



# Determining the factors associated with the pattern and severity of coronary artery involvement in patients with acute coronary syndrome

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## Abstract

**Introduction:** Acute coronary artery syndrome is a term to describe a wide range of diseases associated with a sudden and severe decrease in blood flow to the heart.

**Objectives:** This study aimed to evaluate the variables related to the severity and type of coronary artery involvement in patients with the acute coronary syndrome (ACS).

**Patients and Methods:** This study is a retrospective analytical descriptive study. The statistical population of this study included patients who were admitted to the vascular ward of Shahid Mohammadi hospital in Bandar-Abbas during 2017-2020 with a diagnosis of the ACS and underwent coronary angiography.

**Results:** In the study of the main vessel involvement, left anterior descending artery (LAD) with 38.15% and RCA with 23.97% were the most common vessels involved. The most involved vessels were LAD-right coronary artery (LAD-RCA) (8.61%), left circumflex artery (LCX) (7.95%), obtuse marginal artery (OM) (7.68%) and diagonal arteries (4.77%), respectively. The most common sites of involvement in Chen's anterior descending vessel were the middle part of LAD (m.LAD), the proximal part of LAD (p.LAD), and then the distal part of LAD (d.LAD), respectively. Most of the places of conflict RCA, precisely similar to LAD, were the middle part of RCA (m.RCA), the proximal part of RCA (p.RCA) and the distal part of RCA (d.RCA). There was a statistically significant relationship between the severity of coronary artery disease (CAD) according to age, gender, diabetes, blood pressure, family history and the number of vessels involved. There was no statistically significant relationship between the severity of coronary artery involvement, smoking and mean body mass index (BMI).

**Conclusion:** As it is shown, our results were quite similar to other studies around the country. Hence, following the nationwide guidelines for treating CVD in this city seems rational and helpful.

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## Introduction

Atherosclerosis is a pathological process strongly associated with metabolic disorders of fat oxidation stress (1). Inflammatory changes in the endothelium which are triggered by alteration in the lipid metabolism can lead to coronary artery disease (CAD), including persistent and acute coronary syndrome (ACS) (2,3). ACS refers to any group of clinical symptoms compatible with acute myocardial ischemia (4). The ACS includes myocardial infarction with or without ST-segment elevation and unstable angina (5), which is caused by a blockage of blood vessels in the heart by a blood clot (thrombosis) that reduces blood flow to the parts of the heart muscle (6). CAD is the most common cause of the ACS,

characterized by clinical symptoms such as chest pain and cramping, shortness of breath and fatigue (7). This syndrome is currently one of the most common diagnoses and the most common cause of death in the world (8). Currently, 38% of all deaths in Iran are due to cardiovascular disease. One of the most important groups of cardiovascular disease is coronary heart disease or coronary artery syndrome (9). The incidence of ACS is undoubtedly associated with a combination of cardiac risk factors. One or more risk factors are present in fifty percent of patients with this condition. Modifiable risk factors include hyperlipidemia, hypertension, abdominal obesity, diabetes, smoking, unhealthy lifestyle and psychosocial factors (10). Coronary angiography is the gold

**Key point**

- There was a statistically significant relationship between the severity of coronary artery involvement according to age ( $P < 0.001$ ).
- In the study of the type of main vessel involvement, left anterior descending artery (LAD) with 38.15% and RCA with 23.97% were the most common vessels involved. Accordingly, LAD-right coronary artery (LAD-RCA), left circumflex artery (LCX), obtuse marginal artery (OM) and diagonal arteries were the most involved vessels in patients with 8.61, 7.95, 7.68 and 4.77%, respectively.
- There was no statistically significant relationship between the severity of coronary artery involvement, smoking and mean body mass index (BMI).

standard technique for imaging coronary arteries among these patients' imaging and therapeutic tools (11).

**Objectives**

Due to the high prevalence of CAD, the use of angiographic treatment and lack of comprehensive information on risk factors for exacerbation of heart disease in these patients, the present study aimed to determine the frequency of variables related to the severity and type of CAD in patients with the ACS, designed and conducted.

**Patients and Methods****Study design**

This study was a retrospective descriptive-analytical study. The statistical population consisted of 5195 patients hospitalized in the angiography department of Shahid Mohammadi hospital in Bandar Abbas due to myocardial infarction during 2017 to 2020 with a diagnosis of ACS and underwent coronary angiography. Inclusion criteria included patients who underwent coronary angiography with ACS and had complete records and electronic information. Exclusion criteria included patients' dissatisfaction to participate in the study and file deficiencies and electronic information. Presence of diabetes, hypertension, obesity, addiction were assessed through a medical examination, blood test, or interview.

**Data analysis**

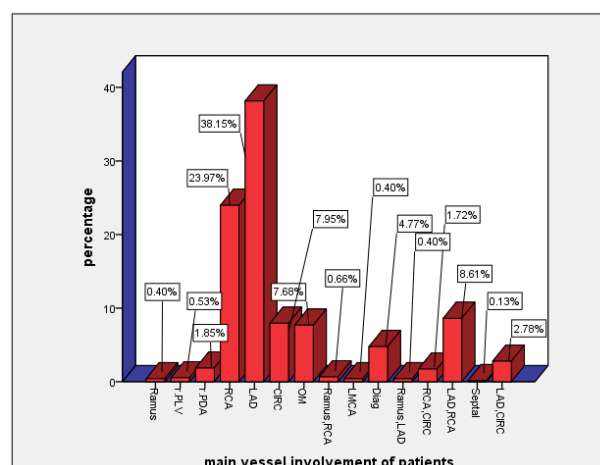
The method of data collection in this study was field and library. After collection, the data were analyzed by SPSS software and according to the data adherence to the normal distribution curve, a one-way analysis of variance was used.

**Results**

A total of 5195 patients with a mean age of  $11.92 \pm 62.79$  years participated in this study. Of these patients, 3311 (63.71%) were male and 1886 (36.29%) were female. The average body mass index (BMI) was  $25 \pm 25 \pm 13.4$  kg/m<sup>2</sup>. About 13.21% of patients had 50-69%, 15.7% had 70-89%, 38.76% had 90-99% and 23.33% had 100% severity of main vessel involvement. In the study of the type of

main vessel involvement, LAD with 38.15% and RCA with 23.97% were the most common vessels involved LAD-RCA, left circumflex artery (LCX), marginal artery (OM) while diagonal arteries were the most involved vessels in patients with 8.61, 7.95, 7.68 and 4.77%, respectively. The most common sites of involvement in Chen's anterior descending vessel were middle part of left anterior descending (m.LAD), p.LAD, and then d.LAD, respectively. Most of the places of conflict RCA, precisely similar to LAD, were m.RCA, p.RCA, and d.RCA. There was no statistically significant relationship between the type of coronary artery involvement according to age ( $P = 0.636$ ). In all age groups, the most significant vessels involved were LAD and RCA, respectively. The main vessels involved in the under44 age group were almost identical. Also, the two age groups in the range of 45-64 years and the age range of 65 years and above were similar in central vessel involvement. There was a statistically significant relationship between the severity of coronary artery involvement and age of participants ( $P < 0.001$ ).

In the study of different age groups, it was observed that in all age groups except 65-74 years, the severity of involvement of the main vessels was 90-99%, however in 65-74 years, this rate was estimated to be 100%. Furthermore a statistically significant relationship between the severity of coronary artery involvement according to age ( $P < 0.001$ ) was detected. Examining the severity of coronary artery involvement by gender showed that 40.68% of men and 35.44% of women had between 90-99% coronary artery involvements. In our study, men had more severe CAD than women. There was a statistically significant relationship between the severity of coronary artery involvement according to gender ( $P < 0.001$ ). In both genders, LAD was more involved than RCA, the main major vessel. On the other hand, LAD involvement was higher in men than women and RCA involvement was higher in women. The difference between the types of coronary artery involvement according to gender is



**Figure 1.** Status of the main vessel involvement of patients (The main involved vessel = i, Percent = j).

not statistically significant ( $P=0.872$ ). Diabetic patients had a higher incidence of main vessel involvement in the range of 70-99% than non-diabetics. In comparison, non-diabetics had a 100% higher incidence of primary vessel involvement than diabetics, which was statistically significant ( $P=0.006$ ). In both diabetic and non-diabetic groups, LAD and RCA were the most involved and LAD was the most involved, compared to RCA. RCA was more involved in patients with diabetes than in non-diabetics. In contrast, non-diabetics were more involved in LAD than patients with diabetes rather than non-diabetics, RCA, LCX and LAD-RCA were more likely to be the main vessels involved. Diabetic individuals differed from non-diabetics in terms of the type of main vessel involved, however this difference was not significant ( $P=0.319$ ). The severity of central vessel involvement in people with hypertension was in the range of 90-99%; while in people without hypertension, the severity of central vessel involvement was higher in the range of 100%, since this difference was statistically significant ( $P=0.009$ ). In both groups with and without hypertension, LAD and RCA were the most involved, while LAD was the most involved than RCA. Patients with high blood pressure had higher levels of RCA and patients without high blood pressure had higher levels of LAD. At the same time, LCX, RCA and LAD-RCA were the main arteries involved in people with hypertension rather than those without it (Figure 1).

In this study, 1540 people (29.8%) of the patients were smokers, and 3590 people (69.5%) were non-smokers. In 11.93% of smokers (currently) and 20% of smokers (recently used), the severity of main vessel involvement was 50-69%. In 15.64% of smokers (currently) and 10% of smokers (recently used), the severity of main vessel involvement was 70-89%, in 36.42% of smokers and 40% of smokers (recently used), the severity of main vessel involvement was 90-99% and in 36% of smokers (now) and 30% of smokers (recently smokers) had 100% of the main vessel involvement; while in 13.67% of non-

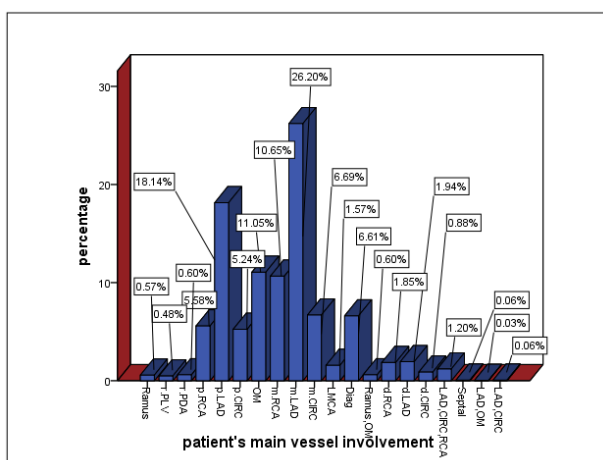


Figure 2. Status of patients' main vessel involvement (The main involved vessel = i, Percent = j).

smokers, the severity of main vessel involvement was 50-69%, in 15.79% of them, the seriousness of main vessel involvement was 70-89%, in 39.63% of them, the severity of central vessel involvement was 90-99%, and in 30.92% of them, the seriousness of central vessel involvement was 100%. In both groups of smokers and non-smokers, LAD and RCA were the most major vessels involved. At the same time, LAD was more involved than RCA. Interestingly, patients who have recently smoked have been exposed to the same amount of LAD and RCA as their main artery. Non-smokers were more involved than smokers in their RCA and LCX levels, while smokers were more involved in LAD than non-smokers. LCX-RCA patients who have recently smoked have been the main vein involved in the two groups of smokers and non-smokers. The severity of central vessel involvement was more than 90-99% in 65.26% of obese patients, 70.4% of regular patients and 72.16% of lean patients. Therefore, the severity of main vessel involvement was higher in individuals with normal and low-BMI; On the other hand, obese people had moderate severity of conflict compared to lean and ordinary people, while people with normal and low-BMI had higher severity of main vessel involvement than obese people, this difference was not statistically significant. In all patients with any type of BMI score, LAD and RCA were the most major vessels involved; simultaneously, LAD was more involved than RCA (Figures 2 and 3). After these two vessels were involved, RCA-LAD and LCX were the most involved vessels. Compared to obese and overweight individuals with LAD and RCA, patients with normal and low-BMI were the main vessels involved. Medical treatment, coronary artery bypass graft surgery (CABG) and percutaneous coronary intervention (PCI) with 804 (15.5%), 1250 (24.2%) and 3060 (59.2%) patients were the

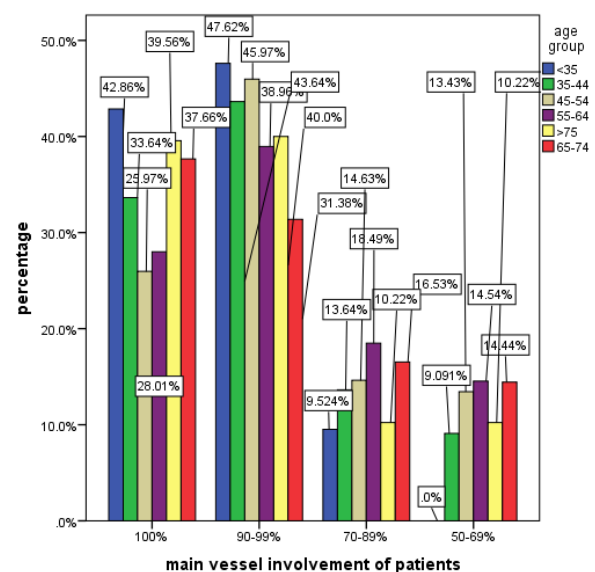


Figure 3. Status of the main vessel involvement of patients (Intensity of main vessel involvement = i, Percent = j).

majority of patients in this study, respectively. Patients who were recommended for medical treatment were (1) patients with severity of central vessel involvement between 50-69% (53.5% of patients) (2) patients with severity of central vessel involvement between 70-89% (17.37% Of patients), (3) patients with the severity of central vessel involvement between 90-99% (11.76% of patients) and (4) patients with the severity of central vessel involvement between 100% (56.65% of patients). Patients who underwent CABG were; (1) patients with severity of central vessel involvement between 50-69% (1.14% of patients), (2) patients with severity of central vessel involvement between 70-89% (16.16 39% of patients), (3) patients with severity of central vessel involvement between 90-99% (47.66% of patients) and (4) patients with severity of central vessel involvement between 100% (30.8% of patients). Most people recommended for CABG and PCI had a severity of primary vessel involvement of more than 90%. Those with the seriousness of central vessel involvement less than 79% were more likely to be recommended for medical treatment, which was statistically significant ( $P<001$ ).

1. Patients with severity of central vessel involvement between 50-69% (3.1% of patients)
2. Patients with severity of central vessel involvement between 70-89% (4.4) 18% of patients)
3. Patients with the severity of central vessel involvement between 90-99% (47.66% of patients)
4. Patients with the severity of central vessel involvement between 100% (30.8% of patients). Most people recommended for CABG and PCI had a severity of primary vessel involvement of more than 90%. Those with the seriousness of central vessel involvement less than 79% were more likely to be recommended for medical treatment, which was statistically significant ( $P<001$ ).

## Discussion

In the present study, 5195 patients participated. Of these, 3311 (63.71%) were male and 1886 (6.29) were female. In our study, men were more likely to develop CAD. This study is consistent with the results of the survey of Hölschermann et al and Kreatsoulas et al, who reported more coronary artery involvement in men than women (12,13).

However, it contradicts the study of Hochner-Celnikier et al, which reported more CAD in women than men (14). In our study, 1540 people (24.89%) were smokers and 3590 people (69.5%) were non-smokers. Therefore, the probability of smoking is less than the obstruction group (present study) and it is consistent with the study by Abdelmonemetal(15). In our study the type of central vessel involvement in our research showed that LAD and RCA vessels with 38.15% and 23.97% were the most common vessels involved, respectively. The most involved vessels were OM, LCX (7.95%), LAD-RCA (7.68%) and diagonal (4.77%), respectively. Eisen et al additionally, showed LAD had the highest prevalence (46%) of involvement (16). After that, the prevalence of involvement in LCA and RCA arteries was 25.3% each. Additionally, 15.38% of the patients with 90-99% severity of the main vessel

involvement and 84.62% of patients with 100% severity of involvement underwent viability study. The researchers concluded that the most significant consequence during the five years after angioplasty is reopening these arteries, which helps clinicians in the follow-up and treatment of these patients. In the present study, 1250 patients (24.2%) were recommended to have CABG. The results in this regard are in agreement with the results of the study by Larsen et al (17). According to the current study results, patients with non-obstructive coronary involvement had a higher BMI than the obstructive group, which is not consistent with the study by Larsen et al (17) (Figures 4 and 5).

## Conclusion

As mentioned above, this descriptive study consists a huge

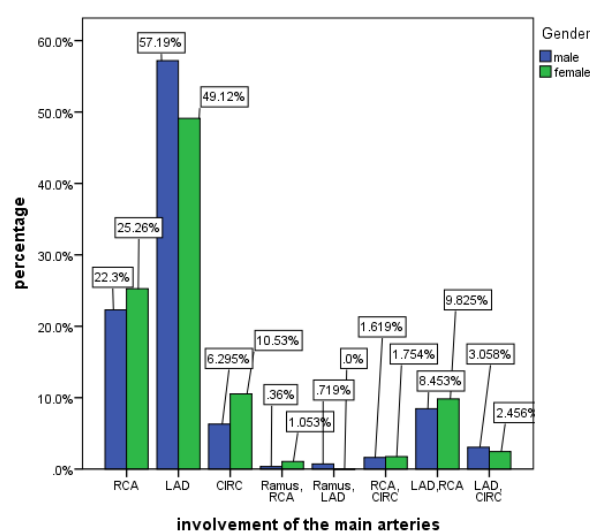


Figure 4. Status of involvement of the main arteries by gender (The main involved vessel = i, Percent = j).

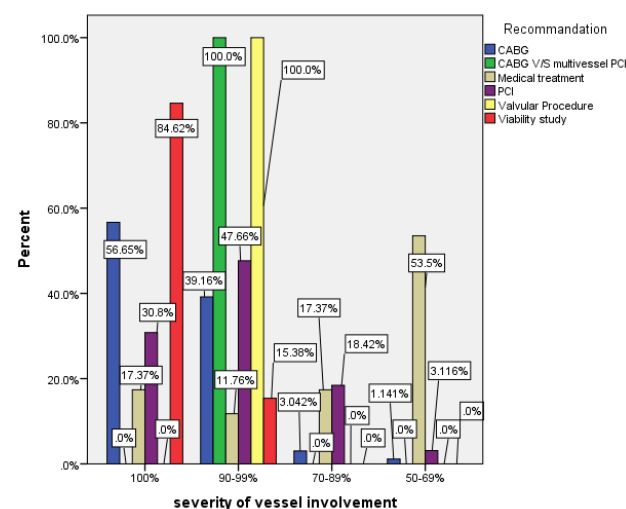


Figure 5. The severity of the involvement of the main arteries as recommended by angiography (The severity of the involvement of the main arteries as recommended by angiography= i, Percent = j).



number of patients suffering from CVD in Bandar Abbas, Iran. We aimed to evaluate the distribution of arteries involved and the severity of vessels involved considering the lack of enough previous data and studies in the city of Bandar Abbas. As it is shown, our results were quite similar to other studies around the country. Hence, following the nationwide guidelines for treating CVD in this city seems rational and helpful.

### Limitations of the study

This study was conducted in Bandar Abbas, Iran. Despite the adequate sample size, expanding this research to a nationwide study is advised to achieve a better outcome.

### Authors' contribution

SS and ARR were the principal investigators of the study. HF and FK were included in preparing the concept and design. SB revisited the manuscript and critically evaluated the intellectual contents. All authors participated in preparing the final draft of the manuscript, revised the manuscript and critically evaluated the intellectual contents. All authors have read and approved the content of the manuscript and confirmed the accuracy or integrity of any part of the work.

### Conflicts of interest

The authors declare that they have no competing interests.

### Ethical issues

The research adhered to the principles of the Declaration of Helsinki. The Ethics Committee of Hormozgan University of Medical Sciences approved this study. (IR.HUMS.REC.1400.194). Accordingly, written informed consent was taken from all participants before any intervention. This study was extracted from M.D., thesis of Ali Rezazadeh Roudkoli at this university. Besides, the authors have ultimately observed ethical issues (including plagiarism, data fabrication and double publication).

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