

## The correlation between early complications of percutaneous coronary intervention and high sensitive C-reactive protein

Farshad Roghani<sup>(1)</sup>, Ali Mehrabi Koushki<sup>(2)</sup>, Negin Nezarat<sup>(3)</sup>, Mohammad Saleki<sup>(4)</sup>

### Short Communication

#### Abstract

**BACKGROUND:** Increased incidence of cardiovascular diseases, especially coronary artery disease (CAD), during recent decades shows this disease entity to be the leading cause of death in the world. On the other hand many successes were achieved in the treatment of these diseases with new technology, which has its own side effects and threats for the patient. Among these new strategies is percutaneous coronary intervention (PCI), especially with stent implantation. Although coronary stents are effective in the treatment of dissection and prevention of restenosis, many side effects and even death have been observed, from 5-10% per year. Some studies showed that there is a relation between high sensitivity C-reactive protein (hs-CRP), as a laboratory marker for early detection of thrombosis and/or restenosis, and early complications of percutaneous coronary intervention. The aim of this study is to evaluate hs-CRP level in patients after PCI and to investigate if this can be a prognostic value for detection of early complication.

**METHODS:** This is a descriptive, analytical study done in Shahid Chamran Hospital (Isfahan, Iran) in 2011–2012. 87 patients who had undergone PCI were studied. Their hs-CRP level was measured before and after the study. Moreover, early stent complications were detected during the first 24 hours after insertion. The data was recorded in a researcher-constructed checklist and analyzed by SPSS for Windows 20.

**RESULTS:** The mean  $\pm$  SD of hs-CRP level in patients with and without complication were  $1.36 \pm 0.97$  and  $3.09 \pm 1.8$ , respectively. According to Student's t-test, the hs-CRP level in patients with early complications was higher than patients without early complications of stent implantation; the difference was statistically significant ( $P < 0.001$ ).

**CONCLUSION:** The hs-CRP serum concentrations of patients with, and without early stent complications were significantly different. According to the control diseases center (CDC) guideline, patients with a high level of hs-CRP need special care and attention.

**Keywords:** High Sensitivity C-reactive Protein (hs-CRP), Percutaneous Coronary Intervention (PCI) Complication

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#### Introduction

Cardiovascular diseases remain the biggest cause of deaths worldwide. Although over the last two decades cardiovascular mortality rates have declined in many high-income countries, they have increased at an astonishingly fast rate in low- and middle-income countries.<sup>1,2</sup> Due to the high incidence of cardiovascular diseases, their treatment methods and techniques were improved in recent decades. One of the most important treatment methods is stent implantation; but unfortunately this new

technique and instrument has some side effects and may lead to death or serious complications. For example stent thrombosis is a complication associated with stents implantation, and continues to be a risk for several months after the procedure.<sup>1-6</sup> According to other studies the total of stent insertion complications is 5-10%. The most important early complications of stents are death, myocardial infarction (MI), urgent target vessel revascularization, stroke, acute thrombosis resulting from stent, and angiographic complications

1- Assistant Professor, Department of Cardiology, Isfahan University of Medical Sciences, Isfahan, Iran

2- Department of Epidemiology, Isfahan University of Medical Sciences, Isfahan, Iran

3- Cardiac Rehabilitation Research Center, Isfahan Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran

4- Sport Medicine Specialist, Isfahan University of Medical Sciences, Isfahan, Iran

Correspondence to: Ali Mehrabi Koushki, Email: mehrabi@mui.ac.ir

including coronary perforation and coronary dissection. In-stent restenosis (ISR) is still a serious complication associated with stent insertion in percutaneous coronary intervention (PCI), even in the drug-eluting stent (DES) era.<sup>1-5</sup>

High sensitivity C-reactive protein (hs-CRP) is a sensitive inflammatory marker. Increased hs-CRP level is related to cardiovascular events such as stent restenosis in the patients.<sup>6-8</sup> The association of hs-CRP with PCI for ISR, especially in the DES era, is still a controversial issue. Current optimal medications such as statins, which exert anti-inflammatory effects, can modulate plasma hs-CRP level by decreasing coronary events.<sup>8</sup> Few studies have assessed the association of hs-CRP with ISR at both admission and follow-up in a large group of patients, especially in the Iranian population. We summarized the results of 87 consecutive stable angina (SA) patients who underwent coronary DES implantation. The aim of this study was the comparison of serum level of hs-CRP in patients with and without early complications.

## Materials and Methods

### a) Study design

This is a descriptive analytical study done in Shahid Chamran Hospital during 2011-2012.

The inclusion criteria were patients with chronic stable angina who had undergone stent implantation. Patients who died within 24 hours after the procedure were excluded.

### b) Methodology

A total of 87 consecutive patients with chronic stable angina who had undergone PCI were selected and followed for 24 hours after stent implantation for early stent complication. We obtained a sample of blood within 24 hours after PCI and sent it to the laboratory in order to determine hs-CRP level. According to the CDC guideline, hs-CRP should be checked twice in two weeks, the patients' average hs-CRP should be considered, and the patients should be in a fixed position. If hs-CRP is more than 10 mg/l, the test is repeated to exclude possibility of inflammatory disease. Plasma hs-CRP level was measured with an immunoturbidimetric method (Beckmann Assay 360, Bera, California, USA) as previously described.<sup>9</sup> Ethylenediaminetetraacetic acid (EDTA) anticoagulated peripheral blood was taken after a 12-hour fasting upon the patients' admission. Plasma was obtained with a centrifugation of 3000 r/min at 4°C for 15 minutes, and the resulting sample was immediately stored at -80°C until further analysis. The lower detection

limit of hs-CRP was 0.2 mg/L, the upper limit was 500 mg/L, and the median normal value was 0.8 mg/L. Other major biochemical indicators were examined at the same time in our clinical laboratory center. All patients were followed for 24 hours after stent implantation for early complications of PCI. The data included hs-CRP level (reported by the laboratory), demographic data, and early complication (recorded in special check lists).

### c) Statistical analysis

Finally the data were entered into the computer and analyzed by SPSS for Windows (version 20; SPSS Inc., Chicago, IL., USA). The chi-square, one way ANOVA, Fisher's exact and student's t-test were used for data analysis.

## Results

Of 87 patients 62 (71.3%) were male and 25 (28.7%) were female. The mean of patients age was  $57 \pm 7.2$  years (range of 44-76); 16 (18.4%) were under 50, 29 (33.3%) were 50-59 and 42 (48.3%) were 60 and above. The mean  $\pm$  SD of age were  $54.7 \pm 6.9$  and  $62.8 \pm 3.8$ , respectively, for men and women. According to the student's independent t-test the difference between male and female was statistically significant ( $P < 0.001$ ).

Any death, urgent target vessel revascularization, and stroke were seen until 24 hours after stent implantation. Other early complications included MI in 2 (2.3%) cases, coronary dissection in 3 (3.4%), and coronary perforation in 1 (1.1%) and were seen within 24 hours after stent implantation.

The mean  $\pm$  SD of age of patients without early complication, with MI, coronary dissection, and coronary perforation was shown in table 1. According to one way ANOVA there was no statistical difference between the 4 groups ( $P = 0.98$ ). Moreover, frequency distribution of early complications by sex was shown in figure 1 and according to Fisher's exact test there was no statistical difference between male and female ( $P = 0.84$ ).

The mean  $\pm$  SD of hs-CRP level was  $1.48 \pm 0.36$  (range of 0.2-5.6) in all patients. Furthermore, hs-CRP level was higher than 1mg/l in 52 (59.8%) patients, between 1-3 mg/l in 24 (27.6%), and 3mg/l and higher in 11 (12.6%) patients. The mean  $\pm$  SD level of hs-CRP in patients with and without complications was  $1.36 \pm 0.49$  and  $3.09 \pm 0.83$ , respectively; according to Student's independent t-test, there is a statistical difference between the two groups ( $P < 0.001$ ). The distribution of hs-CRP level based on early

complications was shown in figure 2.

The level of hs-CRP in patients with and without early complication was shown in table 2. According to one way ANOVA there was significant difference between the hs-CRP levels of the above groups ( $P < 0.001$ ). Moreover, the hs-CRP level based on age groups was shown in this

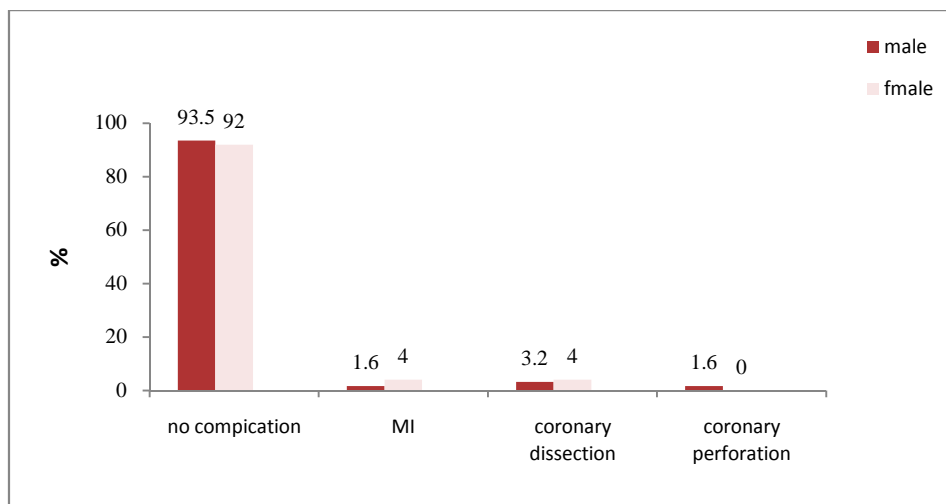
table, and according to one way ANOVA test the difference between age groups was statistically significant ( $P = 0.013$ ). The hs-CRP level in male and female were  $1.43 \pm 0.54$  and  $1.6 \pm 0.48$ , respectively, and according to Student's independent t-test, no statistical difference was seen between males and females ( $P = 0.52$ ).

**Table 1.** Number and age based on early complications in patients who had undergone PCI

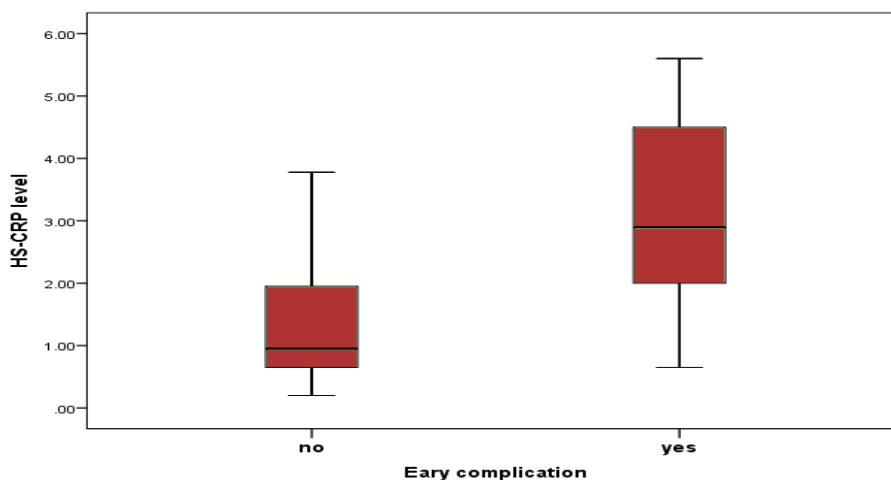
Early complication	Number of patients	Mean age	SD
No complication	81	57.00	7.2
MI	2	56.50	9.2
Dissection	3	57.00	7.8
Perforation	1	54.00	0.0
Total	87	57.02	7.2

( $P = 0.84$ )

PCI: Percutaneous coronary intervention; MI: Myocardial infarction



**Figure 1.** Frequency distribution of early complications based on sex in patients who had undergone PCI  
(PCI: Percutaneous coronary intervention; MI: Myocardial infarction)



**Figure 2.** Distribution of hs-CRP level based on early complications in patients who had undergone PCI  
(hs-CRP: High sensitivity C-reactive protein; PCI: Percutaneous coronary intervention)

**Table 2.** level of hs-CRP based on age, sex, and early complications in patients who had undergone PCI

Variables		Number of patients	Mean of hs-CRP	SD	P
Early complication	No complication	81	1.36	0.97	< 0.001
	MI	2	1.33	0.95	
	dissection	3	3.80	1.67	
	perforation	1	4.50	0.00	
Age groups	< 50	16	0.74	0.49	0.013
	50-59	29	1.70	1.20	
	≥ 60	42	1.60	1.15	
Sex	Male	62	1.43	1.14	0.520
	Female	25	1.48	1.09	

hs-CRP: High sensitivity C-reactive protein; PCI: Percutaneous coronary intervention; MI: Myocardial infarction

## Discussion

The aim of this study was to determine the relationship between hs-CRP level and early complications of PCI. Since the first human percutaneous transluminal coronary angioplasty (PTCA) procedure was performed in 1977, the use of percutaneous coronary intervention (PCI) has increased dramatically, becoming one of the most common medical interventions performed. However, some researchers believe that this operation may lead to reinflammation and restenosis in the coronary artery. In the next decades many cardiologists and surgeons encountered a new problem; restenosis and other serious complication that may lead to death. Thus many cardiologists searched for a way to predict these complications and these studies have continued to the present day. Now, we wish to find a biomarker that can predict life threatening complications. Recent advances in guide wires, stents, and devices to cross chronically occluded arteries are evolving, so that more patients with chronic total occlusions (CTOs) are now being successfully treated percutaneously.

Our study showed that plasma hs-CRP level may independently predict early complications of PCI. This finding is similar to the findings of a study conducted by Xu et al. in china.<sup>2</sup> This shows that a chronic, sustained, systemic inflammatory response might be involved in early complications of PCI. Inflammation plays an important role in complications of percutaneous coronary intervention; multiple inflammatory factors such as cytokines and chemokines are involved in the neointimal tissue response at the site of coronary stenting, and the inflammatory responses are related to arterial injury.<sup>9</sup> On the other hand, hs-CRP, an acute phase reactant and a strong marker of inflammation, has been found repeatedly to be a

strong predictor of future cardiovascular events after treatment by PCI.

In their study Dibra et al. used CRP as a unique inflammatory marker to investigate the impact of rosuvastatin treatment on cardiovascular events. The study enrolled healthy men and women with low-density lipoprotein cholesterol levels of less than 130 mg/dl and high-sensitivity (hs) CRP levels of 2.0 mg/l or higher. Rosuvastatin reduced low-density lipoprotein cholesterol levels by 50% and hs-CRP levels by 37%. Importantly, the decrease in CRP levels was accompanied by a significant reduction in the incidence of major cardiovascular events.<sup>10</sup> Moreover, in another study done by Hong et al. a significant positive correlation was found between pre-interventional CRP level and stent complications.<sup>11</sup>

## Conclusion

Due to the considerable role of inflammation in cardiovascular disease and the prognostic value of CRP, preprocedural measurement of CRP level has been considered to be a tool in identifying patients at higher risk for restenosis and recurrent cardiovascular events.<sup>12,13</sup> However, the association between CRP levels and cardiovascular events occurring after percutaneous coronary intervention (PCI) remains uncertain and is still under investigation.

## Conflict of Interests

Authors have no conflict of interests.

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