

What is the Association Between PSA Levels and the Severity of Coronary Artery Disease in Patients with and without Myocardial Infarction?

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Abstract

Background: In recent years the association between prostate specific antigen (PSA) and coronary artery disease (CAD) has been under the spotlight. The objective of this study was to find the association between PSA level and the severity of coronary arteries' involvement.

Methods: In this cross-sectional study 200 man patients were examined. The first group includes who had been primarily diagnosed with acute myocardial infarction. The second group included CAD patients who were to go under elective angiography. Then, laboratory tests including Total PSA and Free PSA were performed before the angiography. All the blood samples were sent to a reference laboratory after admission. To analyse and determine the association between numerical variables correlation coefficient was applied.

Results: There were positive significant correlations between Total PSA and the Gensini score in STEMI and NSTEMI patients ($r=0.4$, $P=0.030$; $r=0.24$, $P=0.043$), also Free PSA and Total PSA and Gensini score in suspicious to have CAD patients ($r=0.23$, $P=0.021$; $r=0.22$, $P=0.024$). There were significant clinical differences (but not statistical) between the Free PSA level and the number of coronary arteries involved in the STEMI patients ($r=0.679$; $P=0.080$).

Conclusions: An average association between coronary artery involvement and blood indices of prostate exists. However, studies of higher levels of evidence are warranted to prove this association.

Keywords: Coronary artery disease; Prostate specific antigen; Angiography

Introduction

Currently, cardiovascular diseases are the most common causes of death in the world and Iran and constitute 40% of all deaths [1]. By 2020 the most important estimated cause of mortality and morbidity in developing countries will be coronary artery disease [2-4]. Each year, an average 90000 cardiovascular-related deaths occur in Iran [5]. The roles of risk factors such as diabetes, hypertension, dyslipidemia and cigarette smoking in cardiovascular diseases are well-known. At the time being, insulin resistance and type 2 diabetes are on the rise and are considered powerful risk factors for IHD [6,7].

Studies conducted in recent years have referred to the association between prostate specific antigen (PSA) and cardiovascular diseases. Moreover, the cardiogenic shock following acute myocardial infarction and coronary artery bypass grafting (CABG) in CAD patients was associated with an increase in PSA [8].

CAD has been associated with serum PSA and benign prostatic hyperplasia (BPH), where patients with high PSA levels are more likely to have CAD than those with low levels of PSA [9].

To date, an association between PSA levels and the severity of coronary artery involvement and major cardiovascular accidents has been reported [10]. However, the numbers of studies conducted in this

regard are not many, and have yielded different results; hence it seemed necessary to conduct a study with a larger sample size.

Determining the risk of heart disease has been a significant issue and researchers have always attempted to find new cost-effective and non-invasive techniques. Therefore, the purpose of this study was to find an association between PSA levels and the severity of coronary artery involvement in patients with and without acute myocardial infarction. If an association is found, PSA can be used as another indicator for CAD and also for predicting the severity of coronary artery involvement before angiography.

Methods

A cross-sectional study was conducted on patients requiring angiography in Tehran's Baqiyatallah Hospital's Angiography Department during the April-September 2014 period. The samples were selected non-randomly on the basis of certain inclusion/exclusion criteria. Inclusion criteria: all patients who had undergone angiography during the April-September 2014 period. Exclusion criteria were: patients with a history of angiography and/or previous angioplasty, CABG, history of BPH, prostatitis, prostatectomy, prostatic biopsy and prostate cancer. In this study we examined 200 men who underwent coronary angiography; 100 with acute myocardial infarction (MI) and 100 suspected to have CAD (without myocardial infarction). Using statistical formula for Comparison two independent populations and previous studies [14], we reached to sample size equally

200 patients. Patients with acute MI were further classified into two groups, those with STEMI and those with NSTEMI. The patients were classified into two groups. The first group comprised those who had attended the emergency department and who had been diagnosed with acute MI and who had subsequently undergone angiography. The second group consisted of suspicious to have CAD patients who were on elective angiography. Before angiography Total PSA and Free PSA were measured in all patients. All blood samples were sent to a reference lab where the Electrochemoluminescence (ECLIA) technique was applied.

	STEMI (n=29)	NSTEMI (n=71)	Suspicious to have CAD (n=100)	P-value
Free PSA (mean ± SEM)	0.49 ± 0.13	0.55 ± 0.09	0.53 ± 0.06	0.701
Total PSA (mean ± SEM)	1.41 ± 0.37	2.03 ± 0.47	1.76 ± 0.29	0.48
Free/Total PSA (mean ± SEM)	0.37 ± 0.05	0.32 ± 0.01	0.36 ± 0.29	0.399

Table 1: Relation between PSA indices with MI (STEMI, NSTEMI) and suspicious to have CAD.

Data regarding the patients' age, history of cigarette smoking, hypertension, hyperlipidemia, diabetes and familial history of CAD were gathered. The consent form was completed by all the participants and they were ensured of the confidentiality of their data.

	STEMI (n=29)	P-Value	NSTEMI (n=71)	P-Value	Suspicious to have CAD (n=100)	P-Value
Free PSA	r=0.315	P=0.096	r=0.24	P=0.043	r=0.23	P=0.021
Total PSA	r=0.403	P=0.030	r=0.19	P=0.091	r=0.22	P=0.024
Free/Total PSA	r=-0.164	P=0.397	r=0.21	P=0.081	r=0.08	P=0.411

Table 2: Relation between PSA indices with Gensini score in STEMI, NSTEMI and suspicious to have CAD groups.

	STEMI (n=29)	P-Value	NSTEMI (n=71)	P-Value	Suspicious to have CAD (n=100)	P-Value
Free PSA	r=0.080	0.679	r=-0.103	0.408	r=0.151	0.177
Total PSA	r=0.128	0.508	r=-0.212	0.076	r=0.077	0.451
Free/Total PSA	r=-0.171	0.377	r=0.215	0.08	r=0.066	0.556

Table 3: Correlation between PSA indices level and STEMI, NSTEMI and suspicious to have CAD groups.

Results

The mean age of the participants was 64 ± 11. Patients with acute MI were those with STEMI (14.5%); those with NSTEMI (35.5%) and others suspicious to have CAD (50%). Coronary angiography results were normal in 1.5%, non-obstructive CAD in 15%, one-vessel disease in 23%, two-vessel disease in 31% and three-vessel disease in 30%.

According to the diversity and severity of patients with coronary artery disease in this survey and some high levels of Gensini score in samples, the distribution of this variable was not normal.

Table 1 shows the relation of Free PSA, Total PSA and Free/Total PSA ratio for each of the STEMI and NSTEMI and suspicious to have CAD (without myocardial infarction) groups respectively.

The Gensini score is a scoring system in which the type and severity of the coronary artery involvement-based on the percentage of lumen narrowing-are used to set a score for each patient.

In this study an obstruction greater than 50% of the coronary vessel diameter was considered significant. Based on the type and number of coronary vessels involved in coronary angiography, the patients were classified into the following groups: 3 vessels, 2 vessels, 1 vessel, non-obstructive and normal. Obstructions of 1VD, 2VD and 3VD refer to the numbers of vessels involved with a narrowing greater than 50%. The non-obstructive group refers to the group that had smaller than 50% obstruction. All the angiographies were interpreted by two cardiologists.

By severity of coronary artery involvement we are referring to two variables, the Gensini score (severity of coronary vessel involvement) and the number of coronary vessels involved. By prostate specific antigen we are referring to the Total PSA, Free PSA and Free/Total PSA variables.

After completing the data they were entered into the SPSS 20 software. Quantitative variables such as mean and standard error of mean (SEM) were used and the Kruskal-Wallis test was used to compare the quantitative variables because the variables were not normal distribution (with the Kolmogorov-Smirnov test). To analyse and determine the association between numerical variables Correlation Coefficient was applied. A p value<0.05 was considered significant.

Table 2 shows the relation of Free PSA, Total PSA and Free/Total PSA ratio with Gensini score for each of the STEMI and NSTEMI and suspicious to have CAD (without myocardial infarction) groups respectively.

Table 3 shows the relation of Free PSA, Total PSA and Free/Total PSA ratio with Coronary Angiography (Number of coronary vessels involved) for each of the STEMI and NSTEMI and suspicious to have CAD (without myocardial infarction) groups respectively.

Multivariate regression analysis for GENSINI score; including Age, Free PSA, Total PSA, Free/TotalPSA revealed significant correlation with Free PSA and Total PSA (Table 4).

Variables	Coefficient β	P
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Age	0.019	0.804
Free/Total PSA	0.024	0.791
Free PSA	0.221	0.013
Total PSA	0.44	0.009

Table 4: Multivariate regression analysis for GENSINI score; including age, Free PSA, Total PSA, Free/Total PSA.

Discussion

Cardiovascular diseases are the most common causes of death in the world, and many risk factors such as diabetes, hypertension, dyslipidemia and cigarette smoking have been identified in its etiology [6,7].

Therefore, in this study we investigated the effect of an association between coronary heart disease and PSA in patients undergoing coronary angiography, both those who had an MI and those who were suspected to have CAD. We found a moderate correlation and significant association between Total PSA and the Gensini coefficient in only STEMI patients.. We may interpret this as such, that the greater the involvement of the coronary vessels, the higher the PSA level, and vice versa. Patane's 2009 study results were similar to ours in the sense that patients with acute MI had higher Total and Free PSA levels [8]. Weisman's results were very similar to ours, such that a high level of PSA in men with BPH was associated with the frequency of CAD [9,10].

Tahir Durmaz also found an average correlation and significant association between the Gensini coefficient and Free PSA and Free/Total PSA [11]. Borumand et al studied 151 patients in Iran in 2011 and observed significantly higher PSA levels in patients with high Gensini scores [12].

Another research conducted by Patane et al. in 2012 showed a significant relationship between PSA levels and NSTEMI [13]. However, Satioglu's study states otherwise, and has reported no correlation and significant association between increased PSA levels and coronary vessel involvement, and hence concluded that an elevated PSA level is not a suitable indicator for diagnosing or predicting the severity of CAD [14]. However, to our knowledge, no cohort or case-control study has been conducted on the prognosis of cardiovascular disease and PSA levels, and hence further studies of higher evidence are required.

PSA may be used as a predictor for coronary vessel involvement. However, determining the sensitivity, specificity and predictive value of this test for coronary artery disorders is also important. Moreover, the level of scientific evidence is low in cross-sectional studies; hence cohort or case-control studies should be conducted.

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