Assessment of cardiovascular risk in patients with chronic kidney disease according to Framingham's criteria

Avaliação do risco cardiovascular de pacientes renais crônicos segundo critérios de Framingham

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Abstract

Objective: To identify the profile of patients with chronic kidney disease attending a hemodialysis service and estimate the risk of future cardiovascular events over a period of ten years.
Methods: Cross-sectional study with a sample of 242 patients with chronic kidney disease. Cardiovascular risk was assessed using the Framingham Risk Score.
Results: The most prevalent risk factors for cardiovascular disease were: hypertension (90.49%), sedentariness (80.16%), and smoking (51.23%). Cardiovascular risk in relation to the variables gender and family income presented a statistical difference ($p<0.05$). Only 0.8% of the patients presented a high risk of cardiovascular disease; 28.8% presented average risk and 70.2% low cardiovascular risk.
Conclusion: Data show low cardiovascular risk in patients with chronic kidney disease.

Resumo

Objetivo: Identificar o perfil do paciente com doença renal crônica em um serviço de hemodiálise, e a probabilidade do risco de futuros eventos cardiovascular no período de dez anos.
Métodos: Estudo transversal com amostra de 242 pacientes com doença renal crônica. A avaliação do risco cardiovascular foi através do Escore de Risco de *Framingham*.
Resultados: Os fatores de risco para doenças cardiovasculares mais prevalentes foram: hipertensão arterial (90,49%), sedentarismo (80,16%), tabagismo (51,23%). O risco cardiovascular em relação às variáveis gênero e renda familiar apresentou diferença estatística ($p<0,05$). Apenas 0,8% dos pacientes apresentaram alto risco de doença cardiovascular, 28,8% médio risco e 70,2% baixo risco cardiovascular.
Conclusão: Os dados apontaram para baixo risco cardiovascular nos pacientes renais crônicos.

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Introduction

Chronic kidney disease (CKD) is the progressive and irreversible loss of function of the kidneys. [1] This disease is currently a severe public health problem worldwide and is considered an epidemic with an alarming growth rate.[2 Mortality due to CKD is 20 times greater than in the population in general, while cardiovascular disease is the most common cause of death.[3]

There is a direct relationship between the degree of kidney dysfunction and cardiovascular risk (CVR). The presence of proteinuria or microalbuminuria is a strong CVR, while the main causes of kidney diseases are diabetic nephropathy and hypertensive nephrosclerosis, accelerated by smoking and dyslipidemia. Thus, increased CVR among patients with CKD is secondary to the accumulation of these risk factors. [4]

CVR factors include: hypertension, dyslipidemia, presence of left ventricular hypertrophy, obesity, diabetes mellitus (DM) and some lifestyle-related habits (high-calorie diet, saturated fats, high cholesterol, salt, alcohol consumption, smoking and sedentariness).[5-7] In addition to these, there are non-traditional CVR factors, such as inflammation, oxidative stress, persistent infection, proteinuria and hyperphosphatemia.[8]

It was possible, with the Framingham study, to clarify and correlate CVR factors, enabling the identification of high risk patients, encouragement of therapy adherence, and the calibration of efforts to reduce risk, seeking to reduce its incidence and the consequent rates of morbidity and mortality. [9]The instrument most frequently used in clinical practice to compute and estimate absolute CVR is the Framingham Risk Score (FRS), a scale capable of estimating one's risk of developing Cardiovascular Diseases (CVD) over a period of ten years.[10] Recognized worldwide and widely applied to stratify risk, it enables directing specific groups of patients who can benefit from medication therapy as a primary intervention to prevent CVD.[11] The objective in this context was to identify CKD patients in a hemodialysis service to estimate the risk probability of future CVD over a period of ten years.

Methods

This cross-sectional study was conducted in the Nephrology unit of the General Hospital, *Fundação Faculdade Regional de Medicina de São José do Rio Preto*, SP, Brazil from August to December 2011.

A total of 242 patients with chronic kidney disease who met the following criteria participated in the study: being 18 years old or older, attending hemodialysis treatment in the aforementioned hospital between August and December 2011, having no mental deficits, and consenting to participate in the study.

Data were collected through interviews with patients during hemodialysis sessions, addressing data concerning the patients' socio-demographic and economic profiles, and consultation of medical files to obtain clinical, laboratory and anthropometric data.

The collected data were transferred to a Microsoft® Excel spreadsheet. Frequency tables were used for the categorical variables (gender, age, ethnicity, marital status, education, years of schooling, occupation, family income) and descriptive statistics (average, standard deviation) for the continuous variables. The Chi-square test was used for the analysis of association among the following variables: risk factors, gender, age, family income, and years of schooling. A level of significance of $p<0.05$ was adopted.

The Framingham Risk Score was used to assess cardiovascular risk. Each variable in this scale has value ranges that present specific positive or negative scores. The total score takes into account the following variables: gender, age, smoking, diabetes mellitus, high-density lipoprotein, total cholesterol, systolic blood pressure and diastolic blood pressure. The score obtained corresponds to the likelihood of cardiovascular diseases occurring in the next ten years, expressed as a percentage.

Hence, the individuals are classified in the following categories: low risk, which refers to a probability lower than 10% of cardiovascular events occurring in ten years; average risk, between 10% and 20%; and high risk, greater than 20%.

The study met Brazilian and international ethical standards concerning research involving human subjects.

Results

We note a predominance of males, age ranging from 18 and 92 years old, average of 57.45 ±15.68 years, average years of schooling of 6.27 ±3.56 years, and average family income of 3.25 ±3.49 times the minimum wage. Table 1 presents the sample's characteristics according to socio-demographic variables, by gender.

Data in table 2 show a greater concentration of total cholesterol among females, as well as HDL, LDL and triglycerides. In regard to central distribution of waist fat, males presented a higher average waist circumference. In relation to uncontrolled blood pressure, 31.4% of the patients presented uncontrolled systolic blood pressure (≥ 140mmHg) and 20.24% presented uncontrolled diastolic blood pressure.

Table 2. Clinical, laboratory and anthropometric characteristics between genders

Variables	Male	Female	Total
Total Cholesterol (mg/dl)	152.04 ±42.13	182.35 ±48.31	165.27±47.29
HDL (mg/dl)	39.89 ±11.02	45.92 ±18.16	42.52±14.84
LDL (mg/dl)	79.55± 30.38	102.77± 37.39	89.75±35.39
Triglycerides (mg/dl)	163.72± 116.38	177.8 ±109.77	167.61±108.63
SBP (mmHg)	130.07 ±18.8	127.04 ±17.59	128.76±18.34
DBP (mmHg)	79.48 ±11.52	79.42 ±19.28	79.46±10.61
Height (cm)	1.70 ±0.08	1.59± 0.07	1.66 ±0.09
Weight (kg)	71.57 ±14.25	61.96 ±13.93	67.40 ± 14.87
BMI (kg/m²)	24.65 ±5.00	24.90 ±5.38	24.65 ±4.9
WC (cm)	97.68 ±13.95	93.55 ±14.47	95.93±17.93

Legend: Results presented as average ± standard deviation; SBP – systolic blood pressure; DBP -diastolic blood pressure; BMI – body mass index; WC – waist circumference

Table 3 shows that hypertension, sedentariness and smoking were the predominant risk factors found in the studied population and were statistically high in males, as were diabetes and dyslipidemias.

Table 3. Risk factors for cardiovascular diseases, by gender, among patients with chronic kidney disease

Risk Factors	Male n(%)	Female n(%)	Total n(%)
Hypertension	122(50.41)	97(40.08)	219(90.49)
Diabetes Mellitus	52(21.48)	50(20.66)	102(42.14)
Dyslipidemia	51(21.07)	46(19.00)	97(40.08)
Smoking	88(36.36)	36(14.87)	124(51.23)
Obesity (BMI > 30 kg/m²)	16(6.6)	17(7.02)	33(13.63)
WC (cm) *	30(12.39)	78(32.23)	108(44.6)
Physical activity Irregular physical activity/ Sedentariness	100(41.32)	94(38.84)	194(80.16)

Legend: *WC – Waist circumference/ Male WC considered >102 cm and Female WC considered >88cm

When considering the classification of cardiovascular risk (CVR) according to the Framingham score, we observe that low cardiovascular risk predominates (Table 4). The comparison between genders and CVR presented a significant difference (p<0.001). When the socio-demographic variables were compared in the association of genders together with cardiovascular risks, only the family income variable (p=0.004) presented a significant difference. The variables age (p=0.161), ethnicity (p=0.38), marital status (p=0.128) and years of schooling (p=0.130) did not present statistically significant differences in relation to gender and CVR.

Table 4. Framingham score by gender, according to a group of patients with chronic kidney disease

Framingham's score	Gender		Total
	Male n(%)	Female n(%)	n(%)
Low risk	101(41.7)	50(20.6)	151(62.3)
Average risk	26(10.7)	46(19)	72(29.7)
High risk	-	2(0.8)	2(0.8)
Impossible to compute	10(4.1)	7(2.9)	17(7)

Assessing the simultaneity of risk factors for CVD, we observe that the patients whose scores

Table 1. Description of socio-demographic variables of patients with chronic kidney disease according to gender

Variable	Male n(%)	Female n(%)	Total n(%)
Gender*	137(56.6)	105(43.4)	242(100)
Ethnicity**			
Caucasian	84(34.7)	63(26)	147(60.7)
Non-Caucasian	83(34.3)	12(4.9)	95(39.2)
Age (years)**			
Up to 40	19(7.9)	16(6.6)	35(14.5)
41 to 60	59(24.4)	39(16.1)	98(40.5)
Older than 60	59(24.4)	50(20.6)	109(45)
Marital status**			
Single	14(5.8)	8(3.3)	22(9.1)
Married	35(14.5)	27(11.1)	62(25.6)
Widowed	2(0.8)	14(5.8)	16(6.6)
Divorced	4(1.6)	3(1.3)	7 (2.9)
Stable union	2(0.8)	2(0.8)	4(1.6)
Did not answer	80(33)	51(21.1)	131(54.1)
Education			
Illiterate	5(2.1)	11(4.5)	16(6.6)
Non-illiterate	132(54.5)	94(38.8)	226(93.4)
Years of schooling (years)**			
0	5(2.1)	11(4.5)	16(6.6)
1-4	57(23.6)	49(20.2)	106(43.8)
5-8	21(8.7)	9(3.7)	30(12.4)
9-11	30(12.4)	20(8.3)	50(20.7)
>12	15(6.2)	13(5.4)	28(11.6)
Other	9(3.7)	3(1.2)	12(4.9)
Occupation			
Disability retirement	45(18.6)	29(12)	74(30.6)
Full retirement age/time of service	45(18.6)	21(8.7)	66(27.3)
Compensation for temporary disability	22(9)	24(9.9)	46(19)
Pension	-	6(2.4)	6(2.4)
Have a job	24(9.9)	25(10.3)	49(20.2)
Did not answer	1(0.4)	-	1(0.4)
Income (times MW)***			
≤1.0	29(12)	30(12.4)	59(24.4)
1.1 – 3.0	55(22.7)	43(17.8)	98(40.5)
3.1 – 6.0	32(13.2)	14(5.8)	46(19)
6.1-10	6(2.5)	3(1.2)	9(3.7)
>10	6(2.5)	1(0.4)	7(2.9)
Did not report	9(3.7)	14(5.9)	23(9.5)

Legend: *p<0.001 – significant difference between gender and cardiovascular risk factors; * *p>0.05 – this variable did not show significant difference in relation to gender and cardiovascular risk factors; ***Family income (MW – Minimum Wage R$ 622.00, currently) presented a significant difference between gender and cardiovascular risk factors p= 0.004

corresponded to low risk presented a larger number of risk factors when compared to patients who obtained other scores (Table 5).

Table 5. Simultaneity of risk factors for cardiovascular diseases, according to the Framingham score

Number of risk factors	Framingham score				Total
	Low risk	Average risk	High risk	Impossible to compute	
	n(%)	n(%)	n(%)	n(%)	n(%)
0	2(0.8)	-	-	1(0.4)	3(1.2)
1	23(9.5)	-	-	4(1.6)	27(11.1)
2	39(16.1)	10(4.1)	-	6(2.4)	55(25.9)
3	46(19.0)	23(9.5)	-	2(0.8)	71(29.3)
4	26(10.7)	21(8.6)	1(0.4)	2(0.8)	50(20.6)
5 or more	15(6.1)	18(7.4)	1(0.4)	2(0.8)	36(14.8)

Discussion

A predominance of the male gender and low family income among patients with chronic kidney disease is similar to that found by the Census 2011 conducted by the Brazilian Society of Nephrology.[12] The predominant age group is this study was above 40 years old, represented by 85.5% of the sample, which corroborates a study conducted in Campinas, SP, Brazil in which 75% of the population undergoing hemodialysis were adults of a productive age.[1] In relation to ethnicity, there was a prevalence of Caucasians, according to data reported in the literature, showing that chronic kidney disease has more frequently affected Caucasian individuals.[13]

Cardiovascular diseases are the main cause of death among patients with chronic kidney disease undergoing hemodialysis. The greatest risk factor for cardiovascular mortality is hypertension.[14] In this study, 31.4% of the patients presented systolic blood pressure and 20.24% presented diastolic blood pressure outside the normal range; most were male. In relation to the prevalence of abnormal blood pressure found in this study, it was greater among males (50.41%) than among females (40.08%), data that are in agreement with a study conducted in the city of São Luís, Maranhão, Brazil.[15]

Dyslipidemias are among the main risk factors for the development of coronary artery disease.[16] In this sense, data obtained in this study showed that the prevalence of dyslipidemias was greater among males, which is in agreement with epidemiological studies addressing dyslipidemias.[16,17] A study conducted with patients with chronic kidney disease undergoing hemodialysis treatment in a referral outpatient clinic in the state of Sergipe, Brazil found similar results.[18]

Obesity, especially visceral obesity, is related to coronary risk in the development of left ventricular hypertrophy.[19] A prevalence of individuals with normal weight (41.3%) was found in this study, while the average BMI was within desirable limits, in agreement with the results reported by a study addressing patients with chronic kidney disease, showing that inadequate weight in this population can be seen as a risk factor for cardiovascular mortality.[20]

The presence of central obesity defined by waist circumference, when waist circumference greater than 88cm for women and greater than 102cm for men is an increased risk factor for CVR, presented a prevalence of 67.6% among females and 35.4% among men in a study conducted in the city of Brusque, Santa Catarina, Brazil. Such a prevalence was not found in this study's population, who presented percentages lower than those reported by the aforementioned study, while central obesity was more prevalent among females than among males.[21]

Statistically significant differences were found in relation to smoking when genders were compared, in agreement with studies conducted in Viçosa and Rio de Janeiro, Brazil that reported a prevalence of 48.3% and 48.34% respectively among males, which is one of the most important factors for acute myocardial infarction, especially among men. According to one study, smoking cessation reduces the chance of cardiovascular disease by up to 50%, though the degree of existing lesions in individuals who quit smoking is unknown.[6, 22-23]

Diabetes Mellitus is the most frequent cause of chronic kidney disease worldwide and is already the second most common etiology among patients un-

dergoing hemodialysis in Brazil. The prevalence of diabetes in this study is in accordance with a study conducted in Ribeirão Preto, SP, Brazil, where it is more predominant among males.[13-24]

Physical inactivity was prevalent among males (41.32%), which is in agreement with a study conducted in 2000 Brazilian cities, showing that men are more sedentary than women, a fact that can be explained by the greater level of physical activity among homemakers.[25]

More than half of our sample (88.7%) presented two or more cardiovascular risk factors, corroborating another study conducted in Brazil that presented the coexistence of hypertension with four or more risk factors among seniors, which can be explained by the age above 60 years old, because these individuals tend to present a greater association of risk factors.[26]

Patients with chronic kidney disease are considered to be at a high risk for cardiovascular disease, which accounts for 40-50% of death among this population. A prevalence of low cardiovascular risk was presented by the studied patients, which conflicts with results reported in the literature.[27-29]

Aware that cardiac mortality is much higher among individuals with chronic kidney disease than among hypertensive individuals, we would expect that this behavior would be reflected in higher rates of risk among patients with chronic kidney disease. Such a fact was not observed, despite the greater prevalence of hypertension, smoking and diabetes among the patients, suggesting that other factors not addressed by Framingham Risk Score play a more important role in determining risk in patients with chronic kidney disease when compared to the general population.[29]

Such a result may be explained by the fact that the traditional Framingham Risk Score was used in our study instead of the modified Framingham Risk Score, which includes new cardiovascular risk factors based on the evidence of changes in the population's epidemiological profile, such as obesity epidemic and metabolic syndrome, which accelerate atherosclerotic disease such as: left ventricular hypertrophy, microalbuminuria (30 to 300 mg/24h) and plasma creatinine levels greater than 1.5 mg/dl or creatinine clearance less than 60 ml/min.

Nurses and other health professionals cannot act based on intuition and should use the Framingham Risk Score to systematize care, preventing cardiovascular morbidity and mortality, though further studies are needed to improve stratification is special groups like those with chronic kidney disease.[30]

Conclusion

The profile of patients with chronic kidney disease is: men of an economically active age, Caucasian, married, with low education and socio-economic status.

The socio-demographic variables age, ethnicity, marital status, and years of schooling were similar in terms of gender and cardiovascular risk while the variables family income and gender presented statistically significant differences in relation to cardiovascular risk.

The predominant cardiovascular risk factors were: hypertension, smoking, and sedentariness. The patients presented low cardiovascular risk assessed through the Framingham Risk Score. The results indicated low risk for future events, with the exception of those with multiple cardiovascular risk factors.

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Collaboration

Cesarino CB and Borges PP worked on the project's conception, analysis and interpretation of data and redaction. Ribeiro RCHM contributed with relevant critiques of intellectual content and the version's final approval. Ribeiro DF collaborated with data collection, analysis and interpretation of data. Kusumota L participated in the approval of the final version to be published.

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