Journal of
Inflammatory Diseases
(Previous Title: The Journal of Qazvin University of Medical Sciences)

Winter 2022. Vol 25. Num 4

Research Paper

Impact of Metabolic Syndrome in Patients With Acute Myocardial Infarction After Thrombolytic Therapy

Sepas Haji Sobhani[1], Mohammad Mahdi Daei[2], Samira Dodangeh[2], Majid Hajikarimi[1*], Navid Mohammadi[3]

1. Clinical Research Development Unit, Bou-Ali Sina Hospital, Qazvin University of Medical Sciences, Qazvin, Iran.
2. Children Growth Research Center, Research Institute for Prevention of Non-communicable Diseases, Qazvin University of Medical Sciences, Qazvin, Iran.
3. Department of Social Medicine, Faculty of Medicine, Qazvin University of Medical Sciences, Qazvin, Iran.

Use your device to scan and read the article online

Citation Haji Sobhani S, Daei MM, Dodangeh S, Hajikarimi M, Mohammadi N. Impact of Metabolic Syndrome in Patients With Acute Myocardial Infarction After Thrombolytic Therapy. Journal of Inflammatory Diseases. 2022; 25(4):217-222. http://dx.doi.org/10.32598/JID.25.4.3

http://dx.doi.org/10.32598/JID.25.4.3

Article info:
Received: 15 Jun 2022
Accepted: 02 Sep 2022
Publish: 01 Jan 2022

Keywords:
Metabolic syndrome,
Thrombolytic drugs,
Myocardial infarction

ABSTRACT

Background: Metabolic syndrome (MetS) comprises a group of conditions that happen together and increase the risk of heart disorders. MetS has known characteristic diagnostic criteria and is diagnosed through physical examination and blood tests. This syndrome is extremely prevalent in patients with acute myocardial infarction. We aimed to determine the prevalence of MetS and its relationship with myocardial infarction and response to treatment in patients suffering from acute myocardial infarction under fibrinolytic treatment.

Methods: In this cross-sectional study, 145 patients with acute ST-elevation myocardial infarction (STEMI) were enrolled. They were referred to Bu-Ali Sina Hospital in Qazvin, Iran, between January 2018 and January 2019 and were candidates for thrombolytic therapy. The patients were divided into two groups with and without MetS according to the NCEP ATP III definition (the National Cholesterol Education Program-Adult Treatment Panel III). In each group, the ST resolution of more than 50% in electrocardiogram was evaluated 90 minutes after thrombolytic administration. In addition, angiographic information and left ventricular ejection fraction (LVEF) were compared between the two groups.

Results: Overall, the prevalence of MetS was 57.2% in the study population. After treatment, ST-segment resolution of more than 50%, the number of involved coronary vessels, the thrombolysis in myocardial infarction flow grade, mean LVEF, and type of myocardial infarction were similar in both study groups.

Conclusion: Our study indicates that MetS does not affect the response rate to thrombolytic treatment.

*** Corresponding Author:**
Majid Hajikarimi, Assistant Professor.
Address: *Clinical Research Development Unit, Bou-Ali Sina Hospital, Qazvin University of Medical Sciences, Qazvin, Iran.*
Phone: *+98 (912) 2828590*
E-mail: *majidhajikarimi57@gmail.com*

Journal of
Inflammatory Diseases
(Previous Title: The Journal of Qazvin University of Medical Sciences)

1. Introduction

Metabolic syndrome (MetS), syndrome X, or insulin resistance syndrome is a group of various physiologic and metabolic abnormalities characterized by having at least three of the following 5 medical conditions: abdominal obesity, high blood pressure (BP), abnormal high fasting plasma glucose, elevated serum triglycerides (TG), and low high-density lipoprotein (HDL) cholesterol level [1, 2].

MetS is a serious risk factor for the development of cardiovascular diseases, diabetes, dyslipidemia, stroke, osteoarthritis, and some cancers, and it increases mortality [1, 3]. Previous studies demonstrated poor prognosis of MetS among patients surviving after acute myocardial infarction (AMI) [4].

MetS prevalence differs in various societies as factors such as gender, age, race, ethnic predisposition, lifestyle habits, stress, diet type, and socioeconomic conditions affect its prevalence [5-8]. Generally, the prevalence of chronic diseases and MetS is often more seen in developing countries' populations than in developed societies [9].

Based on the National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III), the world prevalence of MetS in the adult population was reported at 35.6% [10, 11]. One study in Tehran, Iran, estimated the MetS prevalence as more than 30% in the adult population [11].

Several studies have shown that MetS is associated with poor outcomes and long-term survival in hospitalized patients with AMI [12, 13]. However, these research studies had the remarkable limitations of inconsistent reperfusion methods, although reperfusion therapy is important in the event of AMI [14].

In a study for the first time, it has been shown that patients with MetS have lower rates of thrombolysis in myocardial infarction (TIMI) grade 3 flow and higher corrected TIMI frame counts after thrombolytic therapy for AMI [15]. However, the impact of MetS on thrombolytic therapy has remained unclear. It is vital to find factors that affect the success of our treatment in patients with ST-elevation myocardial infarction (STEMI). So, the present study aimed to investigate the relationship between MetS and response to fibrinolytic treatment in patients suffering from AMI.

2. Materials and Methods

Patients

In this cross-sectional study, 145 patients with acute STEMI were enrolled. They were candidates for thrombolytic therapy at Bu-Ali Sina Hospital in Qazvin, Iran, between January 2018 and January 2019. The inclusion criteria were having typical ischemic chest pain lasting for less than 12 hours manifested by persistent ST-segment elevation longer than 20 minutes at the two-lead electrocardiogram (ECG) and being a candidate for fibrinolytic treatment. In addition, patients with evidence of left or right bundle branch blocks, cardiogenic shock, and a history of using an intra-aortic balloon pump were excluded from the study.

All patients received reteplase (10 units intravenously) over 2 minutes immediately after the onset of AMI symptoms, followed 30 minutes later by the second 10-unit IV bolus injection over 2 minutes.

To evaluate the components of MetS, total cholesterol, LDL and HDL cholesterol, TG levels, and BP were measured within 24 hours of admission, while waist circumference (WC) and fasting plasma glucose were measured on the last day before discharge. MetS was defined according to the ATP III criteria as the presence of three or more of the following five criteria: WC over 101 cm (for men) or 89 cm (for women), BP over 130/85 mmHg, TG over 150 mg/dL, HDL cholesterol level less than 40 mg/dL (for men) or 50 mg/dL (for women) and fasting blood sugar over 100 mg/dL.

In the present study, WC was considered 95 cm for Iranian men and women [16]. For this purpose, we measured WC in a standard method; while patients were in a standing position during full exhalation, one tap was placed in the middle part between the lower border of the rib and iliac crest, and the amount of WC was recorded by one person.

In all patients, the ST resolution in the ECG was calculated 90 minutes after thrombolytic administration. The calculation method was the total ST-elevation difference in all leads before and 90 minutes after thrombolytic administration. Because all patients underwent elective angiography, and their angiographic information was recorded, left ventricular ejection fraction

(LVEF) data obtained by echocardiography were also recorded and taken 24 hours after admission.

We divided enrolled patients into two groups, with and without metabolic syndrome, based on fulfilling metabolic syndrome criteria. Then, we evaluated the response to thrombolytic therapy according to ST-segment resolution of more than 50% in ECG, the number of involved coronary vessels, the TIMI flow grade, mean LVEF, and type of MI in each group.

The normality of data was checked using the Kolmogorov-Smirnoff test. Quantitative variables were also compared with the t-test or Mann-Whitney U test. For the statistical analysis, the SPSS software version 16 was used for windows (SPSS Inc., Chicago, IL) was used. P-values of 0.05 or less were considered statistically significant.

3. Results

In the present study, 145 patients with AMI who were candidates for fibrinolytic therapy were included. The prevalence of MetS in patients with AMI was 57.2%. As seen in Table 1, TG above 150 mg/dL is the most common criterion (95.2%) among patients with MetS and MI. In the studied samples, 18.6% of patients had one abnormal component, 20.7% of patients had two abnormal components, and 21.4%, 21.4%, and 14.5% of the patients had three, four, or all five abnormal components of MetS.

The prevalence of MetS for women (74.2%) was significantly greater (P=0.04) than for men (52.6%). After treatment, ST-segment resolution of more than 50% in ECG, the number of involved coronary vessels, the TIMI flow grade, mean LVEF, and type of MI were similar in both groups with and without MetS (Table 2).

4. Discussion

It is obvious that due to the higher prevalence of the defining components of MetS among cardiovascular patients, the prevalence of MetS in these patients is much higher than in the general population. However, with regard to the same prevalence, our country ranks high in the global prevalence of MetS among cardiovascular patients, which is worth considering.

The present study assessed the prevalence of MetS in patients with STEMI referring to Bu-Ali Sina Hospital and then evaluated the role of this syndrome in response to thrombolytic drugs.

The prevalence of the syndrome among patients with STEMI based on the ATP III diagnostic criteria was 57.5% (52.6% of males and 74.2% of females). In gen-

Table 1. Baseline characteristics of included patients in the present study

Variables		No. (%)
Waist circumference>95 cm		52(35.9)
High triglyceride level [≥150 mg/dL]		138(95.2)
High fasting plasma glucose concentration [≥100 mg/dL]		99(68.3)
Low HDL cholesterol level [<40 mg/dL for men and <50 mg/dL for women]		37(25.5)
High blood pressure (systolic≥130 mmHg or diastolic≥85 mmHg,		83(57.2)
Number of indicators associated with metabolic syndrome	1	27(18.6)
	2	30(20.7)
	3	31(21.4)
	4	31(21.4)
	5	21(14.5)
Frequency of metabolic syndrome		83(57.2)

Journal of
Inflammatory Diseases
(Previous Title: The Journal of Qazvin University of Medical Sciences)

Table 2. Baseline, ST-segment resolution, echocardiographic and coronary angiographic characteristics in patients with and without metabolic syndrome

Variables		+Metabolic Syndrome (%)	-Metabolic Syndrome (%)	P
Sex	Men Women	52.6 74.2	47.4 25.8	0.04
ST-Segment resolution of more than 50%		54.8	45.2	0.233
Number of coronary vessel involvement	One Two Three	21.7 26.5 51.8	37.1 29.0 33.9	0.059
Thrombolysis in myocardial infarction flow grade	0 2 3	16.9 9.6 73.5	9.7 9.7 80.6	0.457
Mean±SD left ventricular ejection fraction		33.14±9.72	30.18±9.72	0.066
Type of myocardial infarction	Inferior MI Anteroseptal MI Anterolateral MI High lateral	65.1 3.6 30.1 1.2	75.8 1.6 22.6 0	0.457
Mean±SD time between peak pain and fibrinolytic reception		2.69±0.89	2.72±0.97	0.976

Journal of
Inflammatory Diseases

eral, the prevalence of this syndrome in women is even two times higher in men [17, 18].

The rate of MetS in our study was higher than that in other studies. For example, Mokhayeri et al., in a systematic review and meta-analysis, reported the prevalence of this syndrome by 28% using the criteria of the International Diabetes Federation (IDF) and ATP III [19]. Delavari et al., in a national study on Iranians aged 25-64 years living in urban and rural areas, reported these rates at 34.7% and 37.4% based on the ATP III or IDF criteria [10]. According to the study by Hajian-Tilki et al. in northern Iran, the prevalence of MetS was 42.3% (36.5% in males and 47.3% in females) using the ATP III definition [20]. In a comprehensive study in six Middle Eastern countries (Bahrain, Kuwait, Qatar, Oman, Yemen, and the United Arab Emirates) in 2010 on hospitalized patients with the acute coronary syndrome, the overall prevalence of the syndrome was 46% [21]. In Oz et al.'s study, the prevalence of MetS in young Turkish patients with STEMI was about 46%, but this study was limited to patients younger than 46 years old [22].

These differences in prevalence can be attributed to age, sex, lifestyle, and genetic factors of the study population. It can also vary based on the definitions and classifications used for MetS by ATP III, WHO, NCEP III, IDF, and so on. In addition, different prevalence rates of the components of MetS, especially obesity, diabetes, and hypertension in different societies worldwide, can be another reason.

Among the individual components of the MetS, we found that high TG levels had the highest prevalence in AMI patients (95.2%), followed by fasting blood sugar (68.3%); low HDL cholesterol levels had the least positive predictive value. This finding indicates that high TG levels are associated with higher morbidity and may predispose to higher mortality. In line with our study, Pandey et al. in Nepal reported that the TG level had the highest positive predictive value in AMI patients [23].

As the second finding in this study and contrary to expectations, the occurrence of MetS lacked a significant effect on the response to thrombolytic treatment in our patients. In our study, the prevalence rates of ST resolution of more than 50% in patients with and without metabolic syndrome were 54.8% and 45.2%, respectively.

In line with our findings, some studies do not report the role of MetS components in influencing thrombolytic resistance. For example, Van Guilder et al. [24] reported no difference in endothelial capacity in the release of tissue plasminogen activator in obese and non-obese individuals with MetS. Also, Tata et al. showed that patients with metabolic syndrome have a poor response to primary percutaneous coronary intervention [25], but their method for revascularization was different from our study.

However, contrary to our study, in Anand et al., patients with MetS had higher plasminogen activator inhibitor-1 levels than patients without MetS [26], indicating an indirect MetS role in thrombosis formation. In a study by Arenillas et al. [27], thrombolytic drug resistance was observed in 42% of patients with MetS, and they concluded that this syndrome is associated with higher drug resistance (with a probability ratio of 9.8). In a study by Bas et al., insulin resistance in patients receiving intravenous recombinant tissue plasminogen activator was strongly associated with adverse clinical outcomes [28].

There are various factors, including therapy type, drug type, beginning time of chest pain, and prescribing thrombolytic therapy in studied groups, and sample size affect the difference of study's findings.

One study showed that individuals with MetS had a higher prevalence of ST-elevation myocardial infarction (71% vs 30%, P<0.001), multi-vessel disease (50% vs 34%, P=0.003), decreased ejection fraction (P=0.001) and more severe angiographic stenosis based on both modified Gensini (P=0.081) and syntax scores (P=0.008) compared to those without MetS [29]. Nevertheless, in our study, there is no relationship between the number of vessels disease and LVEF with MetS.

5. Conclusion

The prevalence of MetS among patients with the acute coronary syndrome in our selected community was 57.2%. The prevalence of ST resolution of more than 50% in patients with and without metabolic syndrome was 54.8% and 45.2%, respectively, which did not show a statistically significant difference. Generally, findings indicated that this syndrome does not affect the response rate to thrombolytic treatment.

Ethical Considerations

Compliance with ethical guidelines

The Ethics Committee of the Qazvin University of Medical Sciences approved the present study's protocol with the ethical (Code: IR.QUMS.REC.1398.314).

Funding

The paper was extracted from the MD thesis of first author approved by Clinical Research Development Unit, Bou-Ali Sina Hospital, Qazvin University of Medical Sciences, and Qazvin, Iran.

Authors' contributions

Conceptualization: Majid Hajikarimi; Writing–original draft and Data analysis: Sepas Haji Sobhani, Navid Mohammadi; Writing–review & editing, supervision, and project administration: Samira Dodangeh, Mohammad Mahdi Daei.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgments

The authors thank the staff of Bou-Ali Sina Hospital for their support during the study. In addition, the authors would like to appreciate the kind collaboration of Mostafa Sargol.

References

[1] Shiwaku K, Nogi A, Kitajima K, Anuurad E, Enkhmaa B, Yamasaki M, et al. Prevalence of the metabolic syndrome using the modified ATP III definitions for workers in Japan, Korea and Mongolia. J Occup Health. 2005; 47(2):126-35. [DOI:10.1539/joh.47.126] [PMID]

[2] McNeill AM, Rosamond WD, Girman CJ, Golden SH, Schmidt MI, East HE, et al. The metabolic syndrome and 11-year risk of incident cardiovascular disease in the atherosclerosis risk in communities study. Diabetes Care. 2005; 28(2):385-90. [DOI:10.2337/diacare.28.2.385] [PMID]

[3] Jaber LA, Brown MB, Hammad A, Zhu Q, Herman WH. The prevalence of the metabolic syndrome among Arab Americans. Diabetes Care. 2004; 27(1):234-8. [DOI:10.2337/diacare.27.1.234] [PMID]

[4] Lovic MB, Djordjevic DB, Tasic IS, Nedeljkovic IP. Impact of metabolic syndrome on clinical severity and long-term prognosis in patients with myocardial infarction with ST-segment elevation. Hellenic J Cardiol. 2018; 59(4):226-31. [DOI:10.1016/j.hjc.2018.02.002] [PMID]

[5] Santos A-C, Ebrahim S, Barros H. Alcohol intake, smoking, sleeping hours, physical activity and the metabolic syndrome. Prev Med. 2007; 44(4):328-34. [DOI:10.1016/j.ypmed.2006.11.016] [PMID]

[6] Wilsgaard T, Jacobsen BK. Lifestyle factors and incident metabolic syndrome: The Tromsø Study 1979-2001. Diabetes Res Clin Pract. 2007; 78(2):217-24. [DOI:10.1016/j.diabres.2007.03.006] [PMID]

[7] Ford E, Giles W, Dietz W. Prevalence of the metabolic syndrome among US adults. JAMA. 2002; 287(3):356-9. [DOI:10.1001/jama.287.3.356] [PMID]

[8] Bender R, Jöckel K-H, Richter B, Spraul M, Berger M. Body weight, blood pressure, and mortality in a cohort

Journal of
Inflammatory Diseases
(Previous Title: The Journal of Qazvin University of Medical Sciences)

of obese patients. Am J Epidemiol. 2002; 156(3):239-45. [DOI:10.1093/aje/kwf015] [PMID]

[9] Kazemi S, Koosha A, Sharifi F, Moosavi-Nasab S, Mellati A. [Metabolic syndrome prevalence in 17-21 years old population of Zanjan: A new definition for waist circumference in Iranians in comparison with ATPIII and World Diabetes Association (Persian)]. Iran Diabetes Lipid J. 2008; 7(4):393-8. https://www.sid.ir/paper/439109/fa

[10] Delavari A, Forouzanfar MH, Alikhani S, Sharifian A, Kelishadi R. First nationwide study of the prevalence of the metabolic syndrome and optimal cutoff points of waist circumference in the Middle East: The national survey of risk factors for noncommunicable diseases of Iran. Diabetes Care. 2009; 32(6):1092-7. [DOI:10.2337/dc08-1800] [PMID] [PMCID]

[11] Noori N, Mirmiran P, Asgari S, Azizi F. [Calcium and vitamin D intake and metabolic syndrome prevalence in Tehranian adults: Tehran glucose and lipid study (Persian)]. Iran Endocrinol Metab J. 2007; 9(2):191-200. http://ijem.sbmu.ac.ir/article-1-404-fa.html

[12] Zeller M, Steg P, Ravisy J, Laurent Y, Janin-Manificat L, L'Huillier I, et al. Observatoire des Infarctus de Cote-d'Or Survey Working Group. Prevalence and impact of metabolic syndrome on hospital outcomes in acute myocardial infarction. Arch Intern Med. 2005; 165(10):1192-8. [DOI:10.1001/archinte.165.10.1192] [PMID]

[13] Takeno M, Yasuda S, Otsuka Y, Morii I, Kawamura A, Yano K, et al. Impact of metabolic syndrome on the long-term survival of patients with acute myocardial infarction: Potential association with C-reactive protein. Circ J. 2008; 72(3):415-9. [DOI:10.1253/circj.72.415] [PMID]

[14] Won KB, Kim BK, Chang HJ, Shin DH, Kim JS, Ko YG, et al. Metabolic syndrome does not impact long-term survival in patients with acute myocardial infarction after successful percutaneous coronary intervention with drug-eluting stents. Catheter Cardiovasc Interv. 2014; 83(5):713-20. [DOI:10.1002/ccd.25150] [PMID]

[15] Yasar AS, Bilen E, Bilge M, Arslantas U, Karakas F. Impact of metabolic syndrome on coronary patency after thrombolytic therapy for acute myocardial infarction. Coron Artery Dis. 2009; 20(6):387-91. [DOI:10.1097/MCA.0b013e328330d557] [PMID]

[16] Azizi F, Hadaegh F, Khalili D, Esteghamati A, Hossein PF, Delavari A, et al. Appropriate definition of metabolic syndrome among Iranian adults: Report of the Iranian National Committee of Obesity. Arch Iran Med. 2010; 13(5):426-8. https://www.sid.ir/paper/280600/en

[17] El Brini O, Akhouayri O, Gamal A, Mesfioui A, Benazzouz B. Prevalence of metabolic syndrome and its components based on a harmonious definition among adults in Morocco. Diabetes Metab Syndr Obes. 2014; 7:341-6. [DOI:10.2147/DMSO.S61245] [PMID] [PMCID]

[18] Esmailnasab N, Moradi G, Delaveri A. Risk factors of non-communicable diseases and metabolic syndrome. Iran J Public Health. 2012; 41(7):77-85. [PMCID]

[19] Mokhayeri Y, Riahi SM, Rahimzadeh S, Pourhoseingholi MA, Hashemi-Nazari SS. Metabolic syndrome prevalence in the Iranian adult's general population and its trend: A systematic review and meta-analysis of observational studies. Diabetes Metab Syndr. 2018; 12(3):441-53. [DOI:10.1016/j.dsx.2017.12.023] [PMID]

[20] Hajian-Tilaki K, Heidari B, Firouzjahi A, Bagherzadeh M, Hajian-Tilaki A, Halalkhor S. Prevalence of metabolic syndrome and the association with socio-demographic characteristics and physical activity in urban population of Iranian adults: A population-based study. Diabetes Metab Syndr. 2014; 8(3):170-6. [DOI:10.1016/j.dsx.2014.04.012] [PMID]

[21] Al Suwaidi J, Zubaid M, El-Menyar AA, Singh R, Rashed W, Ridha M, et al. Prevalence of the metabolic syndrome in patients with acute coronary syndrome in six middle eastern countries. J Clin Hypertens (Greenwich). 2010; 12(11):890-9. [DOI:10.1111/j.1751-7176.2010.00371.x] [PMID] [PMCID]

[22] Oz TK, Özbilgin N, Sungur A, Bas EG, Zengin A, Gürol T, et al. Prevalence of metabolic syndrome in young patients with ST-elevation myocardial infarction. Int J Cardiovasc Acad. 2018; 4(3):53-8. [Link]

[23] Pandey S, Baral N, Majhi S, Acharya P, Karki P, Shrestha S, et al. Prevalence of the metabolic syndrome in acute myocardial infarction and its impact on hospital outcomes. Int J Diabetes Dev Ctries. 2009; 29(2):52-5. [DOI:10.4103/0973-3930.53120] [PMID] [PMCID]

[24] Van Guilder GP, Hoetzer GL, Greiner JJ, Stauffer BL, DeSouza CA. Metabolic syndrome and endothelial fibrinolytic capacity in obese adults. Am J Physiol Regul Integr Comp Physiol. 2008; 294(1):R39-44. [DOI:10.1152/ajpregu.00564.2007] [PMID]

[25] Tartan Z, Ozer N, Uyarel H, Akgul O, Gul M, Cetin M, et al. Metabolic syndrome is a predictor for an ECG sign of no-reflow after primary PCI in patients with acute ST-elevation myocardial infarction. Nutr Metab Cardiovasc Dis. 2008; 18(6):441-7. [DOI:10.1016/j.numecd.2007.02.015] [PMID]

[26] Anand S, Yi Q, Gerstein H, Lonn E, Jacobs R, Vuksan V, et al. Relationship of metabolic syndrome and fibrinolytic dysfunction to cardiovascular disease. Circulation. 2003; 108(4):420-5. [DOI:10.1161/01.CIR.0000080884.27358.49] [PMID]

[27] Arenillas JF, Sandoval P, Pérez de la Ossa N, Millán M, Guerrero C, Escudero D, et al. The metabolic syndrome is associated with a higher resistance to intravenous thrombolysis for acute ischemic stroke in women than in men. Stroke. 2009; 40(2):344-9. [DOI:10.1161/STROKEAHA.108.531079] [PMID]

[28] Bas DF, Ozdemir AO, Colak E, Kebapci N. Higher insulin resistance level is associated with worse clinical response in acute ischemic stroke patients treated with intravenous thrombolysis. Transl Stroke Res. 2016; 7(3):167-71. [DOI:10.1007/s12975-016-0453-y] [PMID]

[29] Miri R, Sajjadieh A, Parsamahjoob M, Hajibaratali B, Shekarchizadeh M, Kolahi AA, et al. Relationship between metabolic syndrome and angiographic severity of coronary artery disease. ARYA Atheroscler. 2016; 12(5):220-5. [PMCID]