Prevalence of risk factors of ST segment elevation myocardial infarction in Turkish patients living in Central Anatolia

İç Anadolu bölgesinde yaşayan hastalarda ST segment yükselmeli miyokard infarktüsü risk faktörleri prevalansı

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ABSTRACT

Objective: There is not enough available data in our country about the prevalence of risk factors for ST-elevation myocardial infarction (STEMI), which has the highest in-hospital mortality rate within subtypes of acute coronary syndromes. Therefore, in this study, we aimed to evaluate the prevalence of risk factors for STEMI in Central Anatolia, one of the regions with high risk for coronary heart disease (CHD).

Methods: This cross-sectional observational study included 1210 patients (962 men, 248 women) with the diagnosis of STEMI in 3 tertiary-medical centers in 3 cities in Central-Anatolia (Ankara, Konya, and Kayseri). Demographic characteristics (age, gender) and risk factors known to be traditional risk factors for CHD (history of hypertension (HT), diabetes mellitus (DM), smoking, and family history) were inquired and fasting blood samples within 24 hours from onset of STEMI were taken to analyze lipid levels. Patients were divided into 3 groups based on their ages: Group A - age ≤44 years; Group B - age 45-64 years; and Group C - age≥65 years. Prevalence of risk factors and differences within age-groups and genders were evaluated.

Results: The mean age was 58±11 years (range 24-96 years). Although the percentage of female patients increased in relation to increasing age, 80% of the total patients were male. While prevalence of smoking and family history was observed to decrease with aging, there was a statistically significant increase in prevalence of HT and DM ($p<0.001$). Prevalence of smoking was the highest in young patients and males ($p<0.001$). Prevalence of HT and DM, on the other hand, was significantly higher in women than in men ($p<0.001$). Although the number of modifiable risk factors was found to be significantly smaller in men, male patients with STEMI were 8 years younger than females on average.

Conclusions: The results of our study, in which modifiable risk factors and especially smoking were found to have a high prevalence in patients with STEMI living in Central Anatolia, suggested that most STEMI cases especially at younger ages might be prevented by the modification of these risk factors. *(Anadolu Kardiyol Derg 2009; 9: 3-8)*

Key words: ST - elevation myocardial infarction, risk factors, Turkey

ÖZET

Amaç: Akut koroner sendromlar içerisinde en yüksek hastane içi mortaliteye sahip olan ST yükselmeli miyokard infarktüsü (STYMİ) risk faktörleri dağılımı hakkında ülkemizde yeterli veri yoktur. Bundan dolayı, biz bu çalışmada koroner kalp hastalığı açısından yüksek riskli bir bölge olduğu bilinen İç Anadolu bölgesinde STYMİ risk faktörleri prevalansını belirlemeyi amaçladık.

Yöntemler: Enine kesitli gözlemsel nitelikteki bu çalışmaya Ankara, Konya ve Kayseri'de hizmet veren 3 merkezin koroner yoğun bakım ünitelerinde STYMİ tanısıyla takip edilen 1210 (962 erkek, 248 kadın) hasta alındı. Hastaların yaş, cinsiyet, aile hikâyesi, diyabetes mellitus (DM), hipertansiyon (HT), sigara kullanımı durumlarına ait verileri kaydedildi ve STYMİ'nin ilk 24 saati içerisinde kan örnekleri alınarak lipit profili belirlendi. Hastalar yaşlarına göre 3 gruba ayrıldı; grup 1- ≤44 yaş; grup 2- 45-64 yaş arası; grup 3- ≥65 yaş. Yaş gruplarına ve cinsiyete göre risk faktörlerinin dağılımı ve gruplar arası farklılıklar değerlendirildi.

Bulgular: Hastaların ortalama yaşı 58±11 yıl (aralık 24-96 yaş) idi. Yaşla birlikte kadın hastaların yüzdesinde artış olmakla birlikte, çalışmaya

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alınan hastaların %80'ini erkekler oluşturmaktaydı. Yaşla birlikte, aile hikâyesi ve sigara kullanımı prevalansında azalma görülürken, HT ve DM prevalansında istatistiksel olarak anlamlı artış izlendi. Sigara kullanımı, genç yaştaki hastalarda ve erkeklerde prevalansı en yüksek risk faktörüydü (p<0.001). Hipertansiyon ve DM prevalansı ise kadınlarda erkeklere göre belirgin olarak daha yüksekti (p<0.001). Değiştirilebilir risk faktörü sayısı erkeklerde anlamlı olarak daha düşük bulunmakla birlikte ortalama STYMİ geçirme yaşının kadınlara göre 8 yaş daha genç olduğu gözlendi.

Sonuç: İç Anadolu bölgesinde yaşayan ve STYMİ geçiren hastalarda değiştirilebilir risk faktörleri ve özellikle sigara kullanımının yüksek prevalansta tespit edildiği çalışmamız bu risk faktörlerinin kontrolü ile özellikle genç yaştaki STYMİ'lerin büyük kısmının önlenebileceğini düşündürmektedir. *(Anadolu Kardiyol Derg 2009; 9: 3-8)*

Anahtar kelimeler: ST - yükselmeli miyokard infarktüsü, risk faktörleri, Türkiye

Introduction

Coronary heart disease (CHD) is the primary cause of mortality and morbidity in both developed and developing countries and its incidence is increasing rapidly worldwide (1). However, the relative importance of CHD varies from one country to another, as well as across regions within one country. The disease is common in Turkish population. In the Turkish Adult Risk Factor (TEKHARF), a study in which the prevalence of and the risk factors for CHD were examined in Turkish adults, it was estimated that its prevalence was 5.8% in men and 5.0% in women (2). Furthermore, it was assumed that 415.000 new fatal or non-fatal CHD would occur annually.

Increasing prevalence of well-known risk factors for CHD such as increasing life expectancy, cigarette smoking, hypertension (HT), diabetes mellitus (DM), and dyslipidemia are important factors in the spread of the disease. It was demonstrated that the number of new fatal or non-fatal coronary events and mortality could be decreased by the modification of risk factors, most of which are potentially modifiable (3-8). However, the severity and/or prevalence of those risk factors may vary across populations, as well as across different geographic regions within the same population (9, 10).

About 20% of the acute coronary syndromes are ST-elevation myocardial infarction (STEMI) and it has the highest in-hospital mortality within subtypes of acute coronary syndromes. According to TEKHARF study, it may be estimated that approximately 80.000 patients suffer from STEMI each year in Turkey (2). However, there are only a few studies investigating the prevalence of risk factors for CHD in general population and in patients with chronic CHD in Turkey (11-14). To our current knowledge, there is yet no study assessing those risk factors in patients with STEMI. Determining the prevalence of risk factors for STEMI will help to determine the priorities for protection from STEMI according to a specific risk profile and provide better primary health care for patients.

When compared to other regions in the country, Central Anatolia is one of the regions having a high risk for CHD, with its higher percentage of smokers and systolic blood pressure, accompanied by lower high-density lipoprotein cholesterol (HDL-C) levels (10).

As a result, we aimed in this study to assess the prevalence of risk factors in patients with acute STEMI in Central Anatolia.

Methods

Three tertiary-medical centers in 3 different cities in Central-Anatolia (Ankara, Konya, and Kayseri) participated in this cross-sectional observational study, in which 1210 patients with STEMI admitted to coronary care units between the years 2003 and 2007 were included consecutively. ST elevation myocardial infarction was diagnosed by typical electrocardiographic (ECG) findings (≥1 mm ST elevation in at least 2 contiguous derivations) and the elevation of myocardial necrosis markers in the presence of typical chest pain lasting 30 minutes or more (15). The exclusion criteria were the presence of left bundle branch block or paced-rhythm in admission ECG.

Information about demographic characteristics (age, gender), risk factors known to be traditional risk factors for CHD (history of HT, DM, smoking, and family history) were inquired and blood samples were taken to analyze lipid levels. Hypertension was defined as a history of HT and/or usage of antihypertensive drugs (16), and DM was taken as a history of DM and/or usage of anti-diabetic drugs before the hospital admission (17). Blood pressure and fasting glucose levels were also recorded during in-hospital period and the patients having high blood pressure (systolic blood pressure ≥140mmHg or diastolic blood pressure ≥90mmHg) or high fasting blood glucose levels (≥126 g/dl) in sequential measurements were recorded as hypertensive or diabetic patients, respectively (16, 17). Family history of premature cardiovascular disease was defined as at least one first-degree relative with premature CHD or sudden cardiac death (onset age ≤55 years in a male relative, ≤65 years in a female relative) (18). Current smokers were defined as patients reported to have smoked cigarettes or other tobacco products in previous years and those who quit smoking during the last year (9).

Fasting blood samples (12 hours) for lipid profile were taken within the 24 hours of onset of symptoms. Total cholesterol (total-C), HDL-C and triglyceride (TG) levels were quantified by the cholesterol oxidase colorimetric assay of the supernatant from the precipitation of non-HDL lipoproteins with heparin and manganese chloride (Beckman Coulter, Inc., California, USA). Low-density lipoprotein cholesterol (LDL-C) levels were calculated using Friedewald equation (LDL-C= [total-C]-[HDL-C+TG/5]) (19). High LDL-C was defined as LDL-C≥130 mg/dL in non-diabetic patients and as LDL-C≥100 mg/dL in diabetic patients (20). The lipid profiles were not available in 143 patients because of early death or emergency coronary artery bypass surgery. The patients were classified into 3 groups according to their ages: Group 1, young-age ≤44 years; Group 2, middle-age 45-64 years; Group 3, old-age ≥65 years (21).

Statistical Analysis

Statistical analyses were performed with SPSS for Windows 13.0 software (SPSS Inc, Chicago, IL). Continuous variables are expressed as median and inter-quartile range. Mann-Whitney U

test was used to compare continuous variables, categorical variables were compared using χ^2 test. Patient characteristics were compared among the 3 groups using Kruskal-Wallis test followed by Mann-Whitney U-test with Bonferroni's adjustment. A P value <0.05 was considered statistically significant (<0.017 for Bonferroni's adjustment values).

Results

The number and general characteristics of the patients in each group stratified according to age are shown in Table 1. The age range was 24-96 years (mean±SD, 58±11 years), with 11% of patients being ≤44 years of age. Significant differences were observed for all characteristics across age groups, with the exception of high LDL-C level, which was similar across all groups. Although the percentage of female patients was significantly increased in group 3, the distribution of gender showed that male patients were dominant in all age groups. Prevalence of HT and DM was the lowest in group 1 and constantly increased with increasing age, in contrast to smoking and family history, which were much more frequent and whose prevalence decreased continuously with aging. Smoking was the most common risk factor in groups 1 and 2, and it was even observed that smoking was the only modifiable risk factor in 36% and 23% of the patients of groups 1 and 2, respectively, whereas it was only 9% in group 3 (p<0.001 in comparison to all groups). Although all lipid parameters were similar in groups 1 and 2, significant differences were observed in group 3 when compared to younger-age groups; Total-C, TG, and LDL-C levels were lower, whereas HDL-C levels were higher in group 3 than in the other 2 groups. As expected, total-C/HDL-C ratio was lower in group 3. The total-C/HDL-C ratio was higher than 4.5 in only half of the patients of group 3, whereas the ratio of ≥4.5 was observed in approximately 4 of 5 patients in group 1. When all the seven risk factors (elder age, gender, family history, history of HT or DM, smoking, and high LDL-C) were taken into account, 99.6% of the patients had at least one risk factor. One or more modifiable risk factors (history of HT or DM, smoking, and high LDL-C) were seen in 92% of the patients.

As compared to females, male patients were 8 years younger on average (p<0.001) (Table 2). In men, STEMI was much more frequently observed between 45 and 64 years of age, whereas it was observed more frequently in ≥65 years of age in females (p<0.001). Also, the distribution of modifiable risk factors varied significantly between the genders (Table 2). The prevalence of HT and DM were significantly higher (p<0.001 for both) in women as compared to men. A higher prevalence of smoking was observed in male patients at all ages. Smoking was the only modifiable risk factor in 23% of male patients, whereas it was 4% in females (p<0.001). Both total-C and HDL-C levels were higher in women than those in men (p=0.001 and p<0.001, respectively), whereas total-C/HDL-C ratio was significantly lower in women (p<0.001). Although mean LDL-C levels were similar in both genders, categorizing LDL-C levels ≥130 mg/dL in non-diabetic patients or ≥100 mg/dL in diabetic patients as high LDL-C generated a higher percentage in female patients (p=0.002). The total number of the risk factors excluding 'gender' was similar in both sexes (for men 2.5±1.1 and for women 2.4±1.0, p>0.05); however, the number of modifiable risk factors was significantly higher in women than in men (1.8±0.9 versus 1.6±0.9, p=0.004, respectively).

Discussion

In this geographically defined cohort, the risk factors for STEMI were for the first time evaluated in Turkish population. The findings of this study were that smoking and family history are the

Table 1. Distribution of risk factors of the study patients according to age groups

Parameters	All patients (n=1210)	Group 1 (n=131, 11%)	Group 2 (n=699, 58%)	Group 3 (n=380, 31%)	*p
Gender, Male, n(%)	962 (80)	120 (92)	595 (85)	247 (65)[c,e]	<0.001
History of HT, n(%)	428 (35)	19 (15)	209 (30)[a]	200 (53)[c,e]	<0.001
History of DM, n(%)	248 (21)	13 (10)	129 (19)[b]	106 (28)[c,e]	<0.001
Family History, n(%)	281 (23)	56 (43)	177 (25)[a]	48 (13)[c,e]	<0.001
Smoking, n(%)	692 (57)	115 (88)	466 (67)[a]	111 (29)[c,e]	<0.001
Total-C, mg/dL	186 (154-214)	194 (169-214)	184 (157-220)	176 (146-204)[c,e]	<0.001
Triglyceride, mg/dL	105 (73-160)	129 (86-191)	113 (78-168)	90 (62-130)[c,e]	<0.001
HDL-C, mg/dL	37 (32-44)	36 (31-43)	36 (31-43)	39 (33-46)[d,e]	<0.001
LDL-C, mg/dL	121 (98-147)	124 (106-150)	125 (100-150)	114 (91-138)[d,e]	<0.001
#High LDL-C, n(%)	512 (48)	60 (50)	307 (50)	145 (43)	0.1
Total-C/HDL-C	4.9 (4.1-5.9)	5.3 (4.6-6.1)	5.1 (4.2-6.1)	4.5 (3.8-5.3)[c,e]	<0.001
Total-C/HDL-C ≥4.5, n(%)	683 (64)	94 (77)	421 (69)	168 (50)[c,e]	<0.001

Values are presented as median (25th to 75th percentiles) or n (%), where appropriate.
*Chi-square test or non-parametric Kruskal–Wallis test followed by Mann-Whitney U-test with Bonferroni's adjustment.
a- p<0.001 and b - p<0.05 for comparison of group 1 and 2; c - p<0.001 and d - p<0.05 for comparison of group 1 and 3; e - p<0.001 for comparison of group 2 and 3.
DM - diabetes mellitus, HDL-C- high-density lipoprotein cholesterol, HT- hypertension, LDL-C- low-density lipoprotein cholesterol, total-C- total cholesterol.
#High LDL-C was defined as LDL-C ≥130 mg/dL in non-diabetic patients and as ≥100 mg/dL in diabetic patients.

Table 2. Distribution of risk factors in the study patients according to gender

Parameters	Men (n= 962, 80%)	Women (n=248, 20%)	*p
Age, years	56 (49-65)	65 (57-73)	<0.001
≤44, n(%)	120 (12)	11 (4)	
45-64, n(%)	595 (62)	104 (42)	
≥65, n(%)	247 (26)	133 (54)	
History of HT, n(%)	270 (28)	161 (65)	<0.001
History of DM, n(%)	154 (16)	95 (38)	<0.001
Family History, n(%)	229 (24)	54 (22)	NS
Smoking, n(%)	654 (68)	42 (17)	<0.001
Total-C, mg/dL	184 (151-211)	194 (165-223)	0.001
Triglyceride, mg/dL	103 (72-159)	109 (74-161)	NS
HDL-C, mg/dL	36 (31-42)	42 (35-50)	<0.001
LDL-C, mg/dL	121 (96-147)	126 (102-146)	NS
#High LDL-C, n(%)	389 (46)	123 (58)	0.002
Total-C/HDL-C	5.1 (4.2-6.0)	4.6 (3.8-5.4)	<0.001
Total-C/HDL-K≥4.5, n(%)	568 (66)	115 (54)	<0.001

Values are presented as median (25^{th} to 75^{th} percentiles) or n (%), where appropriate.
*Mann-Whitney U test or Chi-square test.
DM - diabetes mellitus, HDL-C- high-density lipoprotein cholesterol, HT- hypertension, LDL-C- low-density lipoprotein cholesterol, total-C- total cholesterol.
#High LDL-C was defined as LDL-C ≥130 mg/dL in non-diabetic patients and as ≥100 mg/dL in diabetic patients.

most common risk factors in younger age groups and that HT and DM are more common in older age groups, consistent with previous studies performed on other populations. Even though LDL-C levels were significantly higher in younger ages, a notably higher prevalence of total-C/LDL-C ratio of ≥4.5 was observed in younger ages. Another important finding of this study was that 92% of the patients had at least 1 modifiable risk factor, which suggested that modifiable risk factors were highly prevalent in patients with STEMI who live in Central Anatolia.

Non-modifiable risk factors

Old age is a well-known risk factor for STEMI (22). Cardiovascular disease is the most frequent diagnosis in elderly persons and the leading cause of death in both men and women older than 65 years (23). Consistent with this, more than half of the patients in our study had old-age criteria. The average age in our study was higher than that of the Middle East and Africa in INTERHEART study; however, it was 5 years lower in men and 3 years lower in women than those of Western European countries (9). The finding in our study that the prevalence of history of HT and DM increased with aging and its high frequency in ≥65-year old patients suggested that the increase in prevalence of those modifiable risk factors might account for the substantial age-related increase in CHD.

Previous studies showed that there were gender-related differences in the natural history, prevalence, clinical outcome, and risk factors of CHD. Coronary heart disease was 2 to 5 times more common in men than in women, and there was a substantial gender-related variability in the prevalence of modifiable risk factors for CHD (24-28). Consistent with previous reports, the number of men in our study was 4 times bigger than that of women, and women experienced their first STEMI on average 8 years later than men did. The average number of modifiable risk factors in our study, as well as in some other studies (29, 30), was greater in women than in men. Some investigators explained this by the claim that women should have more risk factors to develop CHD at the same age as men (31). In contrast to this consideration, a number of studies showed that history of DM or HT appeared to be stronger risk factors for CHD and/or myocardial infarction in women than in men (32, 33). It was proposed that the presence of DM, HT, or smoking might remove some of the relative advantages of premenopausal women. Although smoking was less observed in women, prevalence of HT and DM was significantly higher in women than in men in our study.

Although there were some controversial data in early studies (34), more recent studies have shown that family history is an important risk factor for CHD in both women and men, especially in those <60 years of age (35, 36). In INTERHEART study, it was reported that family history was slightly more important in young patients as compared to older ones (9). It was also more common in younger patients in our study.

Modifiable risk factors

Diabetes mellitus, HT, smoking, and high LDL-C are the major and potentially modifiable traditional risk factors that substantially increase the risk of developing CHD. In an analysis evaluating traditional risk factors for CHD in patients with acute myocardial infarction, acute coronary syndrome, or symptomatic CHD, at least one risk factor was observed in 85% of the patients (37). Consistent with this report, in our study, 92% of the patients had at least one modifiable risk factor.

Presence of DM and/or HT increases the risk of STEMI as compared to normal population, particularly in women (9). Prevalence of DM in INTERHEART study was 26% in women, 16% in men (9). In a study in which cardiovascular risk factors were analyzed in Turkish patients with coronary angiographically documented CHD, prevalence of DM was detected in a higher percentage in women than in men (31% versus 18%, respectively) (13). Consistent with these studies, DM was observed in our study to have higher prevalence in women than in men (38% versus 16%) and its prevalence increased continuously with aging. It was reported in INTERHEART study that prevalence of HT in male patients with acute myocardial infarction was 35%, while it was 53% in females. It was also reported in the same study that HT and DM were the strongest risk factors for acute myocardial infarction after smoking and apolipoprotein B/apolipoprotein A1 ratio (9). A study in patients with CHD in Turkey found that prevalence of HT was 37% in men and 60% in women (13). In our study, prevalence of HT was similar to these two studies and it was a more prevalent risk factor especially in women and old patients.

In some previous reports, it was shown that both total-C and LDL-C levels were lower in Turkish population as compared to American and German populations (11, 38). In our study, both the average total-C and LDL-C levels were lower than those in most of the European countries, too (39, 40). When high LDL-C was

defined as LDL-C≥130 mg/dL in patients without DM or as ≥100mg/dL in those with DM, only 48% of the patients had high LDL-C. However, HDL-C level is also significantly lower, and total-C/HDL-C ratio is substantially higher in Turkish population than in others (11, 38-40). Accordingly, it was reported that total-C/HDL-C ratio would be a more valuable indicator than those levels alone (41). In agreement with this information, the patients with a ratio of total-C/LDL-C of 4.5 or greater were detected in 64% of our cases, with a higher percentage in young patients. This finding may suggest that although the primary goal of cholesterol treatment is LDL-C levels, total-C/LDL-C ratio may be an important treatment aim as LDL-C in Turkish population.

Cigarette smoking and/or use of other tobacco products is one of the most important avoidable risk factors of acute coronary syndromes among men and women. In INTERHEART study, it was reported that smoking was one of the most powerful risk factor on population attributable risk and it was associated with a three-fold increase in odds of a non-fatal acute myocardial infarction, compared with those who never smoked (9). In addition, the magnitude of risk was clearly and linearly related to the number of smoked cigarettes, and they emphasized that there was no safe level (9, 42). Cigarette smoking, increasingly becoming a more serious public health problem in our country, was the most frequently encountered major risk factor in our study population with acute STEMI living in Central Anatolia. It was found in TEKHARF study that 43% of men and 18% of women in Turkish society were smokers. In the same study it was also reported that cigarette smoking increased among young people, especially women, and the potential danger was emphasized (43). The finding of the present study is that 68% of all the subjects and 88% of those ≤44 years old were smokers, and smoking was the only modifiable risk factor in about one third of those ≤44-year old patients, suggesting that most of the acute myocardial infarction cases in this age group could be prevented only by smoking cessation.

Study Limitations

Our study had several limitations. We did not have a control group without CHD for comparison, although the prevalence of conventional risk factors noted in our patients with CHD was substantially greater than their prevalence in the general population. There are several additional risk factors for CHD in addition to those we evaluated in our study. However, those additional risk factors were not included in this study as we aimed to evaluate only the traditional risk factors. Although lipid profiles were not available in 143 patients due to different reasons, this random lack of data was considered unimportant for the overall evaluation.

Conclusions

The present study, which is the first epidemiologic study investigating risk factors for STEMI in Turkish population, showed that the potentially modifiable risk factors, especially smoking, had high prevalence in patients with STEMI living in Central Anatolia. Overall, 92% of the patients in our study had at least one modifiable risk factor, which suggested that these risk factors might significantly contribute to the development of most of STEMI cases. This finding signifies the importance of a struggle against modifiable risk factors and may help to devise a better public health policy. In conclusion, modifications in life-styles and a more aggressive management to avoid these risk factors will probably play a strong protective role against most STEMI cases especially among young individuals.

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