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COMPARISON OF TWO DIFFERENT METHODS FOR CARDIOVASCULAR RISK ASSESSMENT: *FRAMINGHAM RISK SCORE* AND *SCORE* SYSTEM

POREĐENJE DVE METODE PROCENE KARDIOVASKULARNOG RIZIKA: *»FRAMINGHAM« RIZIK SKOR I »SCORE«* SISTEM

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Summary: Numerous studies have shown that the major risk factors for coronary heart disease (cigarette smoking, hypertension, elevated serum total cholesterol and low-density lipoprotein cholesterol – LDL, low serum high-density lipoprotein cholesterol – HDL, diabetes mellitus and advancing age), are additive in predictive power. Accordingly, the total risk of a person can be estimated by summing up the risk imparted by each of the major risk factors. Using data obtained from population studies, various risk assessment algorithms have been developed. The aim of this study was to compare the two most common risk scores. Risk assessment for determining 10-year risk in 185 healthy, asymptomatic individuals of both sexes, 30–85 years old, was carried out according to both Framingham (FRS) and SCORE risk scoring. The risk factors included in the calculation of 10-year risk are gender, age, total cholesterol, HDL-cholesterol, systolic blood pressure, treatment for hypertension and cigarette smoking. The determinations of total cholesterol and HDL-cholesterol were made in sera collected after a 12h fasting period using an Olympus AU2700 automated analyzer. The Framingham risk score was determined using an electronic calculator – ATP III Risk Estimator, and the risk status according to SCORE was obtained using charts for the 10-year risk in populations at high risk. Among 185 participants, in 152 (82%) 10-year risk for Coronary Heart Disease (CHD) death was <10%, 24 (13%) had intermediate and 9 (5%) had high risk (≥20%) according to FRS. According to SCORE, 110 (60%) participants had <1%, 56 (30%) had 1–5% and 19 (10%) had ≥5% of 10-year risk for cardiovascular death. Different categories of risk were assigned to ~30% of individuals according to different risk assessment models. Differences in risk classification when using two dif-

Kratak sadržaj: Brojne studije su pokazale aditivnu prediktivnu vrednost glavnih faktora rizika za pojavu koronarne srčane bolesti (pušenje, hipertenzija, povišena koncentracija ukupnog i LDL-holesterola i niska koncentracija HDL-holesterola u serumu, dijabetes i starost). Na osnovu toga, ukupan rizik za jednu osobu može se proceniti sumiranjem rizika koji nosi svaki glavni faktor rizika pojedinačno. Veliki broj algoritama za procenu rizika razvijen je na osnovu podataka dobijenih iz populacionih studija. Cilj ovog rada bio je poređenje dva najčešće korišćena rizik skora. Za 185 zdravih, asimptomatskih osoba oba pola, 30–85 godina starosti, procenjen je rizik od pojave kardiovaskularnih bolesti (KVB) u narednih 10 godina prema »Framingham« (FRS) i SCORE sistemu. Faktori rizika koji su uključeni u izračunavanje 10-godišnjeg rizika su pol, starost, ukupan i HDL-holesterol, sistolni krvni pritisak, terapija antihipertenzivima i pušenje. Ukupan i HDL-holesterol određivani su u uzorcima seruma, dobijenim posle 12 sati gladovanja, na biohemijskom analizatoru Olympus AU2700. FRS je izračunavan pomoću programa »ATP III Risk Estimator«, a SCORE rizik je dobijen pomoću tablica za 10-godišnji rizik za populacije sa visokim rizikom. Od 185 učesnika, kod 152 (82%) 10-godišnji rizik za srčanu smrt bio je <10%, 24 (13%) je imalo srednji, a 9 (5%) je imalo visoki rizik (≥20%) na osnovu FRS. Prema SCORE-u, 110 učesnika (60%) imalo je 10-godišnji rizik od kardiovaskularne smrti <1%, 56 (30%) je imalo 1–5% rizika, dok je kod 19 osoba (10%) identifikovan visok rizik (≥5%). Oko 30% ispitanika svrstano je u različite kategorije rizika na osnovu različitih modela za procenu rizika. Razlike u klasifikaciji na osnovu kardiovaskularnog rizika, koje se dobijaju korišćenjem dva različita algoritma za procenu rizika, mogu se objasniti time što ovi sistemi

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ferent risk assessment algorithms can be explained with several important issues, including different endpoints, consideration of interactions and incorporation of antihypertensive use. It is important to note that neither FRS nor SCORE have been appropriately adjusted for our population, according to the national cardiovascular mortality rate.

Keywords: cardiovascular disease, risk assessment, Framingham Risk Score, SCORE

koriste različite krajnje ishode bolesti i što se razlikuju po uticaju interakcija i uzimanju u obzir upotrebe antihipertenzivnih lekova. Važno je naglasiti da ni FRS ni SCORE nisu prilagođeni našoj populaciji, na osnovu nacionalne stope mortaliteta od KVB.

Ključne reči: kardiovaskularna bolest, procena rizika, »Framingham« rizik skor, SCORE

Introduction

Cardiovascular disease (CVD) is generally due to a combination of several risk factors. Numerous studies have shown that the major and independent risk factors for coronary heart disease (CHD) are cigarette smoking of any amount, hypertension, elevated serum total cholesterol and low-density lipoprotein cholesterol – LDL, low serum high-density lipoprotein cholesterol – HDL, diabetes mellitus and advancing age (1, 2). These studies (3) show that the major risk factors are additive in predictive power. Accordingly, the total risk of a person can be estimated by summing up the risk imparted by each of the major risk factors.

At least 25% of coronary patients experience sudden cardiac death or nonfatal myocardial infarction without prior symptoms (3). Therefore, identification of coronary patients with subclinical disease, who could potentially benefit from intensive primary prevention efforts, is critically important. CHD events can be predicted with multivariate equations developed using data from large population studies (4, 5, 6), in which major risk factors are variables. However, none of these risk assessment models is considered ideal, but they are essential to begin the process of selecting patients for further intervention or additional testing.

The most frequently used risk assessment algorithm is the Framingham Risk Score (FRS) (4, 7). It is incorporated in the Adult Treatment Panel III (ATP III) (8), clinical guidelines recommended by the American Heart Association (AHA) and the American College of Cardiology (ACA) for cholesterol testing and management. Risk factors used in Framingham scoring include age, sex, total cholesterol, HDL, systolic blood pressure (regardless of whether the person is on antihypertensive therapy) and smoking status. The score is derived from the Framingham community cohort of 5345 individuals followed-up for 12 years. Endpoints of the follow-up were death due to CHD, myocardial infarction, angina or coronary insufficiency. Framingham scoring divides persons with multiple risk factors into those with high, intermediate and low 10-year risk for CHD of >20%, 10 – 20% and <10%, respectively.

European guidelines on CVD prevention in clinical practice (9) recommend using the SCORE Model (Systemic COronary Risk Evaluation) (10) to assess the risk for development of CVD. The SCORE Project Group analysed over 200 000 individuals from 11 European countries, followed-up for a mean of 13 years for cardiovascular death. In SCORE, the following risk factors are integrated: gender, age, smoking, systolic blood pressure and either total cholesterol or the total cholesterol/HDL ratio. Since it predicts fatal events, the threshold for high risk is defined as ≥5%. SCORE Project developed separate algorithms for high-risk and low-risk populations.

The aim of this study was to compare CVD risk determined by using both FRS and SCORE scoring systems.

Patients and Methods

Participants in this study were 185 healthy asymptomatic individuals, 59 men and 126 women, 30–85 years of age. Blood samples were collected after a 12h fasting period. Prior to sample collection, the volunteers were interviewed about their age, smoking status and whether they used antihypertensive drugs. Also, their blood pressure was measured. Persons who had smoked in any amount in the past month were designated as »smokers«.

Total cholesterol and HDL concentrations were measured in fresh serum samples. Both determinations were performed on an Olympus AU2700 automated analyzer (Olympus Diagnostica GmbH, Hamburg, Germany). Total cholesterol was determined by an enzymatic, and HDL using a direct method.

FRS was determined using an electronic calculator – ATP III Risk Estimator (version 2000, Ralph B. D'Agostino, Lisa M. Sullivan, Daniel Levy; Framingham Heart Study) (11). Risk status according to SCORE was obtained using high risk charts (9, 10), since CHD rate in the Serbian population is high.

Results

Obtained values of determined parameters for the studied group of volunteers are presented in *Table I*.

Among 185 participants, in 152 (82%) the 10-year risk for myocardial infarction and coronary

Table I Characteristics of the studied group of volunteers.

	Men	Women
n	59	126
Age (year)	45.2 (14.3)	42.8 (12.5)
Smokers (%)	44	17
Systolic blood pressure (mmHg)	129 (15)	120 (18)
Blood pressure medication (%)	16	46
Serum total cholesterol (mmol/L)	5.83 (1.26)	5.53 (1.24)
Serum HDL cholesterol (mmol/L)	1.29 (0.89)	1.53 (0.35)
Total cholesterol/HDL	5.5 (2.2)	3.8 (1.2)

Values are presented as mean (SD) or proportions.

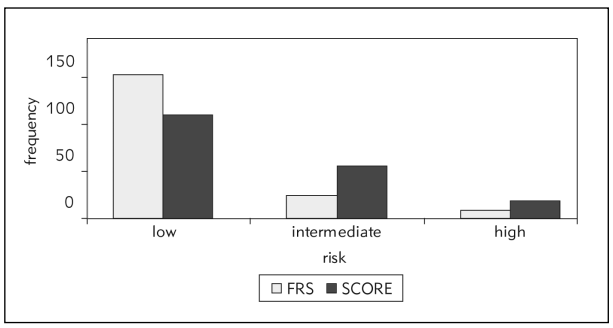

Figure 1 The distribution of risk in examined group of volunteers according to FRS and SCORE.
FRS: <10% low, 10–20% intermediate, ≥20% high risk.
SCORE: <1% low, 1–5% intermediate, ≥5% high risk.

death was <10%, 24 (13%) had intermediate (10–20%) CHD risk and 9 (5%) were identified as persons with high risk (FRS ≥20%). According to SCORE, 110 (60%) participants had <1%, 56 (30%) had 1–5% and 19 (10%) had ≥5% of 10-year risk for cardiovascular death. These data are represented in *Figure 1*.

Different categories of risk were assigned to 56 (~30%) individuals according to different risk assessment models. Fifty of them (27%) had a risk that differed by one risk category and the other 6 (3%) were designated as belonging to both the lowest and highest risk class depending on the used risk algorithm. Higher risk according to the SCORE system had 28% of participants, and according to FRS only 2%.

We also used both SCORE risk charts: one based on total cholesterol and the other on cholesterol/HDL ratio. The same estimated risk using both methods had 94% of persons. However, for 11 participants (6%), on 10-year risk was different, depending which variable was used for calculation.

Discussion

Use of risk scores can provide a reliable risk estimate, leading to more aggessive care and a potential reduction in vascular disease events. There are various risk assessment algorithms available, of which the American FRS and the European SCORE are most commonly used. Differences in CVD risk classification when using these two different models can be explained with several important issues. These include different endpoints, consideration of interactions and incorporation of the use of antihypertensive drugs (12).

Firstly, SCORE is aimed at the estimation of total cardiovascular risk, rather than the risk of coronary heart disease incorporated in FRS. This means that SCORE predicts any kind of fatal atherosclerosis endpoint over a ten-year period. The risk of cardiovascular death is calculated by combining two separate risk estimations: a model for CHD and a model for all non-coronary atherosclerotic CVD. Since this model predicts fatal events, the threshold for being at high risk is defined as ≥5%, instead of the previous 20%, in charts using a composite coronary end point (5, 9).

A prominent feature of risk estimation by means of the FRS is the progressive increase in absolute risk with advancing age. This increase reflects the cumulative nature of atherogenesis, but it may mask the extent of variability in risk because of different plaque burden in older individuals (3). To avoid this disadvantage, SCORE is using age as a measure of exposure time to risk, rather than as a risk factor (10). However, since age is a major determinant of coronary risk, SCORE has limited calculation of the model, fit for the age group 45–65. On the other hand, FRS evaluation is possible for the age 30–80.

Although SCORE Project Group reported that there was no consistent indication of the superiority of cholesterol/HDL ratio-based over cholesterol-based charts (10), leaving out the HDL may be considered as a limitation (7). Our results showed some discrepancies among 10-year risks obtained using the two models. These differences were observed mainly in persons with very low or very high HDL levels. In these cases, individuals would have been classified in a higher or lower risk category, respectively, when the cholesterol/HDL-based chart was used.

For estimating the 10-year risk for developing CHD using FRS, blood pressure value obtained at the time of assessment is used, regardless of whether the person is on antihypertensive treatment. However, if the person is on antihypertensive treatment, an extra point is added beyond points for the blood pressure reading, because treated hypertension carries residual risk (8).

Finally, we must emphasize that neither FRS nor SCORE have been appropriately adjusted for our population. Although FRS has been successfully externally validated (13), it seems that it overestimates the

absolute risk in populations with lower CHD rates. An important advantage of SCORE is that it is calibrated to baseline risk within geographical regions, taking into account genetic and environmental factors, which allowed the development of separate risk charts for high-risk and low-risk European populations. Also, SCORE is open to creating national and regional risk charts based on the published mortality data (10).

Since Serbian Medical Society has accepted the individual risk evaluation based on SCORE charts (14), we hope that adjustments according to our national cardiovascular mortality rate will soon be made.

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