The relationship between HS-CRP serum levels with the results of cardiac perfusion SPECT imaging in patients with suspected coronary artery disease

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ABSTRACT :

Background: Coronary heart disease is known as the leading cause of death in industrialized and developing countries. Measuring the CRP in the study of cardiovascular disease, the cost is reasonable and one study has shown that it can have a strong and independent prognostic value of myocardial infarction and unstable angina. So, we decided to study the relationship between hs-CRP serum levels and the results of cardiac perfusion SPECT imaging in patients with suspected coronary disease.
Materials and methods: This cross-sectional study was conducted in 1393 at Shafa hospital in Kerman; Patients with suspected coronary heart disease, candidates for perfusion scan to confirm or reject the ischemic heart disease were recruited into the study. hs-CRP levels in both groups were compared by normal and abnormal perfusion scans. In the end, the level of hs-CRP in both groups, and the correlation between hs-CRP and sex, age, and risk factors were analyzed.
Findings: The mean age of patients with normal perfusion scan was 64.05 and 59.68 in the group with abnormal perfusion scan. (P=0.744). Average CRP in the group with normal perfusion scan was 1.96 and in the group with abnormal perfusion scan, 3.3. The difference in these two groups was statistically significant. (P=0.012). There was no significant difference between CRP levels and age, sex and risk factors. (P-value respectively: 0.727, 0.924, 0.329)
Conclusion: In general, given the correlation between hs-CRP in patients with abnormal perfusion scan and the role of hs-CRP in infection and inflammation as causes of atherosclerosis inducer, the serum levels of hs-CRP test before ETT, the impact of scan results enhanced accuracy, especially in cases of suspected attenuation.

Keywords: Coronary artery disease, hs-CRP serum levels, perfusion scan

BACKGROUND:

Coronary heart disease is known as the leading cause of death in industrialized and developing countries. In the United States, approximately two million heart attacks and unstable angina occurs annually, resulting in 515 thousand cases of death (1).

Severity of coronary atherosclerosis is among the reasons for referring patients to specialized clinics and hospitals and it has been reported that 90% of emergency patients come to the hospitals with a pain in their chest. Factors such as older age, lipid profile, diabetes, smoking, age, gender and heredity are presented as risk factors for coronary artery disease (2), But if all risk factors and markers are not recognized, of course, symptomatic treatment may not be effective and ultimately lead to death (3).

Atherosclerosis is the most common cause of ischemic heart disease and therefore, the number of heart attacks increased progressively with increasing age and other risk factors. Also inflammatory cells and mediators are involved in the initiation, progression and complications of atherosclerotic lesions (4). Reactive protein C (CRP), a marker of systemic inflammation and one of acute phase proteins increases in cases of inflammation, infection and collagen vascular diseases. CRP increases faster than other acute phase reactants, and its decline occurs more quickly after removing the irritant (5).

Natural level of CRP in adults is less than 0.5 to 0.8 milligrams per liter. CRP serum levels are measured by a variety of qualitative and quantitative methods, among which the biochemical method is the most common (6).

Measurement of CRP serum level in the traditional way, often has been used for determining inflammatory and infectious processes and this method is able to measure the CRP serum levels with concentrations between 3 to 5 µg / ml which is a higher concentration than the concentration found in lots of healthy and normal people, but the measurement of hs-CRP serum level is able to recognize even concentrations around 0.3 µg / ml and less that the method of measurement is used to assess the risk of cardiovascular diseases (7,8). Measuring the CRP in the study of cardiovascular disease, the cost is reasonable and one study has shown that it can have a strong and independent prognostic value of myocardial infarction and unstable angina (9). The diagnostic role of imaging techniques such as myocardial perfusion imaging to determine the extent

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of ischemia and coronary angiography to determine the severity of CAD is widely known (10). As various studies has observed the prognostic role of high-sensitivity CRP in mortality of patients with acute coronary syndrome and heart failure, this is a necessity to conduct a simple test such as the measurement of high-sensitivity CRP to achieve an acceptable prediction about the extent of coronary artery and ischemic heart involvement (11,12).

Furthermore, Identifying and evaluating high-sensitivity CRP levels with results of diagnostic imaging such as perfusion scan and angiography of acute coronary events, provides a substantial contribution to prediction of ischemic heart disease severity even before expensive actions and sometimes invasive imaging (13,14). The present study aims to evaluate the relationship between serum levels of high-sensitivity CRP and the results of perfusion scan in patients undergoing elective diagnostic imaging methods for determining the presence or conflict extent of ischemic heart disease. According to conducted studies, the results of this study will be used to enhance the diagnostic power of perfusion scan and better interpretation of scan results. So, we decided to study the relationship between hs-CRP serum levels and the results of cardiac perfusion SPECT imaging in patients with suspected coronary disease.

MATERIALS AND METHODS

Patients with suspected coronary heart disease, candidates for perfusion scan to confirm or reject the ischemic heart disease were recruited into the study. Basic information including patient demographic data, history of heart disease or previous cardiac interventions, patient's medical history, and history of heart disease risk factors were asked through interviews and recorded in project questionnaires of patients. Two groups were matched in terms of smoking, opium consumption, age and gender. Before the scan, blood samples were taken to determine the hs-CRP levels of patients. Then, 24 hours later, another blood sample was taken to evaluate the possible effect of perfusion scan on the hs-CRP levels. Trend of hs-CRP level in both groups with normal perfusion scan and positive perfusion scan were compared with each other. It should be noted that patients with positive perfusion imaging were referred to coronary angiography unit for further diagnosis. The study was conducted based on cross-sectional method.

Inclusion criteria or the study population included patients with suspected coronary heart disease, candidates for perfusion scan. Exclusion criteria included: 1) Patients for whom perfusion scan is banned. 2) Patients with acute infectious or inflammatory disease 3) Patients taking anti-inflammatory drugs, or NSAIDs recently 4) Patients with kidney failure.

FINDINGS

Among a total of 94 patients, 56 patients had normal perfusion scan and 38 patients had abnormal perfusion scan. Of these, 33 were male (54.54% of patients with abnormal non-perfusion scan and 45.46% of patients with normal perfusion scan).fig 1

The average age in the group with normal perfusion scan was 64.05 and 59.68 in abnormal perfusion group, so there was no significant difference between these two groups. (P=0.744).

Average CRP in the group with normal perfusion scan was 1.96 and in the group with abnormal perfusion scan was 3.3, therefore the difference between these two groups was statistically significant (P = 0.012).

Among a total of 94 patients, 65 (69.1%) had CRP greater than 3 and 29 (30.9%) had CRP under 3. 28 (28.6%) patients showed one risk factor, 31 patients (31.6%) two risk factors and 14 patients (14.3%) three risk factors. The number of risk factors between the two groups was significant (P = 0.010).

No significant correlation between CRP levels and gender, age and risk factors was observed. But a strong correlation between CRP levels and abnormal perfusion scan was reported. (P = 0.000).

Among a total of 38 patients with abnormal perfusion scan, the mean CRP in men was 4.05 and 2.63 in women; there was no significant correlation between CRP levels and gender of patients (P = 0.609). In the group with normal perfusion scan of 56 patients, the mean CRP in men was 1.08 and 2.28 in women; a significant relationship was observed between CRP levels and gender. (P = 0.020). table1

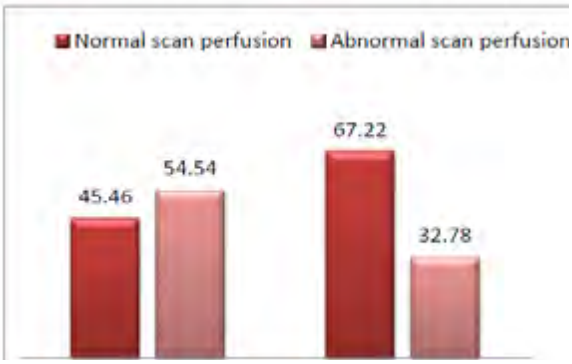

Fig 1: frequency distribution of gender in each group

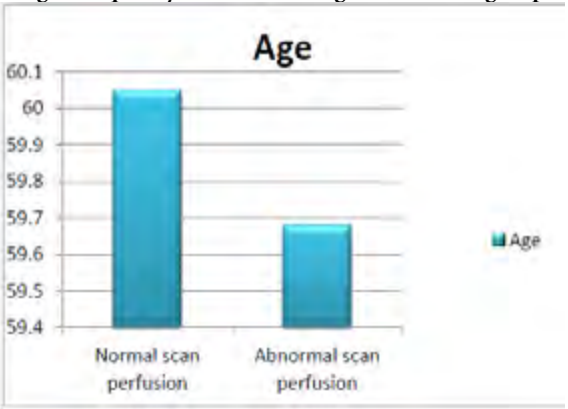

Fig 2: Mean age of patient in each group

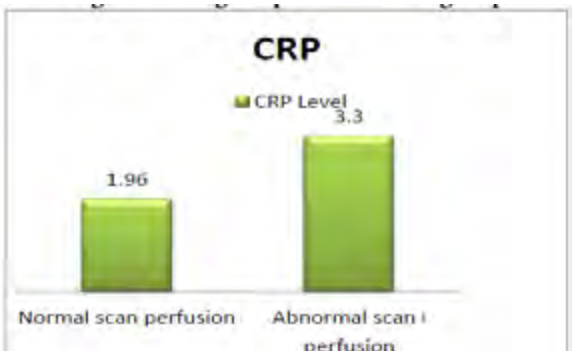

Fig 3: Mean level of CRP in each group

Table1: Mean level of CRP in each group based on gender

	Abnormal scan perfusion		Normal scan perfusion		P-value
	Male	Female	Male	Female	
CRP Level	4.05	2.63	1.08	2.28	0.020

DISCUSSION AND CONCLUSION

In this study we concluded that hs-CRP evaluation in patients undergoing myocardial perfusion scan has been related to imaging results and can be a useful factor for interpretation of myocardial scan specifically in suspected patients. Screening tests can help to identify patients at risk for acute coronary events, but identifying more accurate screening tests that can recognize high-risk patients non-invasively, is felt clearly (15,16).

Multi-factor Rating systems such as Framingham scoring system uses common risk factors including advanced age, diabetes, dyslipidemia and high blood pressure. But one of the subjects we need to determine is whether adding other tests to this rating system can identify high-risk population better or not? Inflammation is a known risk factor for atherosclerosis and cardiovascular events. Ongoing inflammation can increase the risk of injuries to rupture, leading to fatal cardiac events such as heart attack and cardiac arrest (17).

HS-CRP is a bio-marker which more than any other inflammatory markers has been studied and the findings are available today. However, there are still doubts about value of HS-CRP in cardiovascular disease risk and screening (16). In this cross-sectional study, a strong correlation between levels of CRP and abnormal perfusion scan was found. In many epidemiological studies that have been conducted in men and women, the correlation between increased CRP and increased risk of cardiovascular disease has been discussed. In large prospective studies, CRP is a strong independent predictive factor for the occurrence of heart disease, ischemic stroke, peripheral vascular disease and sudden cardiac death among individuals without cardiovascular disease. The aim of the present study was to determine the relationship between hs-CRP serum levels with the results of cardiac perfusion imaging in patients with suspected coronary heart disease. In a study by Majstorov and colleagues in 2008, CRP levels between patients with normal perfusion scan, and patients with positive perfusion imaging were compared using sestamibi gated SPECT MPI. 127 patients with suspected coronary heart disease, who had been referred to the perfusion scan unit, were studied. The results reflected lower levels of CRP in patients with normal perfusion scan (18). In another study by Masood and his colleagues in the Department of Cardiology, Jenna Lahore Hospital in 2011 on 80 patients to evaluate the relationship between hr-CRP serum levels and coronary artery conflict severity, there was a significant correlation between hr-CRP serum level elevation serum in patients and Gensisi score (19). In Vakili and colleagues study in year 89 in Urmia, the patient with CAD but without lesions in left main artery entered the study. According to the results of angiography, patients were categorized in four groups (without clogging or fouling with less than 50%, the conflict involving two vessels, three vessels and four vessels), respectively. Based on the results of this study, CRP was reported as a correct inflammatory marker of the severity of coronary artery disease in patients with CAD. It has been suggested that the measurement of CRP should be considered in addition to the usual risk factors for coronary artery blockage (20). Also in Hosseini et al study, 200 patients (1383-84) who referred to the Mazandaran Cardiac Center for angiography, the severity of coronary artery conflict was determined using coronary angiography based on the number of vessels involved and the severity of stenosis and based on that, patients were divided into two groups of high-risk and low risk that CRP levels in high risk group was significantly higher than the low-risk group (21). In contrast to the above studies, in the results of several studies, the relationship between intensity of coronary artery conflict and CRP plasma levels did not exist. A study by Ulucay in Turkey in 2008 on 51 patients, severity of coronary artery stenosis and hs-CRP serum level was examined, and there was no significant association between hs-CRP serum level and severity of coronary artery stenosis based on the severity of the stenosis (22). In Hoffmeister et al study, CRP levels with stenosis severity of CAD were examined and no significant relation was found between CRP levels and severity of CAD , but 62% of them had MI within the past two years. In Ghattas *et al* study in 2012 on 150 patients and 150 healthy people, no significant correlation was found between CRP serum levels and risk of heart attack (23). In this study, there was no significant relationship between CRP levels and gender, age and risk factors.

In Azarkar *et al* study, acute myocardial infarction risk factors such as blood pressure and blood lipid disorders and etc. and their relationship with hs-CRP levels were evaluated and none of these factors reported a significant relationship. Perhaps the reason is the difference between food and cultural habits of that area (24). In a case-control study conducted in India in 2010 to examine the risk factors for heart disease, the results showed that in patients with acute myocardial infarction compared to the control group, total cholesterol, triglycerides and LDL increased clearly and HDL was dramatically low. In that study a significant increase in inflammatory markers such as TNFα and CRP was found in patients with acute myocardial infarction compared with the control group (25).

On the contrary in Geluk *et al*. study, a significant association between increased hs-CRP serum levels with diabetes, high blood pressure, and partly positive family history of premature ischemic disease was observed (16). Parvizi and colleagues' study, conducted in Shiraz on 87 patients revealed a significant relationship between increases in the level of hs-CRP and risk factors such as high blood pressure, diabetes and positive family history (26).

In general, given the correlation between hs-CRP in patients with abnormal perfusion scan and the role of hs-CRP in inflammation and infection as atherosclerosis inducer factor, CRP measurement in patients who are supposed to undergo previous stress tests such as myocardial perfusion

scan can be helpful for interpretation of results, especially in patients suspected of coronary artery disease.

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