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ORIGINAL ARTICLE

Roma coronary heart disease patients have more medical risk factors and greater severity of coronary heart disease than non-Roma

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Abstract
Objectives Coronary heart disease (CHD) is the most common cause of mortality and morbidity world-wide. Evidence on ethnic differences between the Roma and non-Roma regarding medical risk factors is scarce. The aim of this study was to assess differences in medical risk factors and the severity of CHD in Roma compared with non-Roma CHD patients, adjusted for gender, age and education.
Methods Six hundred seventy four patients were included in this cross-sectional study (132 Roma, 542 non-Roma). Data on medical risk factors, symptoms, medication and severity of CHD were obtained from medical records. After matching Roma and non-Roma according to education, linear and logistic regression analyses with adjustments for gender and age were used.
Results Compared with non-Roma, Roma patients had significantly more risk factors and more severe types of CHD. They were treated less frequently with statins and beta-blockers, were more frequently left on pharmacotherapy and surgically revascularised. These differences remained after controlling for education, gender and age.
Conclusions Roma CHD patients have a worse risk profile at entry of care and seem to be undertreated compared with non-Roma CHD patients.

Keywords Roma · Coronary heart disease · Medical risk factors · Coronary angiography

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Introduction

Coronary heart disease (CHD) ranks among cardiovascular diseases as the most common cause of mortality and morbidity. The publication "European Cardiovascular Disease Statistics 2008" (Allender et al. 2012) showed that CHD remains the most common cause of death in the European Union. The Framingham Heart Study was one of the first studies to show that medical risk factors—e.g. age, total and high-density lipoprotein cholesterol, systolic blood pressure, treatment for hypertension, smoking and diabetes status—influenced the prevalence and incidence of CHD in the general population (D'Agostino et al. 2008). Today many health organisations, institutions and governments are trying to target the population as a whole and people at high risk in particular, to reduce the burden of increasing numbers of cardiovascular deaths and morbidity (Graham and Atar 2007).

Ethnic minorities seem to generally have unfavourable medical risk factors more frequently than majority populations (Baker et al. 2002; Cappuccio et al. 1997), but studies on ethnic differences regarding this trend are relatively scarce. Cappuccio et al. (1997, 2002) found higher prevalence rates of cardiovascular risk factors in certain ethnic groups in Britain compared with the majority population. The association between socio-economic status (SES) and cardiovascular disease risk factors has also been described in the past (Bahonar et al. 2011; Cirera et al. 2013; Hajsheikholeslami et al. 2011).

One of the largest minority groups in Central and Eastern Europe is the Roma population. The highest concentration of Roma in Europe can be found in the Balkan and the Carpathian regions. In the Slovak Republic Roma are considered to be the second largest minority group (Ginter et al. 2001). According to professional demographic estimates, approximately 380,000 Roma live in Slovakia, which represents 7.2 % of the total population of the country (Vano 2001). Previous studies have found higher mortality and lower life expectancy for Roma than for non-Roma (Koupilova et al. 2001; Nozdrovicky 1991). Ginter et al. (2001) reported that premature/untimely cardiovascular mortality occurred more than 2.5 times more frequently among male Roma than among the average male in the Slovak population. High prevalence rates of diabetes, chronic infections and obesity, and very high atherogenic indices (total/HDL cholesterol) were found in this ethnic minority group (Ginter et al. 2001). Kolvek et al. (2012) showed a higher risk of end stage renal disease to be associated with Roma ethnicity, which might be partially explained by a higher occurence of diabetic nephropathy. Rosicova et al. (2011) found Roma ethnicity as a predictor of regional infant mortality rate in Slovakia. This is likely to contribute to the poorer CHD outcomes among Roma (Ginter 1998; McKee 1997; Hajioff and McKee 2000), but evidence on this is lacking.

Therefore, the aim of this study was to assess differences in medical risk factors for CHD and the severity of CHD in Roma compared with non-Roma CHD patients, adjusted for gender, age and education level.

Methods

Patients

Consecutive adult Roma and non-Roma patients undergoing routine coronary angiography (CAG) in the East Slovakian Institute for Cardiac and Vascular Diseases, Kosice, Slovakia, in the years 2001–2010 were asked to participate in the study. Ethnicity was measured based on each patient's declaration and identification by the doctor. In the case of a mismatch the opinion of a third person (a head-nurse) was decisive. The study was approved by the local ethics committee, including written informed consent.

Procedures and measures

Socio-demographic data, disease history, health-related behaviour, clinical and laboratory examination results, use of drugs, coronary findings and type of treatment were collected following the protocol and registered in the medical records of each patient. Socio-demographic data concerned age and gender. Disease history included family and personal history of CHD, previous myocardial infarction, diabetes mellitus, arterial hypertension and dyslipidaemia. We also asked about smoking status (smoker or non-smoker) and alcohol use (alcohol consumption yes or no).

Body mass index (BMI), functional status according to the New York Heart Association (NYHA—ranging from class I denoting mild dyspnoe to class IV denoting severe dyspnoe) and the Canadian Cardiovascular Society (CCS—ranging from class I, denoting mild angina, to class IV, denoting severe angina) classes, systolic and diastolic blood pressure levels, heart frequency and ejection fraction from standard transthoracic echocardiography were measured during the clinical examination. Levels of total, LDL and HDL cholesterol, triglycerides and serum creatinine were registered according to laboratory findings.

Regarding the use of drugs, we collected data about the use of beta-blockers, nitrates, statins and other common cardiovascular drugs (like aspirin, clopidogrel, angiotensin-converting enzyme inhibitors, angiotensin-1 blockers or calcium channel antagonists).

Moreover, we obtained data on coronary findings from CAG and on treatment modality [conservative pharmacological treatment, percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG)]. The type of therapeutic intervention following the CAG was determined by cardiologists based on the results of CAG and clinical status, independently of participation in this study.

The severity of the CHD was evaluated using the CCS and NYHA classifications and by the number of diseased coronary vessels found in the CAG.

Statistical analyses

As the first step, we assessed background and clinical characteristics of the Roma and non-Roma patients. Differences were statistically tested using the t test for continuous variables and the χ^2-test or Fisher exact test when appropriate for categorical variables. Values of $p < 0.05$ were considered statistically significant. In the next step, we matched all Roma patients with all non-Roma

patients according to their education to eliminate the influence of the generally low socio-economic status (SES) of Roma patients. Then logistic and linear regression analyses, with adjustment for gender and age, were performed to assess the effect of ethnicity on the above mentioned health-related behaviour, clinical and laboratory findings, use of drugs, disease severity and type of treatment. We used two models to explain ethnic differences in CHD patients. After matching for education to control for socio-economic status, we tested in Model 1 the crude effect of ethnicity on the outcome variables, and in Model 2 we tested the effect of ethnicity adjusted for gender and age. All statistical analyses were performed using SPSS 16.0.1.

Results

Baseline characteristics of the study population are presented in Table 1 ($N = 674$). There were 132 Roma and 542 non-Roma patients. Roma patients were significantly younger, less frequently women and had more frequently a negative family and personal history of CHD, and a positive history of myocardial infarction than non-Roma patients. The occurrence of arterial hypertension was higher in the non-Roma group. Roma CHD patients smoked more frequently, but drank alcohol less frequently than the non-Roma patients. Lower values of systolic blood pressure, higher heart frequency, lower levels of HDL cholesterol, higher levels of triglycerides and serum creatinine were measured in the group of Roma patients when compared with the non-Roma group. In terms of the use of drugs, Roma patients used fewer statins and more nitrates (Table 1).

Roma patients showed more severe forms of angina pectoris in the CCS classes: there were significantly more of them in the CCS IV class, and they had fewer normal CAGs when compared with non-Roma. Furthermore, significantly more Roma patients received only pharmacotherapy and underwent surgical revascularization of the myocardium, and they underwent PCI with or without stenting less frequently when compared with non-Roma patients (Table 1).

After matching by education level ($N = 462$), we tested in Model 1 the crude effect of ethnicity on the above-mentioned outcome variables (Table 2). Significantly more Roma patients had a negative family and personal history of CHD and a history of previous myocardial infarction. With regard to health-related behaviour, Roma patients were more frequently smokers. The functional status of Roma patients showed symptoms of CCS class IV more frequently. They had higher levels of triglycerides and serum creatinine. In the drug treatment, Roma patients used fewer statins and beta-blockers, but more nitrates when compared with the non-Roma group of patients. Roma patients also had a higher risk of being left on pharmacotherapy and not undergoing PCI with or without stenting and of being surgically revascularised (Table 2).

Model 2 shows that the introduction of age and gender into the model as the other most common confounders did not affect most ethnic differences in a clinically relevant way, except for the history of dyslipidaemia, alcohol consumption, systolic blood pressure and levels of HDL cholesterol, where the significant differences among Roma and non-Roma disappeared. The risk of having had a previous myocardial infarction and having a higher heart frequency measured during physical examination also remained higher in the Roma group of patients, but was more strongly associated with male gender. Three-vessel disease was associated with Roma ethnicity but not as strongly as with male gender and age. Normal CAG was associated not only with non-Roma ethnicity, but also with female gender and younger age. Roma patients had an even higher risk of being treated by CABG after controlling for gender and age.

Adjustment for the period of assessment (2001–2005 vs. 2006–2010) hardly changed the size and statistical significance of differences between Roma and non-Roma, except for the proportions of patients undergoing PCI/stenting and three-vessel disease, which were no longer statistically significant. Similarly, an additional adjustment for BMI neither affected the size nor the statistical significance of any ethnic difference; the biggest difference was 1.4 %.

Discussion

In this cross-sectional study of patients undergoing routine CAG, we explored the differences between the medical risk factors for CHD and the severity of CHD in the Roma compared with non-Roma patients matched for education and controlled for gender and age. Significant differences were found in the medical risk profile of CHD by Roma ethnicity. Most of these differences remained significant even after controlling for education, gender and age. Roma patients were younger, were more likely to have a negative family and personal history of CHD, a positive personal history of myocardial infarction and were more likely to smoke than non-Roma patients. They had lower values of systolic blood pressure, higher heart frequency, lower levels of HDL cholesterol and higher levels of triglycerides. There was also a significant difference in the use of drugs that disadvantaged Roma patients. As far as the severity of CHD was concerned, the study showed significant differences in the clinical symptoms (more Roma patients in CCS IV class), the number of normal CAG

Table 1 Baseline characteristics of the study population by ethnicity ($N = 674$). Kosice, Slovakia, 2010

	Roma ($N = 132$)	Non-Roma ($N = 542$)	Significance of difference (crude)	Significance of difference adjusted for age and gender
Socio-demographic data				
Age (years)	**51.9 ± 7.2**	**57.1 ± 7.4**	*	***
Age range (years)	**28–71**	**24–79**		
Age category distribution				
Up to 45	**14.4 %**	**6 %**		
46–60	**73.5 %**	**60 %**		
Above 60	**12.1 %**	**34 %**		
Gender (male/female)	**73.5/26.5 %**	**63.3/36.7 %**	*	NS
Education				
Low education	**96 %**	**57.2 %**	***	***
Middle education	**2 %**	**19.7 %**	***	**
High education	**2 %**	**23.1 %**	***	**
History of the disease				
Negative family history of CHD	**32.8 %**	**17.6 %**	*	***
Negative personal history of CHD	**44.3 %**	**0.8 %**	*	***
Previous myocardial infarction	**60.3 %**	**43.9 %**	*	**
Diabetes mellitus	28.2 %	30.5 %	NS	NS
Arterial hypertension	**61.8 %**	**79.9 %**	*	**
Dyslipidaemia	59.5 %	51.5 %	NS	NS
Health-related behaviour				
Alcohol consumption	**46.4 %**	**66.7 %**	***	***
Smoking	**35.4 %**	**9.8 %**	*	***
Clinical and laboratory findings				
Functional status CCS IV	**9.4 %**	**2.2 %**	*	**
Body mass index (kg/m^2)	28.9 ± 5	29.0 ± 4.4	NS	NS
Systolic blood pressure (mmHg)	**130 ± 22**	**135 ± 19**	*	NS
Heart frequency (bpm)	**73 ± 10.4**	**70 ± 10.5**	*	*
Total cholesterol (mmol/l)	5.29 ± 1.06	5.03 ± 1.2	NS	NS
HDL cholesterol (mmol/l)	**1.13 ± 0.3**	**1.32 ± 0.67**	*	NS
LDL cholesterol (mmol/l)	2.95 ± 0.83	3.02 ± 1.98	NS	NS
Triglycerides (mmol/l)	**2.48 ± 1.28**	**2 ± 1.62**	*	**
Serum creatinine (mmol/l)	**96.7 ± 26.2**	**90.2 ± 19.4**	*	*
Ejection fraction (%)	49.7 ± 10	51 ± 20	NS	NS
Use of drugs				
Statins	**45.3 %**	**69.1 %**	*	***
Nitrates	**83.8 %**	**65.6 %**	*	***
Beta-blockers	75.2 %	82.8 %	NS	NS
Coronary findings				
One-vessel disease	27.9 %	23.7 %	NS	NS
Two-vessel disease	27.9 %	26.3 %	NS	NS
Three-vessel disease	33.3 %	27.6 %	NS	*
Left main disease	3.0 %	5.4 %	NS	NS
Normal CAG	**9.2 %**	**25.3 %**	***	***
Type of treatment				
Pharmacotherapy	**33.8 %**	**22.4 %**	*	*
PCI/stent	**18.5 %**	**28.3 %**	*	*
CABG	**38.5 %**	**24 %**	*	***

NS not significant, *bpm* beats per minute, *CHD* coronary heart disease, *CCS* Canadian cardiovascular society, *CAG* coronary angiography, *PCI* percutaneous coronary intervention, *CABG* coronary artery bypass grafting

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(fewer Roma had a normal CAG) and the treatment modalities (Roma were more likely to be left on pharmacotherapy or to undergo surgical revascularization). These results support the assumption that Roma patients come for a CAG examination with worse health status than non-Roma.

The higher percentage of patients with a negative family and personal history among Roma might be

Table 2 Associations of ethnicity, adjusted for educational level, with history of the disease, health-related behaviour, clinical and laboratory findings, use of drugs, coronary findings and type of treatment adjusted for gender and age: odds ratios (OR) or beta coefficients (B) with 95 % confidence intervals (95 % CI), significance of the model change (smc) ($N = 462$) Kosice, Slovakia, 2010

	Model 1 Ethnicity adjusted for educational level (Roma vs. non-Roma) OR or B with (95 %CI)	smc	Model 2 Ethnicity adjusted for educational level, gender and age (Roma vs. non-Roma) OR or B with (95 %CI)	smc
History of the disease				
Negative family history of CHD (OR)	**1.85 (1.18, 2.94)****	**	**2.04 (1.25, 3.33)****	*
Negative personal history of CHD (OR)	**83.33 (25.64, 250.00)*****	***	**76.92 (22.73, 250.00)*****	***
Previous myocardial infarction (OR)	**1.64 (1.09, 2.44)***	*	**1.56 (1.01, 2.44)***	**
Arterial hypertension (OR)	**0.41 (0.26, 0.64)*****	***	**0.58 (0.36, 0.93)***	***
Dyslipidaemia (OR)	**1.52 (1.01, 2.33)***	*	1.52 (0.98, 2.33)	NS
Health-related behaviour				
Alcohol consumption (OR)	0.67 (0.24, 1.83)	NS	0.45 (0.16, 1.29)	***
Smoking (OR)	**4.76 (2.78, 7.69)*****	***	**3.34 (1.98, 5.78)*****	***
Clinical and laboratory findings				
Functional status CCS IV (OR)	**20.00 (2.38, 100.00)****	***	**34.96 (3.97, 308.13)****	***
Systolic blood pressure (B)	**5.38 (0.96, 9.80)***	*	2.38 (−2.20, 6.96)	***
Heart frequency (B)	**−3.13 (−5.35, −0.91)****	**	**−3.33 (−5.68, −0.99)****	NS
HDL cholesterol (B)	**0.23 (0.03, 0.43)***	*	0.17 (−0.04, 0.38)	*
Triglycerides (B)	**−0.48 (−0.81, −0.15)****	**	**−0.42 (−0.76, −0.07)***	NS
Serum creatinine (B)	**−7.83 (−12.53, −3.13)****	**	**−8.43 (−13.21, −3.64)****	***
Use of drugs:				
Statins (OR)	**0.36 (0.23, 0.56)*****	***	**0.38 (0.24, 0.60)*****	***
Nitrates (OR)	**2.44 (1.43, 4.35)****	**	**2.86 (1.61, 5.00)*****	**
Beta-blockers (OR)	**0.58 (0.34, 0.98)***	*	**0.55 (0.31, 0.96)***	NS
Coronary findings:				
Three-vessel disease (OR)	0.65 (0.40, 1.05)	NS	**0.54 (0.32, 0.91)***	**
Normal CAG (OR)	**0.28 (0.15, 0.54)*****	***	**0.23 (0.11, 0.46)*****	***
Type of treatment:				
Pharmacotherapy (OR)	**1.67 (1.08, 2.63)***	*	**1.61 (1.01, 2.56)***	NS
PCI/stent (OR)	**0.59 (0.35, 0.97)***	*	**0.57 (0.33, 0.95)***	NS
CABG (OR)	**2.17 (1.39, 3.33)****	**	**2.50 (1.54, 4.00)*****	***

CI confidence interval, *smc* significance of the model change, *HDL* high-density lipoprotein, *LDL* low-density lipoprotein, *CHD* coronary heart disease, *CAG* coronary angiography, *PCI* percutaneous coronary intervention, *CABG* coronary artery bypass grafting

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, *NS* not statistically significant

explained by the lower level of education in this group of patients and thus worse knowledge regarding their own health status and that of their relatives (Filadelfiova et al. 2007). It seems that in the Roma group lower levels of HDL cholesterol and higher levels of triglycerides also contribute to the worse medical risk profile of CHD patients. This is probably caused by a higher consumption of animal fat with saturated fatty acids and a lack of vegetables and fruits in the diets of Roma patients (Brazdova et al. 1998).

Regarding alcohol consumption, no significant difference was found after controlling for the above-mentioned confounders. The symptoms of CHD measured in the CCS classes are worse in the Roma patients: this is closely associated with their more severe forms of CHD. Roma also have three-vessel disease more frequently and in contrast normal CAGs much less frequently. The relative underuse of PCI with or without stenting might be explained again by worse coronary findings and thus more need for surgical revascularization. Despite the fact that Roma patients are more likely to be left on pharmacotherapy, they are often not treated adequately. We found a significant undertreatment with statins and beta-blockers. The higher use of nitrates as purely symptomatic drugs might be explained by the more severe symptoms in the Roma group of patients.

Previous findings

Results similar to those of our study appear in a study by Nozdrovicky (1991), who reported that cardiovascular diseases were the most common cause of death among Roma, and that the prevalence of smoking was also higher in this group of the population. In contrast, Filadelfiova et al. (2007) found substantially lower rates of long-term illness in the Roma population, which might be explained by a different understanding of disease among the Roma and the majority population. They also identified cardiovascular diseases as the most common types of long-term illnesses among Roma. Another study, from the western part of Slovakia (Vozarova De Courten et al. 2003), determined higher prevalences of type 2 diabetes mellitus, metabolic syndrome, cardiovascular disease, hypercholesterolemia and hypertriglyceridemia in Roma. We did not find a significant difference in the prevalence of diabetes mellitus, and found that hypertension, as one of the most important risk factors for the CHD, occurred even significantly less frequent in Roma CHD patients. The Whitehall II prospective cohort study (Britton et al. 2004) showed that South Asians tend to be more likely to undergo cardiac procedures and to be on secondary prevention drugs than white participants. In our study population, Roma patients underwent CABG more frequently, but their medical therapy was not optimal.

Previous studies have suggested that the worse health status of Roma population might be associated with their lower SES. In our study, we tried to eliminate this factor by adjusting for education. We found that significant differences that disadvantaged the Roma ethnicity still remained. This might be partially explained by genetic factors, but other factors such as worse access to the health care services, culture, housing conditions, language problems or discrimination could play a certain role as well (Reijneveld 2010; Foets 2011; Foldes and Covaci 2012).

Strengths and weaknesses of the study

We collected data from a rather large number of Roma patients with CHD in one major cardiac centre in Slovakia, which is unique in this field of interest. The weakness of our study includes its observational cross-sectional design.

Implications

Strategies adopted by European countries including Slovakia to control CHD are directed mostly at majority populations. Our study shows that Roma CHD patients have a significantly greater risk of CHD due to their worse medical risk profile, show significant undertreatment with statins and beta-blockers despite having more severe forms of CHD and are more frequently left on pharmacotherapy and surgically revascularised when compared with non-Roma CHD patients even after controlling for education, gender and age. Differences in clinical symptoms and medical treatment suggest that Roma patients should require special attention from all health care professionals. These findings call for better prevention strategies, including the use of mass media information (Bonaccio et al. 2012) and improvement of the medical treatment in high risk Roma CHD patients.

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