

Chronic stable angina patients with tortuous coronary arteries: Clinical symptoms and risk factors

Morteza Abdar Esfahani⁽¹⁾, Hamid Farzamia⁽²⁾, Negin Nezarat⁽³⁾

Abstract

BACKGROUND: Lack of information about clinical symptoms and risk factors of coronary artery tortuosity prompted us to perform this study to compare patients with and without coronary artery tortuosity.

METHODS: Among patients with chronic stable angina who underwent coronary angiography, we selected 98 patients with coronary tortuosity. They were retrospectively compared with 98 chronic stable angina patients without tortuosity to determine clinical symptom, risk factors, and angiography findings via Gensini score.

RESULTS: In this study, 68.4% of patients with coronary tortuosity were female ($P = 0.001$). The mean age in this group was 59.2 years compared to 53.9 years in patients without tortuosity ($P = 0.001$). More than 7 clinical symptoms despite less coronary stenosis were found in tortuous coronary group. Among cardiovascular risk factors, only diabetes was significantly more common in the non-tortuous coronary group.

CONCLUSION: This study concluded that coronary tortuosity is more common in the elderly and among female gender. Diabetic patients may have less prevalence of tortuosity. Further studies may provide more data about the cause and better management of the higher number of clinical symptoms in these patients despite their less epicardial artery stenosis.

Keywords: Coronary Tortuosity, Clinical Symptoms, Risk Factors.

ARYA Atherosclerosis Journal 2012, 7(Suppl): S115-S118

Date of submission: 3 Jan 2012, *Date of acceptance:* 1 Mar 2012

Introduction

Arterial tortuosity is characterized by multiple elongations in arteries, especially coronary arteries. It is usually detected during angiography.^{1,2} Few studies have evaluated this phenomenon and its etiology, signs, and complications have not yet been fully understood.¹ Some studies have shown that coronary artery tortuosity without coronary artery obstruction or atherosclerosis may cause angina pectoris during activity or exercise test.¹ Therefore, it has been suggested that coronary artery tortuosity causes alteration in blood flow and reduction in coronary artery pressure distal to the tortuous segment and can thus lead to ischemia.¹

Severe tortuosity in coronary arteries facilitates atherosclerosis. As a result, atherosclerosis is more common in patients with coronary artery tortuosity.¹ Hemodynamic shear stress in tortuous arteries may enhance the formation and rupture of atherosclerotic plaques and prepare better conditions for developing acute coronary syndrome.^{3,4} A few studies have

reported angina pectoris to be related with severe coronary artery tortuosity which may have congenital etiology.¹ A correlation has also been suggested between hypertension and aortic tortuosity.¹ A previous research found significant relationships between coronary tortuosity and coronary artery diseases but failed to establish significant correlations between coronary tortuosity and cardiovascular risk factors.⁵

Since only few studies have investigated the role of arterial tortuosity in ischemic heart diseases, this study was designed to compare the clinical signs and risk factors of cardiovascular diseases and coronary artery stenosis in unstable angina patients with and without coronary artery tortuosity.

Materials and Methods

This cross-sectional study was performed in angiography departments of Noor and Chamran teaching hospitals associated with Isfahan University of Medical Sciences (Isfahan, Iran) during a one-year

1- Associate Professor, Department of Cardiology, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran.

2- Cardiologist, Isfahan Cardiovascular Research Center, Isfahan Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran.

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

Correspondence To: Negin Nezarat, Email: n.nezarat@gmail.com

period. Patients with ischemic heart disease who underwent coronary angiography because of chronic stable angina (CSA) were included in this study.

CSA was diagnosed as feeling pain or discomfort in the chest after physical activity or stress which was described by the patients as non-localized pressure and heaviness on the chest with probable radiations to other parts of the body. This pain lasted between 2-5 minutes and was relieved by resting for 5-10 minutes or sublingual nitroglycerin.⁶ Patients with previous history of cardiac or coronary surgery, congenital heart disease, myocardial infarction (MI), and acute coronary syndrome (ACS), or subjects who did not have an accurate medical history were excluded. Among patients with CSA who underwent coronary angiography in the mentioned hospital during a one-year period, two groups of 98 patients with and without coronary tortuosity were selected. A cardiology resident interviewed with all participants and filled out a checklist including demographic characteristics (age, sex, and occupation), risk factors of cardiovascular diseases (positive family history, smoking, dyslipidemia, and diabetes), and clinical symptoms (chest pain, sweating, and dyspnea) for each patient.

CSA was diagnosed considering clinical signs, medical history, and paraclinical results according to Canadian Cardiovascular Society (CCS).

Tortuosity was defined as two continuous endings with an angle of 180 in a major epicardial artery via visual estimation during angiography.⁷ The participants were divided into two groups of 98 patients based on the presence of coronary tortuosity in angiography. Angiographic findings of each patient were also recorded in the checklist. The severity of coronary stenosis was assessed based on Gensini index which is one of the validated methods for evaluating the severity of coronary stenosis. The index has been used and confirmed in previous studies in Isfahan, Iran.⁸ Gensini index scores coronary arteries according to the severity of stenosis. Therefore, scores 1-4 represent 1-49%, 50-74%, 75-99%, and 100% stenosis, respectively.

A coefficient was assigned to each branch of coronary arteries. As a result, a coefficient of 5 was assigned to left main (LM) artery and first segment (S1). On the other hand, left anterior descending (LAD), left circumflex (LCX), and right coronary artery (RCA) were weighted as 20. Finally, a coefficient of 10 was given to first diagonal (D1) artery, first obtuse marginal (OM1), and posterior descending artery (PDA). Afterwards, the severity of

stenosis was multiplied by the coefficient of each branch and the final scores were calculated from 0 to 400.⁸

Correlations between coronary tortuosity and demographic characteristics, risk factors, clinical symptoms, and angiographic findings were then evaluated. During all stages of this study, the cardiology resident cooperated with the cardiology professor.

Chi-square and independent sample t-test were used to analyze data in SPSS₁₈ (SPSS Inc., Chicago, IL, USA). $P < 0.05$ were considered as significant.

Results

Table 1 summarizes the number of male and female patients and the mean of age in the two groups with and without coronary artery tortuosity (TCA and NTCA groups, respectively). Females constituted 67 patients in the TCA group and 44 patients in the NTCA group ($P = 0.001$). The mean of age of patients in the TCA and NTCA groups was 59.2 ± 10 and 53.9 ± 12.7 years, respectively ($P = 0.001$). The mean of Gensini index was 53 ± 43.9 in the TCA group and 80 ± 75 in the NTCA group ($P = 0.003$) (Figure 1).

Table 1. Age and sex distribution in patients with and without coronary artery tortuosity (TCA and NTCA groups, respectively)

| | TCA Group | NTCA Group | Total |
|------------------|---------------|-----------------|-------------|
| Male | 31 (31.6%) | 54 (55.1%) | 85 (43.4%) |
| Female | 67 (68.4%) | 44 (44.9%) | 111 (56.6%) |
| Mean Age (years) | 59.2 ± 10 | 53.9 ± 12.7 | |

Values are expressed as n (%) or mean \pm SD.

Comparison of clinical symptoms such as functional class, orthopnea, and paroxysmal nocturnal dyspnea (PND), and risk factors such as hypertension, hyperlipidemia, diabetes, smoking status, and underlying diseases are presented in table 2. Diabetes was observed in 20.4% and 37.8% of the TCA and NTCA groups, respectively ($P = 0.007$). Tortuosity was most prevalent in OM and LCX arteries.

In addition, as Figure 2 depicts clearly, most TCA patients were in functional classes II and III.

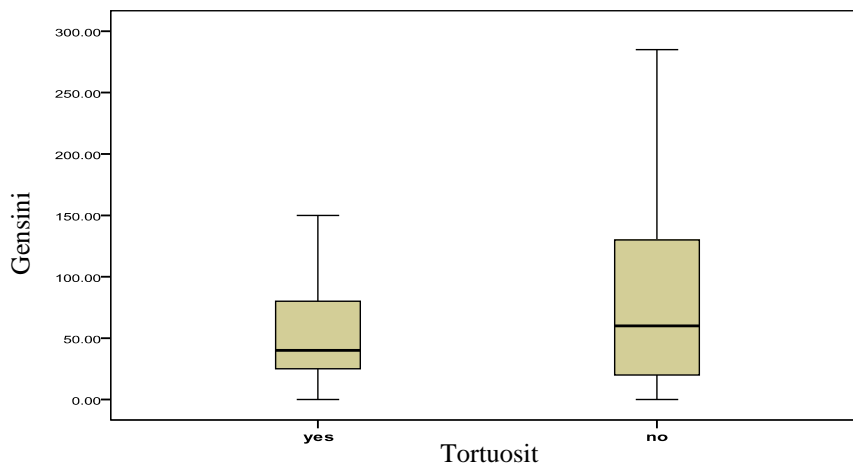


Figure 1. Gensini index distribution in patients with and without coronary artery tortuosity (P = 0.003)

Table 2. Frequency of underlying diseases and risk factors in patients with and without coronary artery tortuosity (TCA and NTCA groups, respectively)

| Variables | TCA Group | NTCA Group | P | |
|-------------------|-----------|------------|-------|------|
| Hypertension | 56.7% | 55.1% | 0.77 | |
| Hyperlipidemia | 41.8% | 43.9% | 0.77 | |
| Diabetes Mellitus | 20.4% | 37.8% | 0.007 | |
| Renal Disease | 11.2% | 13.3% | 0.66 | |
| Pulmonary Disease | 6.1% | 2.0% | 0.28 | |
| Smoking | Positive | 34.7% | 31.6% | 0.76 |
| | Negative | 65.3% | 68.4% | |
| Angina | Stable | 100% | 96.9% | 0.25 |
| | Unstable | 0% | 3.1% | |

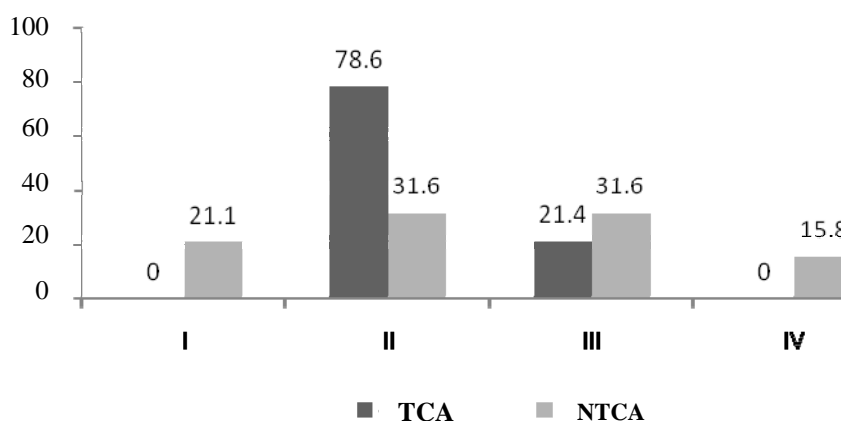


Figure 2. Frequency of functional classes in patients with and without coronary artery tortuosity (TCA and NTCA, respectively)

Discussion

Arterial tortuosity has been described in several organs including coronary arteries. Although its etiology is still unclear, degeneration of elastin layer of the vessels is known to lead to arterial tortuosity.¹

In this study, the mean age of the TCA group was significantly higher than the NTCA group which is consistent with the above facts. On the contrary, Groves et al. did not find any correlation between aging (over 65 years) and coronary tortuosity.⁵

However, several other researchers have reported this relationship.^{1,9-13}

We also observed a significant difference in sex distribution between the two groups. In other words, as Groves et al. mentioned,⁵ coronary tortuosity was significantly more prevalent among females.

Among the risk factors of cardiovascular diseases, only diabetes had a significantly higher frequency in the NTCA group ($P = 0.007$). Due to effects of various factors, diabetic patients are susceptible to all forms of cardiac failure and cardiomegaly. On the other hand, the direct linear relationship between heart weight and arterial diameter, or increased tortuosity and cardiac shrinkage that has been described by some researchers including Grover et al.,¹⁴ can explain this relation.

No significant differences between two groups of tortuouse and non tortuouse in the frequency of hypertension, hyperlipidemia, smoking, and renal diseases which have been reported by several previous studies confirms this correlation.³ However, Groves et al. could not establish a correlation between coronary tortuosity and any risk factors at cardiovascular diseases.⁵

In this study we found significant differences in terms of clinical symptoms between the two groups. There were in fact sever symptoms despite less arterial stenosis among the TCA group. Since few studies have been performed on this relation, adequate published data could not be found.

Compulsory changed in endothelial function due to traction, pressure factors that trend to lengthen a vessel maybe induced such a sever symptom at low rates METS despite to less stenotic vessels.

As mentioned earlier, the mean value of Gensini index was significantly lower in the TCA group compared to the NTCA group. However, no significant differences in orthopnea or PND was observed between the two groups. Finally, limilar to the results of previous studies, tortuosity was most prevalent in LCX and OM arteries.

A limitation of our study was using Gensini index since it can not specify the location of stenosis on the vessels. Nevertheless, we concluded that although patients with CSA and coronary tortuosity had lower Gensini index, they experienced more severe or at least as sever clinical symptoms compared to patients without coronary tortuosity. Therefore, it seems that coronary tortuosity without angiographic stenosis of epicardial coronary arteries can cause clinical symptoms of CSA.

Further studies on coronary tortuosity and its correlation with risk factors and clinical symptoms of ischemic heart diseases are necessary for better evaluation of these patients.

Conflict of Interests

Authors have no conflict of interests.

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