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Original Articles

ASSESSMENT OF CARDIOVASCULAR RISK IN HOSPITALIZED PATIENTS WITH HYPERTENSION AGED 40 AND OVER

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Summary

The aim of the cross-sectional study was to estimate the absolute 10-year risk for fatal cardiovascular disease (CVD) in patients with hypertension by Systematic Coronary Risk Estimation (SCORE). The study was carried out in 2016 as part of Project No 4/2016. Ninety-one patients aged 40-89 years were included. The mean age of the sample was 66.0±11.0, and 44.0% were males. Information of the patients' risk profile included about age, gender, blood pressure, smoking and total cholesterol. The patients with hypertension were stratified according to a 10-year absolute risk of CVD. Data were processed by Statistical Package for Social Science versions 19.0 (SPSS.v.19.0). Over two-thirds of the patients had 1 stage hypertension (31.9%) and 2 stage hypertension (37.4%). Median systolic blood pressure on admission to the clinics was 160 mg Hg, and median diastolic blood pressure was 90 mm Hg. Total serum cholesterol values exceeded 4.9 mmol/L in 64.0% of the patients. Smokers accounted for about one-fourth of the patients, most of them having smoked for 40 years. The mean number of risk factors for CVD was 3.0. Over 65% of the patients were found to be at a very high 10-year absolute risk of fatal CVD by SCORE. Cardiovascular risk assessment has important role in prevention of morbidity, premature death and disability of CVD.

Key words: patient risk profile, hypertension, cardiovascular risk assessment, SCORE risk chart

Introduction

Assessment of cardiovascular risk (CVR) is the first step in the treatment of patients with hypertension. There are different methods of modeling CVR in different populations. The main principle in all systems for assessment of CVR is to calculate the combined effect of high blood pressure and many risk factors on health outcomes (fatal and nonfatal cardiovascular diseases, CVDs) [1].

In general, patients with a history of acute myocardial infarction (AMI), stroke, acute coronary syndrome (ACS), diabetes with microalbuminuria or patients with mild and severe form of chronic kidney disease (GFR<60 ml/min) are classified as patients at very high risk of fatal CVDs.

Systematic Coronary Risk Estimation (SCORE)

is one of the most often used CVR assessment systems. SCORE has been recommended by European Guidelines since 2003 because of some of its undoubted strengths [1-3].

The aim of the study was to estimate the risk of fatal cardiovascular disease (CVD) in patients with hypertension by SCORE.

Patients and Methods

Design

A cross-sectional study was carried-out in 2016, which was a part of Project NO 4/2016 "Economic Assessment of antihypertensive therapy with Lisinopril and Perindopril by cost-effectiveness analysis and cost-utility analysis". The project was approved by the University Ethic Committee and was funded by Medical University - Pleven.

Inclusion and Exclusion Criteria

Ninety-one patients aged 40-89 years were included in the study (Table 1). The patients were treated at the *Cardiology Clinic (I) of University Hospital – Pleven.* They gave an informed consent to take a part in the study.

Only patients over 18 years of age and over, and diagnosed with hypertension were included in the study. Selection criteria were also applied regarding angiotensin-converting enzyme (ACE) inhibitors.

Patients without hypertension, under 18, those with quantitative changes of consciousness, with delirium or acute psychomotor agitation, as well as those who did not consent to participate were not included. Patients in whom ACE inhibitors were contraindicated, e.g. patients with ACS, angina pectoris, hyperkalemia, hypersensitivity to ACE inhibitors, etc., were also excluded.

Table 1. Basic characteristics of the patients (Number, Mean, %)

Variable	Number (%)	Variable	Number (%)
Age	66.0±11.0	**Gender**	
40-49 Yrs	**9** (10.2)	Males	**40** (44.0)
50-59 Yrs	**16** (18.2)	Females	**51** (56.0)
60-69 Yrs	**28** (31.8)		
70-79 Yrs	**24** (27.3)		
80-89 Yrs	**11** (12.5)		
Education		**Social status**	
Lower than primary education	**6** (7.1)	Employed	**16** (18.5)
Primary education	**4** (4.6)	Unemployed	**6** (7.0)
Elementary education	**23** (27.1)	Retired	**44** (51.2)
Secondary education	**35** (41.2)	Retired due to illness	**20** (23.3)
Higher education	**17** (20.0)		
		Total	**91(100.0)**

Data

We obtained information about age, gender, blood pressure on admission, smoking and total cholesterol from the patients and medical records.

CVD is most common in people over 50, so we stratified the patients according to their gender and age: males under the age 55 years and ≥55 years; females under the age 65 years and ≥65 years, respectively.

The patients were classified into 4 groups according to their blood pressure on admission to the clinic (Table 2), using 2013 ESH/ESC Guidelines: Prehypertension, Grade 1 Hypertension, Grade 2 Hypertension and Grade 3 Hypertension [4].

Table 2. Hypertension stage, distribution of the patients (Number, %)

Category	Systolic (mm Hg)	Diastolic (mm Hg)	Patients	
			Number	%
Prehypertension	130÷139	85÷89	7	7.7
Grade 1 Hypertension (mild)	140÷159	90÷99	29	31.8
Grade 2 Hypertension (moderate)	160÷169	100÷109	34	37.4
Grade 3 Hypertension (severe)	>180	>110	21	23.1
		Total	**91**	**100.0**

Information about total cholesterol was obtained from medical records. The patients with total cholesterol level greater than 4.9 mmol/L (>190 mg/dL), were considered as having dyslipidemia [4, 5]. Risk group included the patients with total cholesterol exceeding 4.9 mmol/L (Table 3).

Table 3. Distribution of the patients by risk factors of hypertension (Number, Mean, %)

Risk factor	Total	Males	Females	p
	Number (%)	Number (%)	Number (%)	
Age				
≥55 yrs (males)		32 (84.2)		
≥65 yrs (females)			31 (62.0)	
Total cholesterol				
Mean	5.5	5.5	5.9	0.056
>4.9 mmol/L (%)	64.0			
Smoking				
Smokers	21 (23.1)	13 (32.5)	8 (15.7)	0.088
Daily number of cigarettes	10.0	11.3	4.8	**0.009**
Mean years of smoking	40.0	40.0	20.0	**0.041**
Total	**91 (100.0)**			

We classified the patients into 3 groups according to smoking: smokers (respondents with cigarette consumption during the study), ex-smokers (respondents who had quit smoking 12 months before the study) and non-smokers (respondents who had never smoked; Table 3). Information about the mean number of cigarettes smoked per day and average years of smoking was obtained from smokers.

Cardiovascular risk assessment was performed by SCORE risk chart in high-risk populations. We used data of sex, age, systolic blood pressure (SBP), total cholesterol and smoking to assess a person's 10-year absolute risk for fatal CVD. The crossed cells of these data showed a specific value of CVR in each patient. This value was used to cross-classify the patient in one of four risk groups: very high risk (SCORE ≥10%), high risk (SCORE 5-10%), moderate risk (SCORE 1-5%) and low risk (SCORE <1%).

We classified the patients with medical history of AMI, stroke, ACS, diabetes with microalbuminuria or patients with mild and severe form of chronic kidney disease (GFR<60 ml/min) as patients at very high risk for fatal CVD.

Statistical Analysis

Data were processed by Statistical Package for

Social Science versions 19.0 (SPSS.v.19.0). Descriptive statistics included mean and standard deviation (SD) in normal distribution and median (Mdn) in asymmetric distribution. Nonparametric test Mann-Whitney U was used to assess significant differences in dependent continuous variables with asymmetric distribution (total cholesterol; years of smoking; number of cigarettes smoked per day). Results were considered as statistically significant when p-value was less than or equal to 0.05.

Results

Ninety one patients aged 40-89 years were included in the study. Some basic characteristics of the patients are shown in Table 1. Their mean age was 66.0±11.0 years, and 40 (44%) were males. Most patients (41.2%) had completed secondary school and were retirees (51.2%).

Figure 1 shows the distribution of the patients according to the levels of SBP on admission. The distribution had a right tail. The median SBP was 160.0 mm Hg. The median diastolic blood pressure (DBP) was 90.0 mm Hg, and there was a right asymmetric distribution too (Figure 2).

Over two-thirds of the hypertensive patients were classified in group 1 stage hypertension (31.8%) and group 2 stage hypertension (37.4%; Table 2).

Age is one of the main risk factors for CVD. Over 84% of males were 55 and over, and 62% of females were 65 and over.

The mean total cholesterol was 5.5 mmol/L and over two-thirds of the patients had high values (>4.9 mmol/L). The mean value of the variable was higher in the females (Mdn=5.9 mmol/L) than in the males (Mdn=5.5 mmol/L). However, these differences were not significant (U=739.0; p=0.056; Table 3).

Smokers accounted for 23.1% of the patients, and most of the patients had smoked for 40 years (Table 3). There were significant differences between genders – males had smoked for more years than females (U=8.000; p=0.009). The mean number of cigarettes smoked per day was a higher in the males (Mdn=10.0) than in the females (Mdn=5.0) and these differences were significant (U=19.000; p=0.041).

The mean number of risk factors for CVDs was 3.0, and 16.5% of the patients reported more than 3 risk factors (Figure 3).

When assessing a person's absolute 10-year CVR by SCORE, we used simultaneously data of SBP, age, gender, total cholesterol and status of smoking. A very high risk for fatal CVD was measured in 65.9% of the patients. For 23.1% of the patients, the risk was high, and for 11.0% it was moderate (Table 4).

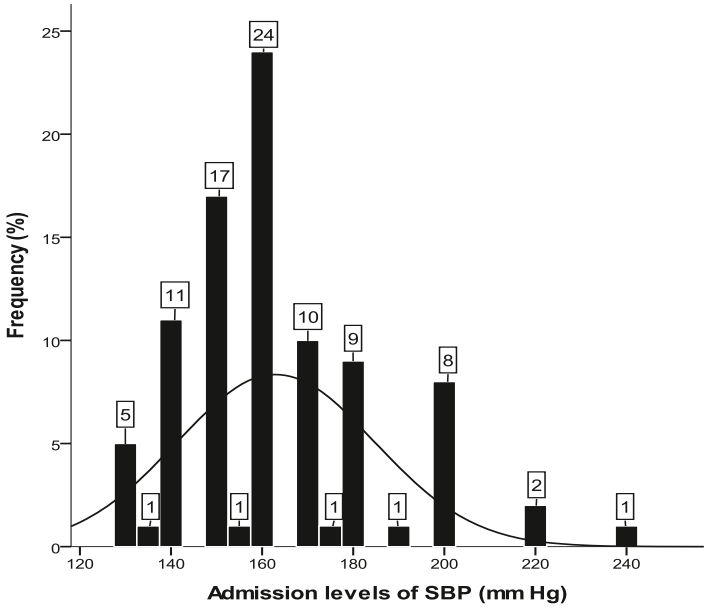

Figure 1. Distribution of the patients according to the admission levels of SBP (%). Curve of normal distribution

Table 4. Hypertension stage, distribution of the patients (Number, %)

Category of CVR	Calculated SCORE	Patients	
	%	Number	%
Moderate risk	1-5%	10	11.0
High risk	5-10%	21	23.1
Very high risk	≥10%	60	65.9
		91	**100.0**

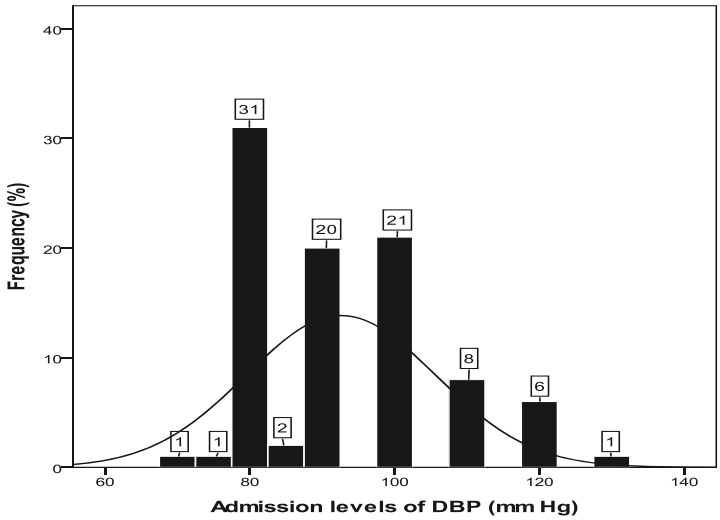

Figure 2. Distribution of the patients according to the admission levels of DBP (%). Curve of normal distribution

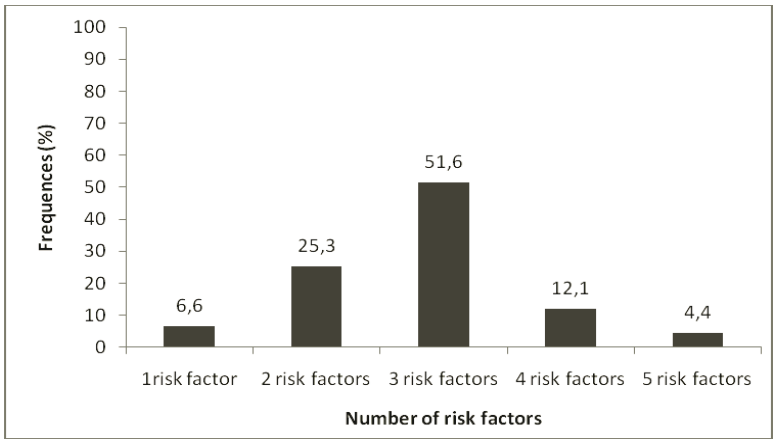

Figure 3. The proportion of the patients according to number of risk factors for CVDs

Discussion

Cardiovascular diseases remain a leading cause of morbidity and mortality in developed countries, including Bulgaria. However, inequalities in age-adjusted CVD mortality among European countries persist and many risk factors, particularly the prevalence of obesity and diabetes mellitus, have increased. Age-adjusted CVD mortality rates have declined in high-income countries (Austria, Belgium, Denmark, Finland, France, Sweden, etc.) since 1980 [6, 7].

Unfortunately, Bulgaria is one of the very-high-risk countries where age-adjusted CVD (2012) mortality rates among subjects aged 45-74 were over 450/100 000 for males and over 350/100 000 for females, and these rates have increased over the years. In 2015, CVDs was

the cause of 65.4% of all deaths in Bulgaria [7]. In 2017, the years of potential life lost from CVDs in Bulgaria are 39% in males and 33% in females, and these values are higher as compared with France, respectively 11% and 7% [8].

Moreover, CVDs place a considerable burden on society. In the European region, costs related to CVDs amount to €210 billion a year, i.e. about 9% of the total healthcare expenditure [7]. Of the total costs of CVDs, 53% (€111 billion) is allocated to direct healthcare, 26% (€54 billion) - to productivity losses, and 21% (€45 billion) is spent on patients with CVDs. The CVD-related health expenditure per capita varied seven-fold in 2015, from €48 in Bulgaria to €365 in Finland [8].

Cardiovascular diseases have a multifactorial aetiology with a number of potentially modifiable risk factors as smoking, high BMI, hypercholesterolemia, unhealthy diet, low physical activity, etc. [2, 7, 9].

Elevated blood pressure increases the risk of CVD, heart failure, stroke and renal failure. A linear relationship has been found between blood pressure range of 115/70÷170/100 mm Hg and CVD [5, 6, 10]. Most hospitalizations of the patients in that study were due to poorly controlled hypertension in outpatient settings. More than one third fell into a category of Grade 1 Hypertension and 37.4% - in Grade 2 Hypertension. Similar results were reported by Lengele et al. (2007) about hypertensive patients (38%) with Grade 2, and a higher proportion of the patients falling into category Grade 3 Hypertension (56%). Success of blood pressure lowering depends on the presence or absence of CVD and the positive effect on a CVD risk is commonly a combination of drug use and lifestyle changes [10].

We established that total cholesterol exceeded the normal range in 64.0% of the hospitalized patients, suggesting dyslipidemia. Many studies have reported that hypertension is a familial disease, which is combined with other risk factors, including high levels of total cholesterol and triglycerides. Over 30.0% of males and females diagnosed with hypertension in Bulgaria in 2007 had high levels of total cholesterol [11]. This combination leads to a manifold increase of the risk for ischemic heart diseases, and an almost eleven-fold risk of CVD death [6, 11]. Recently, researchers have pointed out the role of high-density lipoprotein cholesterol (HDL-C) as a modifiable CVR factor for all ages, in both females and males. Because of that, HDL-C is added as an independent risk factor to a new online version of SCORE risk charts (HeartScore) [2, 12].

Smoking enhances the development of both atherosclerosis and superimposed thrombotic phenomena. A 10-year fatal CVD risk is approximately doubled in smokers and the relative risk (RR) is five-fold higher in male smokers aged <50 years than in non-smokers. The risk is three-fold higher in male smokers aged 45-64 years, and two-fold higher in those aged 65-84 years [7, 13]. In our study, 23.1% of hypertensive patients were smokers (32.5% males and 15.7% females). Our results were different from those reported by other authors [11, 14, 15]. Most likely, this could be attributed to the health status of our patients: varying effectiveness of anti-smoking strategies in countries, etc. We established that males smoked three times as many cigarettes than females and they had been smoking for twice as long. Dose-response relationship was found between smoking and CVR [5, 7, 10]. The RR for AMI in subjects who smoked over 40 cigarettes per day was 10 times higher than in non-smokers. Smokers of low-tar yield cigarettes are at a higher RR for early CVD death [10].

A number of risk factors for CVDs are commonly found together and that increases a health risk many times. Therefore, these risk factors need to be modified simultaneously [3, 7, 9]. It has been proven that a programme that reduces the CVR in a population studied by 1% would prevent 25 000 CVD cases and generate saving of €40 million per year [7]. Over 93% of our patients had a few risk factors and other studies have shown similar results [6].

Apart from conventional major risk factors included in the SCORE risk charts, there are other risk factors called risk modifiers of absolute CVR (family history of premature CVD, BMI and central obesity, physical activity, alcohol intake, nutrition, socioeconomic status, lack of social support, drug use, etc.) [7, 16]. We did not include these additional risk factors in CVR assessment in the study. However, the role of modifiers is more important in situations

when an individual's absolute risk lies close to a critical threshold (SCORE risk of 5%) [7].

Absolute risk (global risk, total risk) is defined as the percentage chance of an individual to develop a CVD over a certain period of time. A calculation of absolute risk is the starting point in developing CVD prevention strategies [2, 6]. There are different systems for assessment of CVR (Framingham, SCORE, ASSIGN, Q-Risk, PROCAM, CUORE, etc.) in different populations [7, 10, 12, 13, 15] but the main principle in all systems is to calculate the combined effect of hypertension and the other risk factors for developing of a CVD.

Since 2003, the European Guidelines on CVD prevention in clinical practice recommend the use of the SCORE system because of a number of its strengths: collected data about large and different populations (12 European cohorts, 205 178 individuals aged 40-65 years were included); could be adjusted to the low-risk and high-risk European countries; a risk for fatal CVDs is assessed better and the results are more comparable between different populations; total (fatal + nonfatal) risk and relative CVR could be assessed additionally.

However, many studies on risk scoring in clinical practice have shown worrying statistics. A low proportion of physicians used a CVD risk calculator, or guidelines for CVD prevention. The most common barriers to guideline implementations were patient values, wishes or compliance, lack of time, and healthcare policy [16].

The assessment of CVD risk in this study was performed by SCORE high-risk chart [3, 5, 7, 12, 17] and the results showed a very high 10-year risk for fatal CVD in 65.9% of the patients, high risk in 23.1% and moderate risk in 11.0%. Our data were different from those reported by Lengele et al. (2007). However, most cardiovascular events do not occur in the small number of high-risk individuals but rather in the much larger proportion of patients in the low-to-moderate risk stratum [6].

One strength of the study is that we excluded individuals under 40 years of age. Thus, a risk of underestimation by SCORE is less likely to happen. However, there remains the risk for underestimating CVR in patients with family history of premature CVD, central obesity, low HDL-C or elevated triglyceride, fibrinogen, ets [16].

One limitation of the study is that over 63% of the patients we studied were older than 65. The SCORE model cannot be applied for risk assessment for people younger than 40 and older than 65 because it can be underestimated or overestimated [2, 3, 7, 17]. Furtermore, overestimation of absolute risk in the elderly can lead to overmedication [17].

Conclusions

Cardiovascular risk assessment should be performed in all hypertensive patients because of its important role in preventing morbidity, premature death and disability of CVD. SCORE is a standard system for assessment of cardiovascular risk and should be based on the population, in which the patient lives, including more modifiers such as family history of premature CVD, BMI, diet, ethnicity, socioeconomic status, psychological factors, drug use, etc. CVD reduction, however, requires a combination of both medical and public heath approaches and focusing intervention on a high-risk stratum, as well as to subjects with risk factors that predispose them to disease in later life.

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