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The applications and clinical significance of IMA, H−FABP joint CK−MB in acute myocardial infarction

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ABSTRACT

Objective: To investigate the applications and clinical significance of ischemia-modified protein (IMA), heart-type fatty acid binding protein (H-FABP) joint creatine kinase isoenzyme (CK-MB) in acute myocardial infarction (AMI). **Methods:** From January 2014 to December 2014, 84 clinical materials of patients with AMI in Department of cardiology were collected, and 80 cases of normal projects were the control group. IMA was determinated with albumin-cobalt ion binding assay. The levels of H-FABP and CK-MB of 84 cases of AMI patients and 80 cases of normal subjects were determinated with immunoturbidimetric. The value of IMA, H-FABP and CK-MB of AMI patients were analyzed with subject-specific curve (ROC). **Results:** The levels of serum IMA, H-FABP and CK-MB of AMI group were significantly higher than those of the control group. Differences showed statistical significance ($P < 0.05$). The levels of serum IMA, H-FABP and CK-MB increased as the increase of coronary lesion vessels in patients with AMI ($P < 0.05$). The levels of IMA, H-FABP and CK-MB of the death group were significantly higher than those of the surviving group ($P < 0.05$). ROC curve analysis showed that when IMA, H-FABP and CK-MB joint detections of sensitivity, specificity, positive predictive value and negative predictive value were greater than single-index detection ($P < 0.05$). **Conclusions:** The expression levels of IMA, H-FABP and CK-MB are closely related to the occurrence and development of disease progression in patients with AMI. IMA, H-FABP joint CK-MB detection can improve the sensitivity and specificity for early diagnosis of AMI.

1. Introduction

Acute myocardial infarction (AMI) refers to a disease with dangerous morbidity and high fatality rate that partial myocardial cells are injured or dead because of long-term severe myocardial schemia[1]. It is extremely important and meaningful to diagnose the disease condition as early as possible and apply effective therapeutic measures for promoting recovery and improving prognosis for patients. Creatine kinase isoenzyme (CK–MB) is a common marker for clinical diagnosis of patients with AMI. However, diagnosing AMI only by CK-MB lacks sensitivit[2]. Recent researches showed that ischemia-modified protein (IMA) could rise rapidly within a short time after myocardial ischemia so that IMA could be a predictive index for the severity of AMI[3]. The relative molecular weight of heart-type fatty acid binding protein (H–FABP) is small. When cardiac muscle is injured, it can release to blood rapidly and lead to the increase of the level of H-FABP in serum[4]. The study would investigate the application values of IMA, H-FABP joint CK-MB in AMI, which aims to provide guidance to early diagnosis for patients with AMI. Presently reports as follows.

2. Materials and methods

2.1. Clinical materials

From January 2014 to December 2014, 84 clinical materials of

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patients with AMI in Department of cardiology were collected. Inclusion criteria: (1) the onset time of patients was less than 12 h; (2) patients were precisely diagnosed with AMI by arteriography and EEG; (3) they all met the standards of the AMI diagnosis standards of American College of Cardiology (ACC); (4) they all signed informed consents. Exclusion criteria: AMI patients combined with stroke, endocrine-metabolic anomaly, malignant tumor, hepatic and kidney functions deficiency, hyperkalemia and other diseases. Among them, 44 cases were males and 40 cases of females with ages from 38 to 82 years. The average age was (65.3 ± 4.5) years. Among them, 32 cases were single-vessel diseases; 35 were double-vessel diseases; 17 multi-vessel diseases. Ten of them died after rescue; 74 left hospital with prognosis. In addition, 30 cases of normal people who had been physically examined in our hospital were regarded as the control group. Among the control group, there were 15 males and 15 females aging from 38 to 80 with the average age of (65.9 ± 4.2) years. Since the baseline data of the two groups had no statistical differences, they were comparable.

2.2. Methods

Four milliliters of venous blood were drawn the day those patients were admitted to hospital, while people in the control group were drawn blood at the physical examination day. The blood was placed in test tubes A, B and C and centrifuged for 10 min with the speed of 1 500 r/min and then the supernatants were collected. Immunoturbidimetric was used to test the levels of H–FABP and CK–MB in tubes A and B. H–FABP kits were bought from Shanghai Jimian Shiye Co., Ltd. and CK–MB kits were purchased from Shanghai Jianglai Biotechnology Co., Ltd.. The operational processes were in strict accordance with specifications of the kits. Albumin-cobalt ion binding assay was applied to test IMA. IMA kits were provided by Changsha Yikang Technology Development Co., Ltd.. The operational processes were in strict accordance with specifications of the kits.

2.3. Statistical methods

Data were analyzed by SPSS17.0. Inter-group measurement data were represented with $x\pm s$. Analysis of variance was used to compare inter-group measurement data and LSD-t was used for further analysis. ROC curve was used to evaluate the application value of IMA, H–FABP and CK–MB in AMI.

3. Results

3.1. Comparison of the levels of serum IMA, H–FABP and CK–MB between AMI and the control groups

After analysis of variance, IMA, H-FABP and CK-MB of the four groups showed statistical differences ($P < 0.05$). LSD-t was used to make intergroup one-to-one analysis. The levels of serum IMA, H-FABP and CK-MB in AMI were significantly higher than those in the control group. Differences showed statistical significance ($P < 0.05$). The levels of patients' serum IMA, H-FABP and CK-MB increased significantly according to the increasing number of coronary lesion vessels ($P < 0.05$) (Table 1).

3.2. The relation between prognosis of patients and the levels of serum IMA, H–FABP and CK–MB

The serum levels of IMA, H-FABP and CK-MB of the survival group and dead group were detected and analyzed by t-test. The levels of serum IMA, H-FABP and CK-MB obviously increased, and differences showed statistically significant ($P < 0.05$) (Table 2).

Table 2

The relation between prognosis of patients and the levels of serum IMA, H-FABP and CK-MB ($x\pm s$).

Groups	Cases	IMA (U/mL)	H–FABP (g/mL)	CK–MB (U/L)
Survival group	74	28.63±6.48	6.12±1.48	59.12±5.48
Dead group	10	56.39±10.45	9.98±1.53	142.25±12.45
t		15.263	7.125	22.986
P		0.000	0.000	0.000

3.3. The application values of IMA, H–FABP and CK–MB in patients' early diagnosis

According to ROC curve, serum IMA > 10.02 U/mL, H–FABP > 3.98 g/mL and CK–MB > 7.98 U/L was the best bound, which can obtain the largest area of ROC. The diagnosis was confirmed if one of the two indexes was positive. If the two indexes were negative, it excluded. The sensitivity, accuracy and specificity of IMA, H-FABP and CK-MB joint detections were higher than single-index detection, and differences showed statistical significance($P < 0.05$) (Table 3).

4. Discussion

AMI is myocardial ischemia and necrosis caused by acute coronary artery occlusion, which makes it a common factor for acute death

Table 1

Analysis of the levels of serum IMA, H-FABP and CK-MB between AMI and the control groups ($x\pm s$).

Groups	Cases	IMA (U/mL)	H–FABP (g/mL)	CK–MB (U/L)
The control nnumber	80	5.25±2.12	3.12±1.42	6.48±2.58
AMI single-vessel diseases group	32	25.02±4.98[a]	5.63±0.98[a]	33.23±5.23[a]
AMI double-vessel diseases	35	32.12±6.48[ab]	6.98±1.12[ab]	70.98±8.45[ab]
AMI multi-vessel diseases	17	42.35±7.98[abc]	8.25±1.25[abc]	124.25±12.96[abc]
F		12.895	8.456	18.265
P		0.000	0.000	0.000

Compared with the control group, [a]$P < 0.05$; compared with the AMI single-vessel diseases group, [b]$P < 0.05$; compared with the AMI double-vessel diseases, [c]$P < 0.05$.

Table 3
The application values of IMA, H-FABP and CK-MB in patients' early diagnosis.

Groups	Cases	IMA		H–FABP		CK–MB		IM+H–FABP+CK–MB	
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
AMI group	84	80	4	78	6	76	8	84	0
The control group	80	0	80	2	78	10	70	1	79
Sensitivity (%)		65.23		71.45		62.33		91.45[abc]	
Specificity (%)		68.96		70.14		70.02		92.22[abc]	
Positive predictive value (%)		72.78		60.23		52.98		89.23[abc]	
Negative predictive value (%)		73.98		62.96		53.79		86.79[abc]	

Compared with IMA, [a]$P < 0.05$; compared with H-FABP, [b]$P < 0.05$; compared with CK-MB, [c]$P < 0.05$.

in clinical practice. The clinical manifestations of patients with the disease are persistent angina, shock, heart failure, changes of EEG features and the increase of the level of serum myocardial enzymes. As the improving life standards and changing life style, the morbidity and fatality of AMI are on the rise, which have severely threatened human health[5]. Early diagnosis and effective measures application have great clinical significances for rescuing dying myocardial cells and improving prognosis of patients.

At present, among diagnostic indices in laboratory, CK–MB and cTnI of myocardial enzymes are common-used indices. CK–MB and cTnI are compounded by myocardial cells. They will largely secrete to serum when myocardial cells are injured leading to the increase of the levels of serum CK–MB and cTnI[5]. However, early diagnosis of the two lacks sensitivity. The levels of serum CK–MB and cTnI do not increase until 6-8 h after the onset of AMI. Therefore, precise diagnosis of early AMI cannot achieve by relying solely on CK–MB and cTnI. Some patients may be misdiagnosed and cause delayed therapy[6]. In the early period of AMI, partial myocardial ischemia, free radicals injury and severe hypoxic acid will lead to a decrease of combining capacity of serum protein and cobalt ions, causing the end of the amino acid sequence deficiency and acetylation. As a result, AMI takes its shape[7]. Zheng *et al*. pointed out that within several minutes of myocardial ischemia, the level of serum IMA increased rapidly and reached its highest at 6 h after the occurrence of AMI. Then, it began to decrease and returned to its normal level as the pathogenetic conditions of patients reached on the outcome period[8]. Differing from traditional myocardial necrosis indexes, IMA increases without irreversible injures of cardiac muscle and it can accurately diagnose early clinical myocardial ischemia. The study showed that the level of serum IMA had a close relation to the pathogenesis, development and outcome periods of AMI patients. With the increase of coronary artery lesion vessels in AMI patients, the level of serum IMA increased obviously. Besides, the level of serum IMA in death group was significantly higher than that in survival group.

H-FABP mainly exists in myocardial cells and possesses myocardial specificity. When myocardial cells are damaged, it can release to blood rapidly so that the level of H-FABP in serum increase quickly[9]. Correctional researches pointed out that within 2 h of the pathogenesis of AMI, the level of serum H-FABP increased rapidly and reached its highest at 12–24 h. Then, it began to decrease and returned to its normal level as the pathogenetic conditions of patients reached on the outcome period[10]. Thus, H-FABP could be an evaluation index for AMI early diagnosis. The study results showed that the level of plasma H-FABP in AMI patients was significantly higher than that in the control group. It also increased as the severity of coronary artery lesion increased. In condition, the level of plasma H-FABP in death group was significantly lower than that in survival group, which indicated that the level of HH-FABP had a close relation with the severity of patients' conditions and its level can reflect the prognosis situations of AMI patients. Compared with single-index detection, IMA, H-FABP joint CK-MB detection could provide a relatively high sensitivity, accuracy and specificity ($P < 0.05$), which indicated that clinical workers could improve clinical diagnosed accuracy by using joint detection.

In conclusion, the expression levels of IMA, H-FABP and CK-MB are closely related to the occurrence and development of disease progression in patients with AMI. IMA, H-FABP joint CK-MB detection can improve the sensitivity and specificity for early diagnosis of AMI.

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