Original Article

The Changes of Cardiac Troponin I and Creatine Kinase MB Isoenzyme after Percutaneous Transluminal Coronary Angioplasty

Rezvanieh Salehi MD, Azin Alizadeh Asl MD*, Alireza Salehi MD
Rasoul Azarfarin MD

Cardiovascular Research Center, Tabriz University of Medical sciences

Abstract

Background: Percutaneous transluminal coronary angioplasty (PTCA) with or without stenting is a well established technique for coronary revascularization. The injury to the myocardium during the technique was investigated by measuring serum levels for cardiac troponin I and activity of Creatine Kinase MB Isoenzyme (CK-MB), the sensitive and relatively specific biomarkers of cardiac injury. In this study, to detect minor myocardial injury after PTCA, we evaluated serum levels of CTNI and CK-MB after PTCA.

Methods: The serum levels of CTNI and the activity of CK-MB were measured by standard methods in 100 patients undergoing elective PTCA, before and 12-24h after the procedure. Patients who had hepatic, renal and thyroid disease; recent myocardial infarction; electrocardiographic changes, chest pain and myocardial infarction after intervention were excluded from our study.

Results: Meaningful differences between the mean levels of CTNI in the samples obtained before and after PTCA; 0.67 ± 0.58 ng/ml VS 1.19 ±0.94 ng/ml (P = 0.000) and those of CK-MB activities; 22.89±8Iu/l VS 26.38±13.39 (P=0.010) were noticed. Stenting place had no effect on the measured parameters. Relationships between history of Hypertension, Diabetes, Hyperlipidemia, Previous myocardial infarction, Smoking and elevations of CTNI and CK-MB levels weren’t statistically significant.

The frequency of increased levels of CTNI and CK-MB in women was significantly higher than men.

Conclusion: We concluded that minor cardiac injury following PTCA may increase the serum level of CTNI and serum activity of CK-MB. CTNI is more sensitive than CK-MB in detecting of the injury and placing stent has no effect on the release of the parameters during the PTCA. (J Cardiovasc Thorac Res 2009; Vol.1 (1): 11-15)

Keywords: CK-MB●PTCA●CTNI

*Corresponding Author: Azin Alizadeh Asl, Cardiovascular research center, Madani Heart Hospital, Tabriz University of Medical Sciences. Tel: 0411- 3363880. Fax: 0411-3344021. E-mail: alizadeasl@yahoo.com.
Introduction

Balloon angioplasty, or percutaneous transluminal coronary angioplasty (PTCA), was first performed by Andreas Gruentzig in 1977 using a prototype, fixed-wire balloon catheter. The procedure was initially limited to less than 10 percent of patients with symptomatic coronary artery disease (CAD) who had focal noncalcified lesions of a single, proximal coronary vessel, where it was used as an alternative to CABG. As equipment design and operator experience evolved rapidly over the next decade, percutaneous coronary intervention (PCI) was expanded to a broader spectrum of patients, such as those with multi vessel disease, more challenging anatomy, reduced left ventricular function, and other serious comorbid medical conditions. The most common complication of current PCI is periprocedural myocardial infarction (MI) and minor cell damage as diagnosed by postprocedure elevation of cardiac markers. The cardio specific enzymes such as cardiac Troponin I and creatine kinase MB isoenzyme (CK-MB) has been introduced as a sensitive marker of myocardial injury. Troponin I re-elevation after percutaneous coronary intervention in high-risk patients with acute coronary syndrome (ACS) is associated with a substantial increase in mortality. Elevation of cardiac troponins I is highly sensitive and specific for myocardial injury in acute coronary syndrome. Cardiac Troponin T has been used to detect minor myocardial injury early after coronary intervention in several previous studies. Minor elevations in cardiac enzymes after apparently successful percutaneous coronary interventions are common (15% to 26%). Minor elevations of CK-MB after successful coronary interventions identify a population with a worse long-term prognosis compared with patients with no enzyme elevations and appear to have an adverse effect on long-term prognosis.

Methods

This was a prospective cross-sectional study which performed in Tabriz Shahid Madani educational-treatmental center from September 2005 to July 2006. 110 patients scheduled for PTCA were included in this study. Blood samples were drawn before and 12-24 hours following PTCA procedure, centrifuged and serum Troponin I was analyzed by ELISA methods and CK-MB levels determined by immunochemical methods. Collected data were analyzed by SPSS 11.5 and statistical correlations were studied by Chi-Square and Independent T-test.

Results

Demographic variable of the 100 patients (67 male and 33 female) undergoing elective primary successful PCI are shown in Table 1. All patients had normal values of cardiосpecific troponin I and CK-MB before PCI. CTNI levels was elevated in 75% of patients but 25% patients showed no changes.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total Num (100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (men)</td>
<td>55.05 ± 12.35</td>
</tr>
<tr>
<td>Mean Age (women)</td>
<td>55.42 ± 9.52</td>
</tr>
<tr>
<td>Male (%)</td>
<td>67%</td>
</tr>
<tr>
<td>Female (%)</td>
<td>33%</td>
</tr>
<tr>
<td>History of MI (%)</td>
<td>34%</td>
</tr>
<tr>
<td>History of Hypertension (%)</td>
<td>50%</td>
</tr>
<tr>
<td>History of Hyperlipidemia (%)</td>
<td>36%</td>
</tr>
</tbody>
</table>

Table 2 shows CTNI and CK-MB changes in comparison with patients characteristics. CK-MB levels were elevated in 61% patients and in normal range 39%. There was meaningful differences between CTNI before and after procedure (0.67 ± 0.58 ng/ml vs 1.19 ±0.94 ng/ml p=0/000) also CK-MB levels was (22.89 ± 81 IU/L VS 26.38 ± 13.39 P= 0.01). Stent implantation had no effect on these levels. The frequency of increased level of enzymes in women was significantly higher than men. The statistically significant
Changes of CTNI and CK-MB after PTCA…

relationship was present in stented versus simple angioplasty group. The increased levels of CTNI in studied group was higher than of elevated CK-MB. There was no relationship between cardiac risk factors and enzyme rising. The higher levels of CTNI and CK-MB were present more in women as compared with men.

Table 2

<table>
<thead>
<tr>
<th></th>
<th>Before PTCA</th>
<th>After PTCA</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean and Standard deviation of CTNI in elective patients</td>
<td>0.67 ± 0.58 ng/ml</td>
<td>1.19 ± 0.94 ng/ml</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean and Standard deviation of CK-MB in elective patients</td>
<td>22.89 ± 8 lu/l</td>
<td>26.38 ± 13.39 lu/l</td>
<td>0.010</td>
</tr>
<tr>
<td>Mean and Standard deviation of CTNI in emergency patients</td>
<td>6.03 ± 2.35 ng/ml</td>
<td>3.57 ± 1.56 ng/ml</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean and Standard deviation of CK-MB in emergency patients</td>
<td>52.7 ± 13.43 lu/l</td>
<td>41 ± 12.66 lu/l</td>
<td>0.001</td>
</tr>
</tbody>
</table>

*CTNI, Cardiac Troponin I;  
**CK-MB, Creatine Kinase-MB

Discussion

In this study, the effect of PTCA on the cardio specific enzymes (CK-MB, CTNI), in the presence of CVD risk factors such as diabetes, hyperlipidemia, hypertension, smoking and a history of previous myocardial infarction and also the effect of stenting in increasing of serum level of these markers was considered.

According to the obtained results of this study, CTNI levels was elevated in 75% of patients and CK-MB levels were elevated in 61% patients. The frequency of increased level of CTNI in women was significantly higher than men. There wasn’t any meaningful relationship between serum levels of CTNI and CK-MB with stenting.

In a similar study that was performed by Cheng-Ju Wu and et al, cardiac Troponin I and CK levels were measured before intervention and 4 hours, 8 hours, 12 hours and 24 hours after apparently successful coronary intervention in 106 eligible patients. The frequency of cardiac Troponin I in crease after coronary intervention was higher than that of CK increase (40.2% vs. 8.2%). The frequency of cardiac Troponin I in crease in the stent group was significantly higher than that in the PTCA group (49.2% vs. 21.9%, p <0.001).

However in our study from 65 patients undergoing stenting, CTNI level was increased in 52 cases, but the relationship between stenting and CTNI level increasing wasn’t meaningful. So, they concluded that CTNI is more sensitive than CK-MB in diagnosing of minor injuries of heart muscle and the usage of stenting causes significant increase of CTNI level. 23

Another study by Salam M. Saadeddin and et al, CTnI and cTnT levels were compared with those of CK or CKMB in 50 consecutive patients with stable angina undergoing visually successful PTCA with stenting (n = 35) or without stenting (n = 15). Cardiac TnI, cTnT, CK and CKMB levels were measured before and 6, 24, and 48 hours after the procedures was performed. Troponin I was elevated in 10/35 patients after coronary stenting (29%) and in 2/15 patients after PTCA (13%) (P= 0.327). They concluded that cTnI is a very sensitive marker in detecting minor myocardial injury after coronary angioplasty with or without stenting. The frequency of increased serum levels of cardiac Troponins is higher in patients undergoing stent implantation than in those treated with angioplasty alone but does not reach significance. 24

However in our study there wasn’t significant meaningful relationship with stenting and serum levels of CTNI and CK-MB.

Dr.Annalisa Mongiardo and et al, reported that CTNI is a sensitive and specific marker in determining of primary injury of myocardium, and the incidence of CTNI serum level increase after PTCA is 5-40%. Dr.Shmuel Fachs and et al concluded in their studies that troponin I re-elevation after percutaneous coronary intervention in high-risk patients with ACS is associated with a substantial increase in mortality and reduced event-free survival at 6-month follow-up. 13

The study that performed by Dr. Alaa E. Abdelmeguid and et al, shows that minor elevations of CK-MB after successful coronary interventions identify a population with a worse long-term prognosis compared with patients with no enzyme elevations and appear to have an adverse effect on long-term prognosis. 27
According the results of our study, the frequency and mean increase of CTNI, was higher in female patients than male patients and this is not indicated in other studies. This may show more sensitive myocardial tissue in women than men. In this study, we compared the effect of emergency and elective PTCA on the changes of serum levels of CTNI and CK-MB. We conclude that CTNI and CK-MB serum levels in patients undergoing emergency PTCA traverse their own natural revolution and decrease. So by comparing with these results, we can conclude that minor increases of cardio specific enzymes in elective PTCA happen and are measurable. On the other hand such increases in emergency PTCA are not measurable as a result of their high serum levels and we can’t have a subtle comparison about them.

References


24. Salam M, Saadeddin1, MohOd A, et al. Ferns3: Detection of minor myocardial injury after successful...

