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Open Access Original Article

Crescent Journal of Medical and Biological Sciences
Vol. 8, No. 2, April 2021, 138–143
eISSN 2148-9696

The Relationship Between Clinical Presentation and the Type of Coronary Artery Involved in Patients With Acute Coronary Syndrome

Mohsen Abbasnezhad[1], Mohammadreza Taban Sadeghi[1], Bijan Zamani[2], Naser Khezerlou Agdam[1], Razieh Parizad[1], Amirreza Abbasnezhad[3], Babak Nasiri[1*]

Abstract

Objectives: According to cardiologists' experiences, there is possibly a relationship between clinical symptoms and the type of coronary artery involvement in patients with the acute coronary syndrome (ACS). Given the significance of the issue, the present study was conducted to explore the relationship between clinical symptoms and the type of coronary artery involvement in ACS patients.

Materials and Methods: In general, 720 ACS patients hospitalized in Shahid Madani hospital of Tabriz were enrolled in this descriptive, cross-sectional study from August 2011 to February 2012. Participants were selected by means of convenience sampling and according to inclusion criteria. Data collection tools were a demographic questionnaire and ACS indices. The results were analyzed using SPSS16 and $P<0.05$ was considered statistically significant.

Results: The findings showed that following the diagnoses through coronary artery angiography, 289 (40.1%), 201 (27.9%), 227 (31.5%), and 18 (2.5%) patients had single-vessel disease, two-vessel disease, three-vessel disease, and the left main disease, respectively. A total of 416 patients (57.8%) suffered from left anterior descending (LAD) disease while involvement rates were 142 (19.7%), 208 (28.9%), 8 (1.1%), 73 (10.1%), 17 (2.4%), and 21 (2.9%) patients for patent ductus arteriosus, obtuse marginal artery 2, obtuse marginal artery 1, diagonal 2, diagonal 1, right coronary artery (RCA), and left circumflex (LCX), respectively.

Conclusions: Based on pathological findings, retrosternal pain was the most common symptom to all coronary occlusions regarding ACS symptoms. LAD, as the most involved vessel, had varying manifestations. Finally, referred pain to teeth was only observed in RCA involvement. The results can be helpful for timely and accurate diagnosis of cardiac patients who refer to emergency rooms and thus reduce the mortality rate by taking appropriate therapeutic measures.

Keywords: Acute coronary syndrome, Symptoms, Angiography, Coronary occlusion

Introduction

Coronary heart diseases (CHDs) are currently among the most prevalent and disabling diseases in the world. It is estimated that more than 16 million people in the United States have CHDs and more than eight million cases have already had a myocardial infarction (MI). Approximately one million people develop CHDs (1-3). Despite the decline in mortality over the past few decades, CHDs remain the major cause of death in developing countries (4-7).

Evidence suggests that half of the mortalities in developed countries and one-fourth in developing countries are associated with cardiovascular diseases that also include hypertension and atherosclerosis-induced diseases (8). Other statistics show that more than 13 million people in the United States live with CHD (9). This disease manifests in different ways and its preliminary symptom includes chest discomfort which can range from transient ischemia to complete blockage of coronary arteries called angina pectoris (10,11).

Based on the part of the findings of Framingham, 25% of acute MIs (AMIs), over a 30-year follow-up period, are only revealed in an electrocardiogram (ECG) test. In almost half of these cases, MI has been completely latent and asymptomatic or accompanied by atypical symptoms (12).

According to the World Health Organization, the criteria for the diagnosis of an MI are chest pain, progressive increase in cardiac enzymes, and changes in ECG. The realization of two of these parameters will verify the diagnosis. Impaired coronary artery flow may occur without any symptoms. The syndrome is manifested as consecutive angina pectoris in 40% of patients while it has no angina symptoms in more than 10% of patients. Moreover, latent ischemia is of higher prevalence in diabetic patients, and angina, which is a warning sign without new coronary artery disease, is not generally observed in these patients. In general, the prognosis of

Received 9 June 2020, **Accepted** 17 October 2020, **Available online** 1 February 2021

[1]Cardiovascular Research Center, Tabriz University of Medical Sciences, Tabriz, Iran. [2]School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran. [3]University of Tehran, Tehran, Iran.
*Corresponding Author: Babak Nasiri, Tel: +989123054674, Email: babaknasir@yahoo.com

Key Messages

- These results showed that retrosternal pain was the most common symptom to all coronary occlusions (i.e., LAD, LCX, RCA, D1, D2, OM1, OM2, and PDA). Dental pain was not reported in any ACS patients.
- **What is the current knowledge?** Previous research has studied the relationship between symptoms and type of pain with electrocardiographic findings, clinical outcomes, and survival.
- **What is the novelty of the present study?**
  - The patient's symptoms were matched with coronary artery involvement based on angiographic findings.
  - The coronary artery involved in the angiography was estimated based on clinical symptoms.

patients with latent ischemia is worse than that of patients with angina pectoris (10).

Studies demonstrate that factors such as gender, age, and type of the underlying disease can moderate acute coronary syndrome (ACS) symptoms (13-15). According to the results of the study, women had more back pain compared to men, breathing discomfort, indigestion, nausea and vomiting, and asthenia while men tended to experience severe chest pain more than women. Most studies in this area have concluded unanimously that women are older than men at the time of diagnosis and thus develop the disease later in life. On the contrary, older women are at the greater risk of developing diabetes compared to men and experience lower functioning and higher depression than male patients

Research also represents that the prevalence of diabetes in ACS patients is significantly higher in women. In addition, mental disorders may have adverse effects on CHD progress and outcomes. The findings of other studies reveal that acute depression in ACS patients doubles the risk of death (16-18).

A number of researchers have reported that men experience more chest pain and sweating in comparison with women while others have found that women are more likely to suffer rapid breathing and back pain. There are still other researchers who have not found any differences between men and women in this regard while concluding that women further tend to experience indigestion, palpitation, nausea, numbness in hands, and unusual fatigue which do not make any difference in diagnosis (14, 15).

In the Dorsch et al study (14), it is reported that atypical clinical manifestations are associated with increased mortality of MI patients, and AMI at the heart's lower chamber is more likely to be accompanied by the symptoms of vagal stimulation. The study addresses gender-dependent differences in presentation and researchers argue that clinical features, prognosis, and treatment of patients are manifested with unusual types of AMI.

According to other studies, the atypical symptoms of MI without chest pain are highly common and unfortunately associated with a high mortality rate that might be due to failure in the implementation of proper therapeutic strategies. The researchers further argue that MI patients could show the symptoms without chest pain and that these patients are representative of high-risk individuals who are extensively unlikely to receive therapeutic strategies related to the proven advantage of disease prognosis (19,20).

The results of another study show patients with left main coronary artery (LMCA) stenosis who all may have milder angina pectoris than severe angina had a major disease elsewhere in addition to LMCA stenosis (21).

The findings of physical examinations and the stability of clinical manifestations are of rather equal importance in ACS diagnosis and treatment. Additionally, signs and symptoms are the determinants of what treatments patients should receive and how the services should be provided by the emergency room staff. Based on cardiologists' personal experiences, there could be relationships between clinical symptoms and the stenosis of coronary arteries in ACS patients (22). The review of the literature indicates that there has been no research to assess this hypothesis and the existing data are insufficient to determine whether the reported relations about the symptoms are clinically significant. Therefore, this study sought to evaluate a large number of cardiac patients of a particular age group with ACS-related symptoms and those who have been repeatedly admitted to Shahid Madani hospital of Tabriz in order to explore the relationship between the clinical symptoms and the type of coronary artery occlusions. To this end, researchers tested the hypothesis that the clinical symptoms in ACS patients are related to the occlusion of coronary arteries.

Materials and Methods

This prospective descriptive-analytical and cross-sectional study was conducted among all patients hospitalized with ACS in Shahid Madani hospital of Tabriz from August 2011 to February 2012.

The inclusion criteria included no previous history of coronary artery diseases (CADs), complaints about angina pains, and a willingness to complete the questionnaire. On the other hand, the exclusion criteria were normal angiographic findings, coronary artery aneurysm, and previous history of CAD, percutaneous coronary intervention, or coronary artery bypass grafting. Seven hundred and twenty patients met the study criteria. Data collection tools were a demographic questionnaire measuring age, gender, marital status, education, income, employment, underlying disease, history of taking heart medications, and ACS indices.

All patients provided a written informed consent form. As there were chances of mistake in filling out the questionnaire after hospitalization, patients were evaluated in the emergency room in terms of the symptoms and

quality of chest pain, accompanying and intensifying symptoms, history of taking heart medications, and clinical features, and then were asked to complete the questionnaires. The subjects were selected by means of convenience sampling and according to the inclusion criteria.

Questionnaire data were analyzed by SPSS, version 16. The quantitative data were analyzed using the mean ± standard deviation, and the frequency and percentage were used for qualitative data. Chi-square test and one-way ANOVA test were implemented to compare qualitative and quantitative data, respectively. Adequate follow-up tests were applied to assess possible relationships between the variables, and the level of significance was set at $P<0.05$.

Results

Of the 720 patients, 522 (72.5%) cases were males and 198 (27.5%) of them were females. The mean age of the subjects was 59.26±11.80 years ranging from 27 to 91.

The results showed that 55, 564, and 242 patients had right hemithorax pain, retrosternal pain, and left hemithorax pain, respectively (Figure 1).

The pain was referred to neck area (n = 104, 14.4%), back (n = 341, 47.4%), jaw (n = 11, 1.5%), teeth (n = 1, 0.0%), right arm (n = 182, 25.6%), left arm (n = 376, 52.2%), right shoulder (n = 65, 9%), and left shoulder (n = 136, 18.9%), the details of which are displayed in Figure 2.

The results also suggested that patients also had other manifestations such as shortness of breath (n = 240, 33.3%), upper abdominal pain (n = 77, 10.7%), nausea (n = 323, 44.9%), vomiting (181, 25.1%), burping (n = 38, 5.3%), indigestion (n = 5, 0.7%), asthenia (n = 61, 8.5%), vision problems (n = 30, 4.2%), vertigo (n = 85, 11.8%), coughing (n = 34, 4.7%), excessive sweating (n = 4.5, 60.4%), and ramus pain (n = 10, 1.4%). However, fainting was not observed in any of the patients. Pain quality also varied across the patients, including chest pressure (n = 232, 32.2%), burning pain (n = 396, 55%)), numbness (n = 11, 1.5%), chest heaviness (n = 125, 17.4%), pins and needles pain (n = 8, 1.1%), vague pains (n = 30, 4.2%), and sporadic pains (n = 19, 2.6%).

When diagnosed through the angiography of coronary arteries, patients were categorized into four groups based on the type of occlusions. Based on the results, 289 (40.1%), 201 (27.9%), (31.5%), and 18 (2.5%) patients had single-vessel disease (SVD), two-vessel disease, 227 three-vessel diseases, and LM disease, respectively (Figure 3).

In this study, 416 patients (57.8%) suffered from left anterior descending (LAD) while the involvement rates for left circumflex (LCX), right coronary artery (RCA), diagonal 1 (D1), diagonal 2 (D2), obtuse marginal artery 1 (OM1), obtuse marginal artery 2 (OM2), and patent ductus arteriosus (PDA) were 142 (19.7%), 208 (28.9%), 60 (8.3%), 8 (1.1%), 73 (10.1%), 17 (2.4%), and 21 (2.9%) patients, respectively. During the study, the relationship

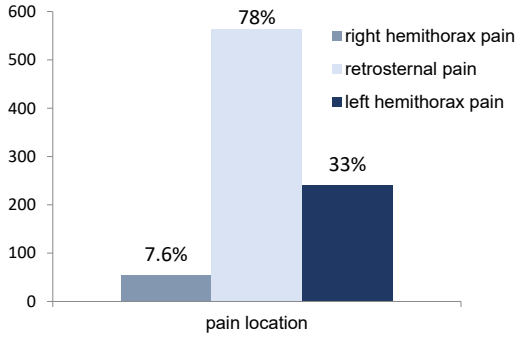

Figure 1. Locations of Chest Pain.

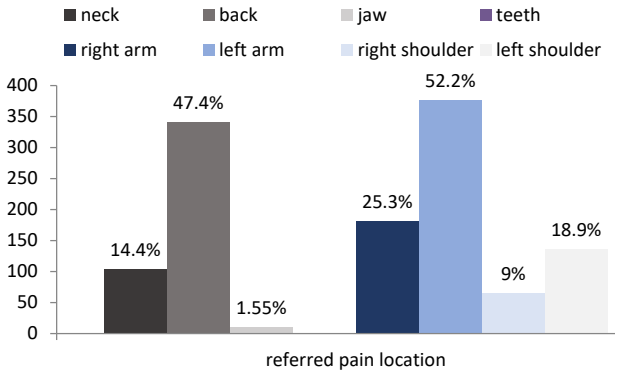

Figure 2. Referred Chest Pain Locations.

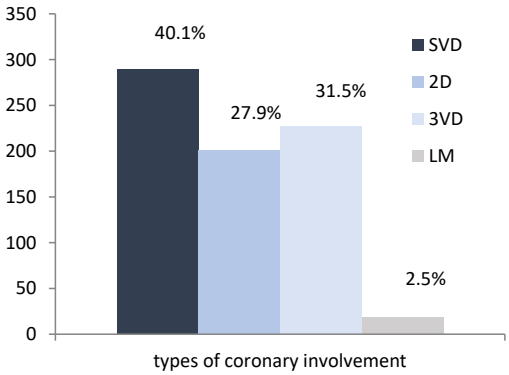

Figure 3. Types of Coronary Involvement.

between different clinical tableaus and the type of coronary involvement was evaluated and the results of the Pearson Chi-square test were investigated accordingly. In the LAD vessel and in terms of pain location, no significant relationship was found between pain locations in the right ($P = 0.276$) and left ($P = 0.441$) side chest while the relationship was significant between retrosternal pain location and the LAD vessel involvement ($P = 0.026$).

Regarding the relationship between the referred location and the LAD vessel involvement, *P*-values for the referred pain to the neck, back, jaw, right arm, left

arm, right shoulder, and left shoulder was 0.030, 0.175, 0.147, 0.242, 0.841, 0.971, 0.001, and 0.619, respectively, suggesting significant relationships between the LAD vessel involvement and referred pain to the neck and the right shoulder.

In the LCX vessel and in terms of pain location, no significant relationship was found between pain locations in the right ($P=0.631$) and left ($P=0.460$) side chest and retrosternal pain ($P=0.392$). As regards the relationship between the referred location and the LCX vessel involvement, *P*-values for the referred pain to the neck, back, jaw, right arm, left arm, right shoulder, and left shoulder were 0.692, 0.146, 0.526, 0.620, 0.029, 0.977, 0.001, and 0.050, respectively. This shows significant relationships between the LCX vessel involvement and referred pain to the right arm and right and left shoulders.

In the RCA vessel and regarding pain location, there was no significant relationship between pain locations in the right ($P=0.454$) and left ($P=0.168$) side chest and retrosternal pain ($P=0.107$). Concerning the relationship between the referred location and the RCA vessel involvement, *P*-values for the referred pain to the neck, back, jaw, right arm, left arm, right shoulder, and left shoulder were estimated at 0.036, 0.161, 0.582, 0.116, 0.913, 0.821, 0.425, and 0.041, respectively. Accordingly, the relationships between the RCA vessel involvement and the referred pain to the neck and the left shoulder were significant.

In the D1 vessel and in terms of pain location, no significant relationship was found between pain locations in the right ($P=0.798$) and left ($P=0.168$) side chest and retrosternal pain ($P=0.513$). However, regarding the relationship between the referred location and the D1 vessel involvement, *P*-values for referred pain to the neck, back, jaw, right arm, left arm, right shoulder, and left shoulder were 0.898, 0.669, 0.314, 0.763, 0.796, 0.005, 0.456, and 0.012, respectively. Accordingly, the relationships between the D1 vessel involvement and referred pain to the left arm and left shoulder were significant.

As regards pain location in the D2 vessel, no significant relationship was observed between pain locations in the right ($P=0.589$) and left ($P=0.324$) side chest and retrosternal pain ($P=0.135$). In terms of the relationship between the referred location and the D2 vessel involvement, *P*-values for the referred pain to the neck, back, jaw, right arm, left arm, right shoulder, and left shoulder were 0.393, 0.881, 0.723, 0.916, 0.985, 0.121, 0.730, and 0.642, respectively. Based on these findings, no significant relationship existed between the D2 vessel involvement and referred pain locations.

Regarding pain location in the OM1 vessel, no significant relationship was detected between pain locations in the right ($P=0.237$) and left ($P=0.236$) side chest whereas the relationship was significant between retrosternal pain location and the OM1 vessel involvement ($P=0.019$). In terms of the relationship between the referred location and the OM1 vessel involvement, *P*-values for the referred pain to the neck, back, jaw, right arm, left arm, right shoulder, and left shoulder were 0.225, 0.916, 0.908, 0.737, 0.876, 0.600, 0.493, and 0.573, respectively, without any significant relationship between the OM1 vessel involvement and referred pain locations.

Similarly, no significant relationship was found between pain locations in the right ($P=0.231$) and left ($P=0.978$) side chest and retrosternal pain ($P=0.170$) in the PDA vessel and in terms of pain location. As regards the relationship between the referred location and the PDA vessel involvement, *P*-values for the referred pain to the neck, back, jaw, right arm, left arm, right shoulder, and left shoulder were 0.215, 0.388, 0.562, 0.862, 0.505, 0.188, 0.936, and 0.584, respectively. This suggests that no significant relationship existed between the PDA vessel involvement and referred pain locations.

Discussion

Based on the findings, SVD and LAD were the most common disease and the most involved vessel with different manifestations, respectively. Moreover, the referred pain to teeth was only observed in the RCA involvement. Pathological findings indicated that retrosternal pain was the most common symptom to all coronary occlusions, and dental pain was the only symptom that was observed in no involvements. The results of similar studies indicated that the symptoms of coronary involvement are generally referred to as constrictive pain to the anterior chest area, left arm, and back (8,23).

In their study, Holli et al indicated several factors that might be involved in the clinical experiences of ACS patients (24). The age range in their study was between 24 and 97 years which can be considered a milestone. The 67-year mean age of women also provided valuable data on the ACS symptoms of older women while the present study included both genders with a 59.26-year mean age ranging from 27 to 91 years. They found no differences between men and women in terms of back pain, breathing discomfort, nausea and vomiting, or asthenia. A significant point in their study was that men and women were not different at all in the incidence of classic symptoms such as chest pain, excessive sweating, and rapid shallow breathing whereas another study reported generally contradictory results on these symptoms (25).

DeVon et al (9) demonstrated that men experience more chest pain and sweating compared to women while other Pelletier et al concluded that women suffer more rapid breathing and back pain compared to men. Nonetheless, DeVon et al and Pelletier et al found no differences between men and women in this respect. Women tend more to experience indigestion, palpitation, nausea, numbness in hands, and unusual fatigue. These differences in symptoms for three clinical diagnoses of ACS need further investigation (9,15).

Dorsch et al argued that AMI is generally accompanied

by chest pain although limited research is available on patients who refer to the hospital with symptoms other than chest pain (19). In the Dorsch et al study, it is reported that atypical clinical manifestations are associated with increased mortality of MI patients and AMI at the heart's lower chamber is more likely to be accompanied by the symptoms of vagal stimulation (19). The present study also confirmed that retrosternal pain is the most prevalent manifestation although it should be noted that clinical manifestations are widely within the typical-to-atypical range.

In the Dorsch et al study, nearly 3684 patients with likely AMI admitted over a three-month period were identified, of whom 2096 cases had confirmed AMI. Dorsch et al found that the atypical symptoms of MI without chest pain are highly common and unfortunately associated with a high mortality rate, which is also supported by the present study. This might be partly because of the failed implementation of proper therapeutic strategies. The researchers argue that MI patients could show the symptoms without chest pain and these patients are considered high-risk individuals. The diagnosis of this complication and its increasing risks is the first step forward (19).

In a prospective study, Banim et al reported the clinical features and results of research on 20 patients with LMCA stenosis who all had milder angina pectoris rather than severe angina. In the angiography of coronary arteries, all patients had a major disease elsewhere in addition to LMCA stenosis. No mortality or significant complication was found in their research, which is consistent with the finding of the present study. Sixteen of the 17 patients who survived through surgical operation did not have angina pectoris. A remarkable improvement was observed in the maximum exercise abilities of 10 patients who had exercise tests before and after the surgery. The researchers found that the prognosis for LMCA stenosis was extremely poor such that only less than half of the under-treatment patients could live for only five years after the diagnosis (25).

Limitations of the Study

The present study was conducted only on patients at Shahid Madani Hospital of Tabriz over seven months in 2011 which could potentially limit generalizations to patients in other centers.

Conclusions

The results on the ACS symptoms suggested that LAD was the most involved vessel with different manifestations. In patients with complaints about jaw pain, indigestion, and dental pain, RCA and LAD were the most involved vessels while in other cases, LAD was the most involved vessel.

Retrosternal pain with the referred pain to the neck and right arm along with shortness of breath, vertigo, and ramus pain could be the signs of LAD vessel involvement while the referred pain to the right arm, right and left shoulders, along with vertigo and sweating could indicate LCX vessel involvement, and the referred pain to the neck and left shoulder with asthenia and burning pain might suggest RCA vessel involvement. The referred pain to the left arm and left shoulder with numbing pain could mean D1 vessel involvement. Retrosternal pain with coughing could reveal OM1 vessel involvement while the referred chest pain to the left shoulder could be a sign of OM2 vessel involvement. The upper abdominal pain with vague pain could mean PDA vessel involvement.

Further Research

Therefore, further research should consider the following issues to make the results more generalizable:

- An equal number of patients showing similar symptoms;
- Other features of patients including a history of symptoms such as medical history and other information;
- Research on patients with SVD.

Authors' Contribution

MA and MTS offered the study. BZ designed the present research. RP and AA participated in literature review. NKA extracted the data and summarized it. PR and MTS translated and BZ supervised the study. NKA reviewed the quality of the articles and revised it.

Conflict of Interests

Authors have no conflict of interests.

Ethical Issues

The research was approved by the Ethics in Research Committee, Tabriz University of Medical Sciences (Ethics No. IR.TBZMED.REC.1390.5.4.4790).

Financial Support

None.

Acknowledgments

The researchers would like to express their gratitude to the Deputy for Research and Technology and the Faculty of Medicine at Tabriz University of Medical Sciences for their technical support, as well as to all patients who kindly contributed to the present study.

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