ORIGINAL ARTICLE

Comparison of secondary prevention in coronary heart disease patients living in rural and urban areas

Kırsal ve kentli hastalarda koroner kalp hastalığı sonrası ikincil korunmanın karşılaştırılması

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ABSTRACT

Objective: The aim of the present study was to assess differences between urban and rural patients with coronary heart disease (CHD) with respect to secondary prevention.

Methods: This cross-sectional study included all consecutive patients diagnosed with CHD at 2 cardiology clinics between January 2016 and January 2017. The demographic characteristics and laboratory parameters were recorded at routine control visits. The patients were divided into 2 groups according to residence based on their statements: urban (n=1752) and rural (n=456).

Results: The median age of the patients was 64 years (interquartile range: 12 years). A mean of 4.1±2.1 years had passed after the first (index) coronary event. It was determined that 22.2% of the patients continued to smoke. The rate of quitting was significantly higher in the urban group (20.5% vs. 11.2%; p<0.001). The presence of hypertension (64.3% vs. 56.7%), diabetes mellitus (45.6% vs. 39.2%), cerebrovascular events (9.2% vs. 3.8%), and chronic obstructive pulmonary disease (11.4% vs. 5.5%) was significantly greater among the rural patients (p<0.05 for each). In all, 34.2% were obese, and the number of obese patients was significantly greater among the rural patients (46.4% vs. 31.2%; p<0.001). The number of patients performing regular exercise was significantly lower in the rural patient group (34.4% vs. 23.9%; p<0.001). Overall, 88.9% of the patients were taking antiplatelet agents, 62.1% were taking statins, 73.1% were taking beta-blockers, and 34.2% were taking ACEI/ARB. The rate of medication use was significantly greater among urban patients compared with rural patients (p<0.05 in all cases).

Conclusion: Secondary prevention efforts among patients with CHD require additional improvement. Moreover, secondary prevention is currently less successful among the rural population than the urban population.

ÖZET

Amaç: Çalışmamızda kırsalda ve kentte yaşayan koroner kalp hastalarında (KKH) ikincil korunmanın karşılaştırılması amaçlanmıştır.

Yöntemler: Kesitsel çalışmamıza iki farklı kardiyoloji kliniğinde Ocak 2016 ve Ocak 2017 tarihleri arasında başvuran KKH tanılı ardışık tüm hastalar dahil edildi. Hastaların demografik özellikleri, tıbbi öyküleri ve son üç ayda bakılan laboratuvar değerleri kayıt edildi. Hastaların beyanlarından yerleşim yerlerine göre; kırsal (n=456) ve kentsel (n=1752) hastalar olarak iki gruba ayrıldı.

Bulgular: Hastaların medyan yaşı 64 (çeyrekler arası, 12) yıl olup kırsal ve kentsel hastalar arasında fark izlenmedi. İlk koroner hadiseden ortalama 4.1±2.1 yıl geçmiş idi. Hastaların %22.2'sinin hala sigara içtiği ve sigara bırakma oranının kentsel hastalarda belirgin daha yüksek olduğu saptandı (%20.5 ve %11.2; p<0.001). Hipertansiyon (%64.3 ve %56.7), diabetes mellitus (%45.6 ve %39.2), serebrovasküler olay (%9.2 ve %3.8) ve kronik obstrüktif akciğer hastalığı (%11.4 ve %5.5) öyküsü kırsal hastalarda belirgin daha yüksek idi (tümü için; p<0.05). Tüm hastaların %34.2'si obez olup obezite oranı kırsal hastalarda kentsel hastalara göre belirgin daha yüksek saptandı (%46.4 ve %31.2; p<0.001). Düzenli egzersiz yapma oranı kırsal hastalarda belirgin daha düşük idi (%34.4 ve %23.9; p<0.001). Hastaların %88.9'u anti-platelet, %62.1'i statin, %73.1'i beta-bloker ve %34.2'si ACEI/ARB tedavisi almaktaydı. İlaçların kullanım oranlarının kırsal hastalarda kentsel hastalara göre belirgin daha düşük olduğu saptandı (tümü için: p<0.05).

Sonuç: Çalışmamızda KKH olan hastalarda ikincil korunmanın istenilen seviyeden uzak olduğu ve kentsel hastalara göre kırsal hastalarda bu oranın belirgin olarak daha düşük olduğu saptanmıştır.

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Coronary heart disease (CHD) is the leading cause of mortality and morbidity in Turkey as well as in the whole world.[1,2] As patients with a history of CHD have the greatest cardiovascular risk, secondary prevention strategies, such as lifestyle changes, risk factor management, and cardiovascular medication, are very important in the follow-up of these patients.[3,4] Unfortunately, population-based studies that have investigated the success of the recommended therapies have established that the implementation of secondary prevention efforts is far from optimal.[5–10] For example, the results of European Action on Secondary and Primary Prevention through Intervention to Reduce Events (EUROASPIRE) studies conducted in Europe, including Turkey, have demonstrated that control of modifiable risk factors in secondary prevention is generally insufficient.[7–9] In addition, EUROASPIRE studies have illuminated significant differences between European countries in terms of secondary prevention. Data from the EUROASPIRE III and IV studies have indicated that secondary prevention is worse in Turkey than in other European countries.[8,9] In addition, other studies have revealed differences in the management and awareness of cardiovascular risk factors among different socioeconomic groups.[11–16] Rural residents are more likely to be obese, have less education, and a lower income than urban residents.[11,12,14,17] The data of several studies evaluating secondary prevention in CHD patients have largely been obtained from centers included in multicenter studies, and generally trials.[7,9,18] These results may not reflect the entire population, especially those living in rural areas.

The aim of this study was to evaluate differences in lifestyle, risk factor management, and cardioprotective medication used as secondary prevention measures in urban and rural patients with CHD in Turkey.

METHODS

Between January 2016 and January 2017, all consecutive patients with CHD who presented for outpatient follow-up visits at the cardiology clinics of 2 hospitals (Gaziantep Dr. Ersin Arslan Training and Research Hospital and Nizip State Hospital, Gaziantep) were included in the present cross-sectional study. The inclusion criteria limited participation to patients who were 18 years of age or older, those eligible to provide a complete medical history, and those who provided written consent to participate in the study. Patients who used anticoagulant agents for any reason were excluded.

Abbreviations:

ACEI	*Angiotensin-converting enzyme inhibitor*
ARB	*Angiotensin receptor blocker*
BMI	*Body mass index*
BP	*Blood pressure*
CABG	*Coronary bypass graft*
CHD	*Coronary heart disease*
DM	*Diabetes mellitus*
EUROASPIRE	*European Action on Secondary and Primary Prevention through Intervention to Reduce Events*
HDL-C	*High-density lipoprotein cholesterol*
HT	*Hypertension*
IQR	*Interquartile range*
LDL-C	*Low-density lipoprotein cholesterol*
PTCA	*Percutaneous transluminal coronary angioplasty*

The study protocol was approved by the ethics committee of Gaziantep University (number: 2016/104). The medical history, demographic characteristics, and physical examination details of the patients were recorded. All recorded medications were also controlled from the general data of Social Insurance System if the patients were regularly receiving them. CHD was defined as a history of a previous percutaneous transluminal coronary angioplasty (PTCA) and/or stenting or coronary bypass graft (CABG) procedure, or having stable coronary artery disease. The first coronary intervention (PTCA/stenting or CABG) or diagnosis of stable coronary artery disease was defined as the index event.

Smoking was classified according to the statements of the patients. Those who never smoked were defined as "never smoked," those who had smoked but stopped after the index coronary event were defined as "quit smoking," and those who were still smoking were defined as "current smoker." Hypertension (HT) was diagnosed as a systolic blood pressure (BP) of ≥140 mm Hg or a diastolic BP of ≥90 mm Hg, or when the patient was receiving any antihypertensive treatment. Diabetes mellitus (DM) was diagnosed when the patient's fasting plasma glucose was ≥126 mg/dL and/or when the patient was receiving antidiabetic treatment. Hyperlipidemia was defined as a total cholesterol level of >200 mg/dL or the use of lipid-lowering medications. Weekly physical activities performed by patients outside of work were recorded. Regular physical activity was defined as heavy exercise 2 or more times a week for at least 20 minutes or mild-to-moderate exercise for 150 minutes or more per week. The patient's weight and height were recorded and the body mass index (BMI) value was calculated (weight

in kg/height in m^2). Overweight was defined as a BMI of 25 to 29.9 kg/m^2 and obese was defined as a BMI of ≥30 kg/m^2. Waist circumference was measured using a metal tape applied horizontally at the point midway in the mid-axillary line between the lowest rim of the rib cage and the tip of the hip bone (superior iliac crest) while the patient was standing. Central obesity was defined as a waist circumference of >88 cm for women and >102 cm for men. Routine laboratory values and lipid parameters, including total cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and triglycerides measured within the last 3 months were recorded from the hospital's digital system records. The European Society of Cardiology (ESC) dyslipidemia guidelines recommend a lipid-lowering treatment target for secondary prevention of LDL-C ≤70 mg/dL or a reduction of >50% compared with the baseline LDL-C level.[19] Since the baseline LDL-C level prior to treatment was not available for all of the study patients, only the target LDL-C level of ≤70 mg/dL was used to determine the success of the lipid-lowering treatment. The definition of rural and urban populations varies between countries. In some countries, such as Austria and France, such areas are defined by geography, while in others, such as Canada, Greece, New Zealand, and Turkey, urban and rural areas are defined by population density.[20] According to the Turkish Statistical Institute, settlements with a population of >20,000 are considered urban and other areas are considered rural.[21] In our study, patients who stated that they had spent at least half of their life in an area with a population density of <20,000 were defined as rural residents. All other participants were defined as urban residents.

Statistical analysis

Continuous variables were presented as mean±SD or median (interquartile range [IQR]), and categorical variables were expressed as number and percentage. Continuous variables were compared across groups using Student's t-test or the Mann-Whitney U test. Normality of the data distribution was verified using the Kolmogorov-Smirnov test. Homogeneity of variance was assessed with Levene's test. Categorical variables were compared using a chi-square or Fisher's exact test. A P value of <0.05 was considered statistically significant. All of the data were analyzed using IBM SPSS Statistics for Windows, Version 20.0 software (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 2208 (456 rural and 1752 urban, 36% female) patients were recruited to join the study. A mean of 4.1±2.1 years had passed since the index coronary event. Table 1 illustrates the clinical characteristics of the study population. The median age of the study population was 64 years (IQR: 12 years). There were no significant differences between the urban and rural patients in terms of age, gender, or presence of heart failure, hyperlipidemia, or chronic kidney disease. However, a history of HT, DM, cerebrovascular events, chronic obstructive pulmonary disease, and the number of patients <50 years of age at the time of the index event were significantly greater in rural patients than in urban patients (p<0.05 for each). Of the patients, 22.2% (n=489) were current smokers. The smoking cessation rate after the index event was significantly lower among rural patients (11.2% vs. 20.5%; p<0.001). In this study group, 34.2% (n=698) were obese, and the number of obese patients was significantly greater among rural patients than urban patients (46.4% vs. 31.2%; p<0.001). The number of patients who participated in regular physical activity was significantly greater among urban patients compared with rural residents (34.4% vs. 23.9%; p<0.001). Overall, 37% (n=818) of the participants had a high BP reading (≥140/90 mm Hg), with no significant difference between urban and rural patients (Table 2). Among the group, 78.4% (n=1731) of the patients had their fasting blood glucose recorded in routine control visits and 46.6% (n=807) had a high fasting blood glucose level (≥126 mg/dL), with no significant difference between urban and rural patients.

The median LDL-C was significantly higher in rural patients than in urban patients (107 [IQR 45] mg/dL vs. 99 [IQR 48] mg/dL, respectively; p=0.001). Only 13.1% of the patients had an LDL-C ≤70 mg/dL, and this value was similar in both rural and urban patients (Table 2). Table 3 presents a summary of the medications used by the study population. Of the patients, 88.9% used antiplatelet agents, 62.1% used statins, 73.1% used beta-blockers, and 34.2% used an angiotensin-converting-enzyme inhibitor (ACEI)/angiotensin receptor blocker (ARB). The use of triple medication: antiplatelet agents, statins, and ACEI/ARBs, was significantly higher in urban patients compared with rural patients (p<0.05 for all). Similarly, the combined use of antiplatelets, statins, beta-block-

Table 1. Comparison of baseline characteristics

Parameters	All patients (n=2208)		Rural (n=456)		Urban (n=1752)		*p*
	n	%	n	%	n	%	
Age, years, median (IQR)	64	12	65	11	64	13	0.441
Female	795	36	162	35.5	633	36.1	0.811
Age at first diagnosis of CHD							
<50 years	466	21.1	119	26.1	347	19.8	0.020
50–59 years	730	33.1	141	30.9	589	33.6	
60–69 years	807	36.5	162	35.5	645	36.8	
≥70 years	205	9.3	34	7.5	171	9.8	
Coronary artery bypass graft	702	32.3	138	31.1	564	32.6	0.546
PTCA/stent/stenosis <50%	1473	67.7	306	68.9	1167	67.4	
Heart failure	531	24.0	114	25.0	417	23.8	0.594
Smoking							
Current smoker	489	22.2	108	23.7	381	21.7	<0.001
Quit smoking	411	18.6	51	11.2	360	20.5	
Never smoked	1308	59.2	297	65.1	1011	57.7	
Hypertension	1287	58.3	293	64.3	994	56.7	0.004
Hyperlipidemia	1044	47.3	213	46.7	831	47.4	0.784
Diabetes mellitus	894	40.5	208	45.6	686	39.2	0.012
Cerebrovascular disease	108	4.9	42	9.2	66	3.8	<0.001
Chronic kidney disease	144	6.5	24	5.3	120	6.8	0.222
Chronic obstructive pulmonary disease	149	6.7	52	11.4	97	5.5	<0.001
Education level							
Illiterate	1005	45.5	213	46.7	792	45.2	<0.001
Primary school	915	41.4	216	47.4	699	39.9	
High school	204	9.2	21	4.6	183	10.4	
University	84	3.8	6	1.3	78	4.5	

CHD: Coronary heart disease; IQR: Interquartile range; PTCA: Percutaneous transluminal coronary angioplasty.

ers, and ACEI/ARBs was significantly higher among urban patients than rural patients.

DISCUSSION

The present study yielded 2 primary findings. First, a large proportion of patients with CHD do not comply with the lifestyle modifications, management of risk factors, and cardioprotective medication recommended in secondary prevention guidelines. Second, the risk factors for CHD are more intense in rural patients than in urban patients, yet the management of these risk factors and the use of cardioprotective medication is significantly lower in rural areas. These results suggest that differences between rural and urban patients should be taken into account in studies related to CHD patients.

Many studies have illustrated that lifestyle changes, such as smoking cessation, healthy diet, and regular physical activity, reduce the risk of new events in patients with CHD.[22–24] However, a large majority of patients with CHD fail to achieve the recommended lifestyle changes, risk factor management, and therapeutic targets set by the guidelines.[7,15,16,18,25–28] In addition, there is a large variation between countries and populations with regard to therapeutic lifestyle changes and implementation of secondary prevention.

Table 2. Comparison of anthropometric and laboratory parameters

Parameters	All patients (n=2208)	Rural (n=456)	Urban (n=1752)	p
Waist circumference (cm), mean±SD (n=1579)	101±10.7	102.4±10.3	100.4±10.8	0.002
Waist circumference (Men ≥102 cm, Women ≥88 cm), n (%)	968 (61.3)	226 (68.5)	742 (59.4)	0.002
BMI (kg/m2), mean±SD (n=2040)	29.2±10.7	31.1±3.9	27.9±13.7	<0.001
Overweight, (BMI ≥25 kg/m^2) n, (%)	1663 (81.5)	383 (94.6)	1280 (78.3)	<0.001
Obese, (BMI ≥30 kg/m^2), n (%)	698 (34.2)	188 (46.4)	510 (31.2)	<0.001
Systolic blood pressure (mm Hg) median (IQR)	130 (20)	130 (20)	130 (19)	0.131
Diastolic blood pressure (mm Hg) median (IQR)	74 (10)	70 (10)	75 (10)	0.523
Systolic blood pressure/diastolic blood pressure ≥140/90 (mm Hg), n (%)	818 (37.0)	168 (36.8)	650 (37.1)	0.241
Total cholesterol (mg/dL) median (IQR) (n=2133)	190 (63)	192 (65)	187 (65)	0.007
LDL-C (mg/dL) median (IQR) (n=2133)	104 (46)	107 (45)	99 (48)	0.001
LDL-C ≥70 mg/dL, n (%)	1854 (86.9)	381 (85.2)	1473 (87.4)	0.235
HDL-C (mg/dL) median (IQR) (n=1842)	40 (13)	39 (13)	40 (13)	0.163
Triglyceride (mg/dL) median (IQR) (n=1886)	177 (128)	180 (136)	176 (128)	0.318
Fasting blood glucose (mg/dL), median (IQR) (n=1731)	121 (76)	118 (81)	122 (72)	0.849
Fasting blood glucose ≥126 mg/dL, n (%)	807 (46.6)	162 (46.2)	645 (46.7)	0.844

BMI: Body mass index; HDL-C: High density lipoprotein cholesterol; IQR: Interquartile Range; LDL-C: Low density lipoprotein cholesterol.

Table 3. Pharmacological treatment

Drug treatment	All patients (n=2208)		Rural (n=456)		Urban (n=1752)		*p*
	n	%	n	%	n	%	
Antiplatelet	1962	88.9	393	86.2	1569	89.6	0.042
Statin	1371	62.1	217	47.6	1154	65.9	<0.001
Beta blocker	1613	73.1	334	73.2	1279	73.0	0.917
ACEI/Angiotensin receptor blocker	756	34.2	123	27.0	633	36.1	<0.001
Calcium channel blocker	226	10.2	39	8.6	187	10.7	0.088
Diuretic	201	9.1	24	5.3	177	10.1	0.001
Proton pump inhibitor	477	21.6	66	14.5	411	23.5	<0.001
Antiplatelet-statin	1217	55.1	177	38.8	1040	59.4	<0.001
Antiplatelet-statin-beta-blocker combination	1170	53.0	177	38.8	993	56.7	<0.001
Antiplatelet-statin-beta-blocker-ACEI ARB combination	400	18.1	48	10.5	352	20.1	<0.001

ACEI: Angiotensin converting enzyme.

[7–9,12,15,16,18] In particular, high-income countries have been shown to have a significantly higher rate of compliance with secondary prevention than low-income countries.[15,16] Regardless of the country's economic development, it has been shown that rural patients take significantly less cardioprotective medication and have poorer management of risk factors than urban patients.[15,16] This may be due to differences

between rural and urban areas in the demographic, social, and physical environment, as well as accessibility to healthcare.[29–32]

Similar to our findings, previous studies of the Turkish population have also found that the number of patients who were young at the time of the index event was significantly greater than that of European countries.[7,9,18] This may be a result of the significantly greater prevalence of cardiovascular risk factors leading to earlier CHD. After an acute coronary syndrome event, quitting smoking represents a relative reduction in coronary mortality.[22] However, both our study and previous studies of Turkish patients have shown that the number of patients who continue to smoke remains high. This result may be explained by many factors, including low education level, low level of health-related knowledge, social factors, and the health system.[8,9] Given the effect of smoking on CHD, it is important to refer patients who continue to smoke after the index event to centers where they can receive professional support.

Regular physical activity is known to have a protective effect against hypertension, obesity, dyslipidemia, diabetes, and CHD.[23,33] In the EUROASPIRE III and EUROASPIRE IV studies, 48.6% and 49.6%, respectively, of the Turkish patients stated that they had increased their level of physical activity after the index event.[8,9] Similarly, in the Survey of Risk Factor Management (SURF) study, approximately 47% of the patients performed physical activity for 30 minutes or longer 3 to 5 times a week.[34] However, the ratio of patients with increased physical activity was significantly lower in our study than that reported in previous studies. Additionally, this ratio was much lower among the rural patients in our study. Changeable habits, such as regular physical activity, healthy eating, smoking cessation, and weight control, require long-term effort even after a coronary event. Therefore, long-term follow-up should be considered to help change the attitude of these patients when necessary and encourage healthy habits.

DM is among the most important cardiovascular risk factors. In the EUROASPIRE III study, the rate of diabetes in Turkish patients was similar to that of European patients (33.6% and 34.8%, respectively). In our study, the percentage of diabetic patients was higher (40.5%) than that reported in these earlier studies. Our results indicated that 2 avoidable risk factors for CHD, BP and fasting blood glucose level, were not well controlled in either the urban or rural environment.

The ESC secondary prevention recommended target value of LDL-C ≤70 mg/dL has been demonstrated to be associated with reduced risk of recurrent cardiovascular events.[27] The EUROASPIRE IV and SURF studies reported that only 10.2% and 12.2%, respectively, of Turkish patients, achieve this value.[9,34] The EUROASPIRE III, IV, and SURF studies found that, respectively, 65.0%, 81.0%, and 57.3% of patients received statin treatment in the course of follow-up. In our study, two-thirds of all patients and half of all rural patients were on statin treatment. Nonetheless, although almost half of the patients received statin therapy, only one-tenth of the population reached the target LDL level, which may suggest ineffective dose levels.

In our study, 88.9% of the patients used antiplatelet agents, 73.1% used beta-blockers and 34.2% used ACEI/ARBs. These rates were 91.4%, 73.8%, and 69.0% in the EUROASPIRE III study, and 98.7%, 86.6%, and 78.3% in the EUROASPIRE IV study. Similar to our findings, 88.1% of patients in the SURF study used antiplatelet agents, 71.4% used beta-blockers, and 41.9% used ACEI/ARBs.

In both our study and the SURF study, the rate of the use of cardioprotective drugs was lower than that reported in the EUROASPIRE studies. This may be due to differences between study populations. The EUROASPIRE studies were mostly based on patients at tertiary healthcare centers and those who lived in urban settings. The SURF study and our current research examined patients in both secondary and tertiary healthcare centers and living in both urban and rural areas.

To the best of our knowledge, this is the first study in Turkey to evaluate compliance with secondary prevention in patients living in urban and rural areas. In the present study, we demonstrated that the use of cardioprotective medication and the management of risk factors was significantly lower among rural patients. Moreover, the risk factors for CHD were more intense in rural patients than in urban patients. These findings may be the result of several factors, including restricted availability of cardioprotective drugs, lower education level, costs associated with healthcare, lack

of transportation, long distances to clinics in some rural areas, restricted access to healthcare providers, and the absence of systematic programs for long-term preventive care. In addition, a lack of awareness among patients and their doctors of the need for life-long therapy with cardioprotective drugs might be another reason for this difference. Oftentimes, doctors working in rural areas do not remain in the locality for a long period of time, which may lead to disruption in the follow-up of patients. Furthermore, almost half of the urban and rural populations studied were illiterate. Patients with a lower level of education may be more likely to have less awareness of secondary prevention as a result of difficulty understanding educational materials or communicating with healthcare providers.

We believe that specialized clinics, educated nurses or family physicians, cardiac rehabilitation programs, and other appropriate means should be considered to assist with secondary prevention of CHD in our country. Extended hospitalization for cardiac rehabilitation at the time of the index event might also be considered in order to increase patient adherence to guidelines, especially for rural patients.

Limitations

The most important limitation of our study is that the patients in this study were recruited from a single region of Turkey, and therefore the study sample does not reflect all regions of the nation. In addition, the study was conducted in a region with a socioeconomic level below the national average, which may have affected the results. Another important limitation of this research is that patients may have provided incomplete information during the course of the outpatient service. Finally, any potential reduction in LDL-C could not be assessed because the available laboratory values were incomplete; instead, the target value of ≤70 mg/dL was the measure.

Conclusion

The results of this study have demonstrated that the implementation of lifestyle modifications, risk factor management, and the use of cardioprotective medication as recommended by professional guidelines are still not at the desired level among CHD patients. Furthermore, there is a significant difference in the risk factors for cardiovascular disease among rural and urban patients.

Ethics Committee Approval: The study was approved by the Ethics Committee of Gaziantep University (number: 2016/104).

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