary artery disease in our hospital and the correlation of MAD parameters with left heart function and serum indexes was further analyzed.

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2. Materials and methods

2.1. General information

A total of 89 patients with coronary heart disease who were treated in our hospital between August 2012 and August 2015 were selected, and based on clinical symptoms and laboratory

indexes, they were divided into angina pectoris group (with history of angina pectoris attack, without history of myocardial infarction and with a few minutes of angina pectoris attack that could be alleviated by medication) 42 cases that included 23 male cases and 19 female cases who were 42-71 years old and (62.81±7.53) years old in average, and myocardial infarction group (with history of typical myocardial infarction and chest pain, and with characteristic electrocardiogram changes) 47 cases that included 25 male cases and 22 female cases who were 41-73 years old and (63.69±7.62) years old in average. 58 cases of healthy subjects who received physical examination in our hospital during the same period were selected as control group that included 30 male cases and 28 female cases who were 38-70 years old and (59.37±8.41) years old in average. Three groups were not statistically significantly different in gender and age distribution (P>0.05) and could be subsequently compared.

2.2. Detection indexes

2.2.1. Mitral annular displacement

IE33 color Doppler ultrasonic diagnostic instrument (Netherlands Philps Company) was used to assess the mitral annular displacement in patients. Subjects took left lateral position, breathed quietly and were connected to electrocardiogram, apical four-chamber 2D view was taken, mitral annular lateral wall, posterior interventricular septum and apex were traced respectively, and the maximal displacement at interventricular septum (TMAD1), the maximal displacement at lateral wall (TMAD2) and the maximal displacement at the midpoint of interventricular septum and lateral wall (TMADmid) were calculated.

2.2.2. Left heart function

Echocardiography was used to determine left heart function of three groups, including left ventricular end-diastolic diameter (LVEDD), left ventricular end-systolic diameter (LVESD), left ventricular ejection fraction (LVEF) and peak A/E ratio.

2.2.3. Serum illness-related indexes

A total of 2 mL of peripheral blood was collected from three group and centrifuged to get serum, and enzyme-linked immunosorbent assay was used to determine levels of coronary heart disease-related indicators, including the heart type fatty acid binding protein (H-FABP), carboxy-terminal telopeptide of type Ⅰ collagen (ICTP), cystatin C (CysC) and homocysteine (Hcy) and von willebrand factor (vWF).

2.3. Statistical methods

SPSS23.0 was used to input and analyze the data obtained in the study, measurement data was in terms of mean±sd. Comparison between group was analyzed by t test, correlation analysis was by Pearson test. P<0.05 was set as the standard of statistical significant differences.

3. Results

3.1. Mitral annular displacement

Mitral annular displacement parameters TMAD1, TMAD2 and TMADmid of myocardial infarction group, angina pectoris group and control group were significantly different (P<0.05), TMAD1, TMAD2 and TMADmid values of myocardial infarction group and angina pectoris group were significantly lower than those of control group, mitral annular displacement parameters TMAD1, TMAD2 and TMADmid values of myocardial infarction group were lower than those of angina pectoris group, and pair-wise comparison of mitral annular displacement parameters TMAD1, TMAD2 and TMADmid showed significant differences (P<0.05), shown in Table 1.

Table 1
Mitral annular displacement parameter values (mm).

Groups	Case No. (n)	TMAD1	TMAD2	TMADmid
Myocardial infarction group	47	6.38±0.71	6.12±0.65	5.83±0.57
Angina pectoris group	42	8.95±0.92	8.53±0.96	8.26±0.91
Control group	58	12.13±1.76	11.48±1.92	12.41±1.76
F		8.594	9.724	8.932
P		<0.05	<0.05	<0.05

3.2. Left heart function

Left heart function indexes LVEDD, LVESD, LVEF and A/E values of myocardial infarction group, angina pectoris group and control group were significantly different (P<0.05), LVEDD, LVESD and A/E values of myocardial infarction group and angina pectoris group were higher than those of control group while LVEF values were lower than that of control group; LVEDD, LVESD and A/E values of myocardial infarction group were higher than those of angina pectoris group while LVEF value was lower than that of angina

Table 2
Left heart function index values.

Groups	Case No. (n)	LVEDD (mm)	LVESD (mm)	LVEF (%)	A/E
Myocardial infarction group	47	67.28±7.12	56.49±6.12	41.26±4.57	1.31±0.14
Angina pectoris group	42	62.09±6.83	52.37±5.84	46.37±5.01	0.85±0.09
Control group	58	54.73±6.12	47.53±5.12	51.28±5.83	0.67±0.07
F		8.394	6.293	8.122	5.283
P		<0.05	<0.05	<0.05	<0.05

pectoris group, and pair-wise comparison of left heart function indexes LVEDD, LVESD, LVEF and A/E showed significant differences (P<0.05), shown in Table 2.

3.3. Serum illness-related indexes

Serum H-FABP, ICTP, CysC, Hcy and vWF levels of myocardial infarction group, angina pectoris group and control group were significantly different (P<0.05), serum H-FABP, ICTP, Hcy and vWF levels of myocardial infarction group and angina pectoris group were higher than those of control group while serum CysC levels were lower than that of control group; serum H-FABP, ICTP, Hcy and vWF levels of myocardial infarction group were higher than those of angina pectoris group while serum CysC level was lower than that of angina pectoris group, and pair-wise comparison of serum H-FABP, ICTP, CysC, Hcy and vWF levels showed significant differences (P<0.05), shown in Table 3.

3.4. Correlation of mitral annular displacement with left heart function and serum indexes

Unary linear regression was used to analyze the correlation of MAD parameter values with left heart function and serum index levels, and the specific results were as follows: mitral annular displacement parameters TMAD1, TMAD2 and TMADmid values were negatively correlated with LVEDD, LVESD and A/E values as well as H-FABP, ICTP, Hcy and vWF levels, and were positively correlated with LVEF value and CysC level (P<0.05), shown in Table 4.

4. Discussion

Vascular lesion severity in patients with coronary heart disease is closely related to the final treatment outcome, and early and accurate diagnosis of coronary heart disease and judgment of illness severity is the key of targeted treatment and optimizing patients' clinical outcome[3]. Cardiac anomalies appear relatively late in patients with coronary heart disease, the serum indexes have higher sensitivity, but lower specificity, and looking for a more objective and reasonable index to judge the condition of coronary heart disease is the current clinical hotspot. MAD uses two-dimensional ultrasound STI to track mitral annular motion relative to the ventricular apex, and is mainly used to evaluate left ventricular systolic function[4,5]. High temporal resolution of two-dimensional ultrasound speckle tracking imaging makes up for the limitations of traditional M-type ultrasonic cardiogram, and it is a new way to early assess heart damage and predict cardiovascular events[6]. In the study, STI was introduced in MAD measurement, and it was found that parameters such as TMAD1, TMAD2and the maximal displacement at TMADmid values of myocardial infarction group and angina pectoris group were lower, and with the aggravation of coronary heart disease, the values of above indexes further reduced. It indicated that mitral valve motion ability declines in patients with coronary heart disease, which is mainly because that myocardial contractility decreases after ischemia necrosis and stretches the mitral valve, and also shows that MAD can sensitively identify early myocardial ischemia of coronary heart disease, and can also reflect the degree of ischemia and myocardial injury[7].

Some scholars believe that MAD can replace cardiac function and become the gold standard for early diagnosis of coronary heart disease, but some people think that the correlation between MAD and cardiac function indexes in patients with coronary heart

Table 3
Serum illness-related index levels.

Groups	Case No. (n)	H-FABP (ng/mL)	ICTP (ng/mL)	CysC (mg/L)	Hcy (μ mol/L)	vWF (%)
Myocardial infarction group	47	65.38±7.12	9.73±1.01	0.91±0.9	23.73±3.12	157.63±18.34
Angina pectoris group	42	47.12±5.07	6.38±0.72	1.15±0.18	17.45±1.97	121.35±14.58
Control group	58	13.89±1.61	4.32±0.53	1.28±0.15	10.52±1.89	90.37±11.45
F		9.384	8.273	5.182	8.374	12.183
P		<0.05	<0.05	<0.05	<0.05	<0.05

Table 4
Correlation of mitral annular displacement with left heart function and serum indexes.

Indexes	TMAD1		TMAD2		TMADmid	
	Determination coefficient r	P	Determination coefficient r	P	Determination coefficient r	P
LVEDD	–0.657	<0.05	–0.673	<0.05	–0.683	<0.05
LVESD	–0.709	<0.05	–0.713	<0.05	–0.726	<0.05
LVEF	0.683	<0.05	0.736	<0.05	0.742	<0.05
A/E	–0.712	<0.05	–0.693	<0.05	–0.698	<0.05
H-FABP	–0.673	<0.05	–0.712	<0.05	–0.715	<0.05
ICTP	–0.738	<0.05	–0.718	<0.05	–0.709	<0.05
CysC	0.694	<0.05	0.679	<0.05	0.683	<0.05
Hcy	–0.761	<0.05	–0.673	<0.05	–0.726	<0.05
vWF	–0.729	<0.05	–0.728	<0.05	–0.693	<0.05

disease is not clear, and it is cannot macroscopically replace the diagnostic significance of cardiac function indexes for the coronary heart disease[8]. In order to define the relationship between MAD parameters and conventional indexes to judge coronary heart disease, cardiac function and serum related index levels of three groups were detected in the study. LVEDD, LVESD, LVEF and Peak A/E ratio are currently recognized representative indicators of cardiac function, and in the case of myocardial ischemia and left ventricular diastolic dysfunction, LVEDD, LVESD and A/E increase and LVEF value decreases[9,10]. In the three groups of the study, LVEDD, LVESD and A/E values of myocardial infarction group and angina pectoris group were higher while LVEF values were lower, indicating that the heart function parameters detected by echocardiography can accurately reflect myocardial injury in patients with coronary heart disease. And LVEDD, LVESD and A/E values of myocardial infarction group were higher than those of angina pectoris group while LVEF value was lower than that of angina pectoris group, indicating that levels of cardiac function indexes also have important value for judgment of coronary disease severity[11].

About serum index levels in patients with coronary heart disease, it was found in the study that serum H-FABP, ICTP, Hcy and vWF levels of myocardial infarction group and angina pectoris group were higher than those of control group while serum CysC levels were lower. H-FABPmainly exists in the ventricle, and is released into the blood circulation in the case of myocardial cell ischemia hypoxia; coronary artery atherosclerotic plaque is rich in collagen type Ⅰ, it generates ICTP after catalytic degradation of MMPs, and ICTP levels are associated with necrotic plaque core area size; CysC can inhibit endogenous cysteine protease activity, and participate in the vessel wall matrix remodeling and the development of coronary heart disease; Hcy is an independent risk factor for coronary heart disease, and as Hcy levels rise, the risk of coronary heart disease is multiplied; vWF is stimulated and released into the blood after endothelial cell injury, and it has been found in recent years that vWF is closely associated with ischemic heart disease[12,13]. The changes in the levels of above indexes are consistent with their role in coronary vascular lesions, indicating that joint detection of above serum indexes is helpful to the diagnosis of coronary heart disease and determination of the disease severity.

The correlation of TMAD1, TMAD2 and TMADmid values in patients with coronary heart disease with cardiac function and serum index levels was further analyzed in the study, and it was found that the mitral annular displacement parameters TMAD1, TMAD2 and TMADmid values in patients with coronary heart disease were negatively correlated with LVEDD, LVESD and A/E values as well as H-FABP, ICTP, Hcy and vWF levels, and were positively correlated with LVEF value and CysC level, indicating that MAD parameter values can well represent the disease severity in patients with coronary heart disease, and can be used as the reliable way to early diagnose the disease, judge the illness and evaluate the prognosis[14,15].

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