Correlation between heart rate variability and myocardial perfusion scintigraphy

Rodrigo Daminello Raimundo[1,2], Patricia Alves Ribeiro Santoro[2], Pamela de Souza Santos[2], Victor Santoro[3], Vitor Engrácia Valenti[4], Tatiana Dias de Carvalho[5], Andrés Ricardo Pérez-Riera[1], Juliana Zangirolami Raimundo[1], Paulo Evaristo de Andrade[1], Luiz Carlos de Abreu[1]

Raimundo RD, Santoro PAR, de Souza Santos P, et al. Correlation between heart rate variability and myocardial perfusion scintigraphy. J Heart Res September 2018;1(1):1-5.

Introduction: The use of myocardial perfusion scintigraphy (MPS) associated with physical stress or pharmacological is a noninvasive method of great diagnostic value in coronary artery disease (CAD). To evaluate and study how the autonomic nervous system (ANS) adapts to the different stimuli in the control of the cardiac system, under normal or pathological physiological conditions, the heart rate variability analysis is commonly used. We hypothesize that a positive CPM result is associated with a worsening of the HRV parameter.

Objective: To correlate the results of heart rate variability (HRV) parameters with those of CPM.

Method: This cross-sectional study evaluated 40 individuals of both sexes between the ages of 20 and 80 years, with or without previous history of CAD, who were indicated to perform the examination according to the criteria of the cardiologist. The heart rate was collected from beat to beat during 12 minutes at rest. Next, the myocardial perfusion study was performed, with a two-day protocol. On the first day the images were taken at rest and the second day after the pharmacological or physical stress. The HRV index data were analyzed by a specific computer program and compared statistically with the MPC results.

Results: In the frequency domain, the analysis of the sympathetic-vagal balance in our study through the indices and joint action of the vagal and sympathetic components on the heart, with sympathetic predominance (LF) (results were 0.022, 0.018 and 0.021 comparing with the parameters of perfusion analysis SSS, SRS and SDR, respectively.

Conclusion: We did not verify correlation between the cardiac autonomic modulation by linear parameters of HRV, with the positive or negative result of MPS, in patients with or without previous diagnosis of ischemic heart disease.

Key Words: *Coronary artery disease; Acute myocardial infarction; Sympathetic; Parasympathetic activity*

INTRODUCTION

Myocardial perfusion scintigraphy (MPS) is a noninvasive method of cardiology with high sensitivity and specificity in the early detection of CAD one of the leading causes of death in worldwide [1,2]. MPS is one of the diagnostic methods that studies the viability of the cardiac muscle, showing areas of transient (viable tissue) or definitive (dead tissue/ infarcted) hypocaptation [3,4].

To evaluate and study how the autonomic nervous system (ANS) adapts to the different stimuli in the control of the cardiac system, under normal or pathological physiological conditions, the analysis of the heart rate variability (HRV) is commonly used [5,6]. The autonomic nervous system (ANS) has great importance in the regulation of the cardiovascular system, through the sympathetic and parasympathetic terminations, which respond to the various physiological stimuli [7,8].

This ANS regulation, adaptability, and response to heart rate is measured by the analysis of the results of heart rate variability, which describes the oscillations between the RR intervals of the electrocardiogram (ECG), and consecutive heart beats [9]. The HRV indexes are able to indicate in advance the efficiency of the autonomic mechanisms, where a high HRV characterizes a healthy individual, whereas the low HRV indicates an abnormal functioning of the SNA [10].

Heart rate variability has been widely used to understand several pathologies, such as CAD, hypertension, acute myocardial infarction, heart and kidney failure, chronic obstructive pulmonary disease, stroke, Alzheimer's disease, leukemia, diabetes, epilepsy, obstructive sleep apnea, and migraine [10-12]. The purpose of this study is to correlate the findings of myocardial perfusion scintigraphy with the analysis of heart rate variability. If there is a correlation between the two, patients may benefit from another examination in a noninvasive way.

OBJECTIVE

Correlate parameters of heart rate variability (HRV) with positive or negative results of myocardial perfusion scintigraphy associated with pharmacological or physical stress.

METHOD

Forty subjects were selected from the cardiology outpatient clinic of the Bandeirantes Hospital and studied with both methods.

To be included in the study, the patient was previously referred by his physician to the Hospital Bandeirantes (São Paulo/SP-Brazil) for myocardial perfusion scintigraphy for suspected or known CAD, chest pain suspected of coronary ischemia, chest angina with the aim of evaluating the extent and severity of coronary ischemia, a function of left ventricular contraction, as well as identifying the possible artery that causes the clinical picture (guilty artery), chronic CAD for the purpose of diagnosis, extension evaluation and severity of the condition, orientation of the modality of treatment to be instituted and assessment of myocardial ischemia in symptomatic patients already treated with coronary angioplasty or saphenous vein surgery, cardiac insufficiency to assess left ventricular function, identify ischemic and viable areas. All the patients signed a free and informed consent form of the research.

Subjects with recent clinical complications, prior acute myocardial infarction, angina or incapacitating congestive heart failure, cardiac arrhythmia, tachycardia above 130 beats per minute (bpm), cardiac transplantation and cardiac pacemaker users, were excluded from the study. beta-blocking drugs, or follow-up of patients receiving chemotherapy with doxorubicin (late cardiotoxicity) as well as any patient

[1]Laboratório de Delineamento de Estudos e Escrita Científica da Faculdade de Medicina do ABC, Santo André, São Paulo, Brasil; [2]Departamento de Fisioterapia das Faculdades Metropolitanas Unidas, São Paulo, São Paulo, Brasil; [3]Serviço Nuclear do Hospital Bandeirantes, São Paulo, São Paulo, Brasil; [4]Centro de Estudos do Sistema Nervoso Autônomo (CESNA), Departamento de Fonoaudiologia, Faculdade de Ciências, UNESP Marília, São Paulo, Brasil; [5]Universidad Nacional de La Matanza, Departamento de Ciencias de la Salud, Buenos Aires, Argentina

Correspondence: Raimundo RD, Laboratório de Delineamento de Estudos e Escrita Científica da Faculdade de Medicina do ABC, Santo André, São Paulo, Brasil, Telephone 551149937256; e-mail rodrigo.raimundo@fmabc.br

Received: February 24, 2018, Accepted: September 14, 2018, Published: September 24, 2018

who has presented contraindications to the infusion of the dipyridamole stressor.

Variability of heart rate

Before conducting the myocardial perfusion examination, heart rate data were collected from the subjects for 12 minutes, beat-to-beat, by means of a cardiofrequency meter (S810i, Polar Electro Oy, Kempele, Finland), which was fixed to wrist of the patient's right hemisphere, where he received signals from the capture band fixed on the region of the precordium. From the collected records, time series were generated and used for the analysis of HRV [5,7].

After the collection, the data was transferred from the receiver of the cardiofrequency meter to a computer in which the Polar ProTrainer 5 program was installed. And with this program, the filtering of the signal (digital filtering) was done. With manual filtering completed, the files were forwarded to another program (Kubius HRV Analysis 2.0-Physiolab Engineering) thus generating the data for the analysis of the VFC indexes [5].

In the time domain, the MeanRR indices were used in milliseconds (ms), SDNN (ms), rMSSD (ms), pNN50 in percentage (%), RRTri and, finally, TINN (ms). Already in the frequency domain, the LF indices in milliseconds squared (ms2), HF (ms2) and LF/HF. Whereas, in the quantitative analysis of the indices derived from Poincaré graph, SD1 (ms) were measured; SD2 (ms) and SD1/SD2 [5].

Myocardial perfusion scintigraphy

Protocol for administering the radiopharmaceutical: Protocol for two consecutive days for myocardial perfusion scintigraphy, patients underwent myocardial perfusion scintigraphy using the dose of the radio-drug Sestamibi-99mTc (MIBI) of 8 to 10 mCi, or 29 to 37 MBq (approximately 100 μCi/kg or 0.37 MBq/kg) that will be administered by an antecubital vein to the patient at rest [13,14]. Then he was asked to make a small greasy snack (a biscuit from the Social Club brand provolone flavor accompanied by juice of a box of grape flavor) and wandering while waiting for the scintigraphy.

Acquisition of images: The acquisition of the scintigraphic images at rest begins 60 to 90 minutes after the administration of the radioactive dose and MIBI, with the patient in the supine position and the arms fully extended above the head, which will be captured by a gamma camera Millennium MG-Multi Geometry Digital CSE Dual Detector Gamma Camera Acquisition Systems -H3000 ZL-2184116, in circular orbit of 1800 around the patient's chest, beginning with the right anterior oblique projection to the left posterior oblique projection. The detector moves automatically and records 1 image every 30 arc, recording 62 images of 20 seconds each, so the image acquisition time varies from 10 to 15 minutes [1,13,14].

Protocol for the performance of pharmacological stress: On the following day after the resting stage, the patient underwent pharmacological stress testing with dipyridamole, and the patient was placed in the dorsal position and monitored by a Digistress Pulsar 12-lead cardiac monitor from the manufacturer Digitrônica Equipamentos Eletrônicos LTDA 2010. followed by a cardiologist, venous puncture was performed with intravascular device number 20 on the right upper limb, at the intravenous dose of 0.14 mg/kg/minute using a 20 ml syringe for 4 minutes, after 3 minutes of infusion of dipyridamole, the MIBI radiopharmaceutical is administered using the same intravenous access of dipyridamole after 1 minute of MIBI injection and injected with aminophylline at a dose of 140 μg/kg/min, after which time cardiac monitoring was terminated. The patient was instructed to wait for a period of 1h to perform the images, which are acquired in the same way as the resting stage, with the difference that the images are synchronized with the 1-lead electrocardiogram (ECG) of the device itself, and electrodes are placed on the patient's chest, while the gamma photons are detected, the MC-5 lead is recorded, in each projection at least eight images are acquired during the R-R cycle [1,13,15].

Protocol of non-pharmacological stress test: Exercise or treadmill exercise testing, wearing comfortable clothes and sneakers, and having received all the guidelines about the exam, and being informed about the objectives of the test and its methodology, how to avoid physical exertion in the 24 hours before the exam, meals If you smoke, stop smoking 2 hours before the test and 30 minutes afterwards, stop any medication that can change the ECG, heart rate, blood pressure, and heart rate, saving the cases where you want to evaluate the therapeutic efficacy, which is not the case in the present study [1,15].

Patients were monitored by a 12-lead cardiac monitor and MC5 shunt recording was recommended. In systems using 12 leads preserving the CM5 lead, a different distribution of the Mason and Likar leads is used [1].

Left arm electrode placed in the V5 position of the conventional ECG, right leg electrode positioned on the right costal border, at a point determined by the right hemiclavicular line or, on the iliac crest, electrode of the left leg placed at a point on the left costal border determined by the left hemiclavicular line or, on the iliac crest, precordial electrodes at the positions V1, V2, V3, V4 and V6 and the V5 electrode placed immediately next to the classic V5 electrode [1,15].

MIBI is administered at the time of maximal heart rate (MHR), calculated using the Karvonen (FCM=220-age) or submaximal formula, i.e., 85% of the MHR, at a dose of 8 to 10 mCi, or 29 at 37 MBq (approximately 100 μCi/kg or 0.37 MBq/kg) by intravenous access in the upper limb. After the injection of the MIBI, the patient remained in the workout for about 60 seconds, after which time it slows down the treadmill until it stops completely. The test was terminated, the patient electrodes were removed and the patient was instructed to consume the food (the same as described previously) offered by the Nuclear Medicine department of Bandeirantes Hospital, and wait for a period of 60 minutes for the acquisition of the images, in the same way as previously described in the step using pharmacological stress [1,15].

The scintigraphy images were interpreted by two physicians specialized in myocardial perfusion evaluation, using visual and polar perfusion maps (qualitative and semiquantitative), made independently of each other, and without knowledge of HRV information.

The procedure of placement of the cardiofrequency gauge strap does not present risks except for the constraint of placing the patient in the thorax. In addition, contact dermatitis may occur with the brace (although there are no reports). As for the scintigraphy procedure the risks can be of flushing (sensation of heat in the head); angina; migraine; dizziness; hypotension; dyspnea and nausea.

Statistical analysis

The correlation between heart rate variability parameters and cardiac scintigraphy data was tested using Spearman's correlation with the aid of the SPSS program (version 19). The Spearman correlation coefficient is a nonparametric correlation measure that evaluates an arbitrary monotome function that can be the description of the relationship between two variables, without making assumptions about the frequency distribution of the variables. It can be used for the variables measured at the ordinal level, it does not require the assumption that the relationship between the variables is linear and also that the variables are measured in the class interval.

Spearman's coefficient is between -1 and 1, where 1 means a strong positive correlation between two variables, -1 a perfect negative correlation between two variables, that is, if one variable increases, then the other decreases, and 0 means that the two variables do not depend linearly on each other. Normality was verified by the Kolmogorov-Smnnov test. The chi-square test was used to analyze the proportions between the groups. The level of significance was set at $p<0.050$.

RESULTS

Data were collected from 40 patients (18 males and 22 females), with a mean age of 63.9 ± 11 years.

TABLE 1 Correlation of time domain data in relation to the myocardial perfusion score

VFC	SSS (r)	SRS (r)	SDS (r)
SDNN	-0.282	-0.241	-0.17
RMSSD	-0.09	-0.076	-0.04
pNN50	-0.032	-0.071	0.117
TINN	0.017	0.107	-0.073

SDNN: Standard deviation of all RR intervals; RMSSD: Square root of the mean of summation between normal RR intervals; pNN50: Percentage of RR intervals; TINN: Correlation with the standard deviation of all RR intervals; SSS: Sum of the stress score; SRS: Rest score sum; SDS: Sum of differences score; (r): Spearman coefficient

According to the results of table 1 obtained through the statistical analysis, the correlation between SDNN with SSS, SRS and SDS was -0.282, -0.241, -0.170 respectively; Among RMSSD with SSS, SRS and SDS, it was -0.090, -0.076, -0.040 respectively. Among pNN50 with SSS, SRS and SDS, was -0.032, -0.071, 0.117 respectively. Between TINN with SSS, SRS and SDS, it was 0.017, 0.107, -0.073 respectively. However, based on the results presented, there were no significant results ($p>0.05$).

In Table 2 the correlation between LF with SSS, SRS and SDS was 0.026, 0.023, 0.026 respectively. Among HF with SSS, SRS and SDS, it was -0.026, -0.023, -0.026 respectively. The relationship between LF/HF with SSS, SRS and SDS was 0.022, 0.018, 0.021 respectively. Based on the results presented, there were no significant results ($p>0.05$).

TABLE 2 Correlation of the frequency domain data in relation to the myocardial perfusion score

VFC	SSS (r)	SRS (r)	SDS (r)
LF	0.026	0.023	0.026
HF	-0.026	-0.023	-0.026
LF/HF	0.022	0.018	0.021

LF: Joint action of the Vagal and Sympathetic components on the heart with sympathetic predominance; HF: Respiratory modulation and indicator of the vagal nerve acting on the heart; Relationship between LF / HF: Changes between sympathetic and parasympathetic components; SSS: Sum of the stress score; SRS: Rest score sum. SDS: Sum of differences score; (r): Spearman coefficient

Table 3 shows the correlation between SD1 with SSS, SRS and SDS, was -0.090, -0.076, -0.040 respectively. Between SD2 with SSS, SRS and SDS, it was -0.266, -0.231, -0.145 respectively. The relationship between SD1/SD2 with SSS, SRS and SDS was 0.180, 0.172, 0.131 respectively. Based on the results presented, there were no significant results ($p>0.05$).

TABLE 3 Correlation of the quantitative analysis of the indices derived from the poincaré chart in relation to the myocardial perfusion score

VFC	SSS (r)	SRS (r)	SDS (r)
SD1	-0.09	-0.076	-0.04
SD2	-0.266	-0.231	-0.145
SD1/SD2	0.18	0.172	0.131

SD1: Dispersion of points perpendicular to the line of identity and instantaneous index index of the beat-to-beat variability; SD2: Disperses the points along the identity line and represents the HRV in long-term records; Relation between SD1 / SD2: Variations of short and long intervals RR; SSS: Sum of the stress score; SRS: Rest score sum; SDS: Sum of differences score; (r) Spearman coefficient

DISCUSSION

In our study, the analysis of HRV indices in the time and frequency domain was performed with the perfusion myocardial perfusion scans (MPS), and in the literature there are no similar studies, which represent a wide field of studies and contribution to the scientific community.

Reduction in HRV is considered a predictor for autonomic dysfunctions and worsening of already known heart diseases. HRV analysis was performed using linear methods, as a function of two parameters; time domain (SDNN, TINN, rMSSD, pNN50) and frequency domain (HF, LF) [5].

A widely used test to confirm the existence of these perfusion diseases of the heart, mainly the left ventricle, is MPS, due to its high degree of specificity and sensitivity. Based on these two methods, we decided to make a correlation between them, since previous studies have observed that coronary insufficiency is closely linked to a dysfunction of the autonomic modulation of HR, which is characterized by an increase in sympathetic modulation or a decreased vagal modulation [16].

The results of our study [9] showed, HRV indexes in the time domain, SDNN (-0,282, -0,241 and -0,170), being compared with the parameters of myocardial perfusion evaluation, SSS (summed stress score), SRS (summed difference score) and SDS (summed difference score), respectively, that is, there is no correlation of global autonomic alterations with myocardial perfusion changes in stress, rest, and sum of differences. Some studies have associated the reduction of SDNN values and SDS results with the presence of stable angina, as well as coronary stenosis, increasing the risk of AMI.

As with TINN, which also evaluates global vaso-vagal activity, the results were 0.017, 0.107, -0.073, compared with SSS, SRS, SDR, respectively, even though there was no significant correlation, we noticed a higher positive correlation with the score in rest. In other study [2], it shows a decrease in HRV in the time domain, as well as a myocardial sympatho-vagal dysautonomy, in patients with vasovagal syndrome. The result of rMSSD (Root-Mean of square successive NN interval difference), which reflects the parasympathetic activity of the heart, was -0.090, -0.076, -0.040, compared to SSS, SRS, SDR, respectively, this correlation was even lower.

The pNN50, which also evaluates the parasympathetic activity, was -0.032, -0.071 and -0.117, compared with SSS, SRS, SDR respectively, also showed no relation However, in this case, it showed a somewhat higher correlation of parasympathetic activity with RDS.

The frequency domain uses HF (High Frequency) records, which corresponds to respiratory modulation and is an indicator of the vagus nerve acting on the heart and LF (Low Frequency), due to the joint action of the parasympathetic and sympathetic components on the heart, with the preponderance of the sympathetic. Analyzing the sympathetic-vagal balance in our study through the HF / LF indices, the results were 0.022, 0.018, 0.021, and comparing with the SSS, SRS and SDR perfusion analysis parameters, respectively, also found no correlation between the two analyzes [16].

Comparing the time domain correlations of rMSSD, pNN50, and HF frequency assesses the parasympathetic activity and LF evaluates the sympathetic activity of the heart, with findings of the myocardial perfusion results, showed that there is no correlation between them, however, studies observed a significant correlation between autonomic

disorders with HRV reduction, with coronary disease, systemic arterial hypertension, increased risks for AMI, atherosclerosis [17].

Kunz et al. [8] analyzed the relationship between autonomic functions and the clinical and angiographic characteristics of patients with CAD in 52 men. The HRV was analyzed using Shannon's entropy (SE), which calculates the degree and complexity distribution of a series of standard RR intervals (iRR) and symbolic analysis (0V and 2ULV), which relate to the predominance of the sympathetic and vagal, respectively. The results of this study, based on SE and symbolic analysis, indicate the presence of cardiac autonomic dysfunction in patients with CAD with occlusion ≥ 50%, compared to the same patients with CAD with <50% of obstruction and normal individuals. These results indicate that the autonomic dysfunction is related to the degree of coronary occlusion and cardiac involvement.

Migra et al. [16] studied the incidence of early myocardial changes and autonomic dysfunction in 47 patients with asymptomatic type 1 (DM1) and type 2 diabetes mellitus (DM1), with a negative exercise test and no signs of systolic dysfunction, through the analysis of VFC and CPM Gatede SPECT 99mTc. The results were diastolic dysfunction was found in 10% of DM1 and 11% of patients with DM2 by echocardiography, whereas none of the patients had systolic dysfunction. Hypoperfusion was confirmed in 35% DM1 and 60% DM2. The diagnosis of cardiac autonomic neuropathy was established in 60% of patients with DM1 and 77% of patients with T2DM. In the DM1 group, a significant association was found between cardiac autonomic neuropathy (NC) and frequency of hypoglycemia, the results of the study show a high incidence of myocardial hypoperfusion and cardiac autonomic neuropathy in asymptomatic diabetic patients, without changes in the standard diagnostic approaches, including exercise test and echocardiography. Therefore, it is concluded that diabetic heart disease in asymptomatic patients can be detected by more sensitive methods, such as HRV measurement and myocardial scintigraphy.

In the study by Kochiadakis et al. [9], the objective was to examine autonomic disorders in patients with different types of vasovagal syndrome, using myocardial scintigraphy, using iodine-123-metaiodobenzylguanidine (123 I-MIBG), which represents an analogue is used to assess pathological changes in the integrity and function of pre-synaptic myocardial nerve endings, along with time-domain VCF analysis, to assess the sympatho-vagal function of these patients, the results indicate that patients with vasovagal syncope showed significant dysfunction of myocardial adrenergic innervation. While our MPS study, MIBI-99mTc was used, which is captured in the mitochondrial membrane, concentrating in greater quantity in tissues with high metabolic rate, in a way proportional to the regional blood flow, thus analyzing how much the myocardium is perfused, and being correlated with HRV, showing no relationship between left ventricular perfusion deficit and VCF in the time domain.

Other studies [11,16,17] have identified that the risk of coronary artery disease (CAD), death or myocardial infarction (MI) is associated with ≥ 10% ischemic myocardium in the nuclear image due to stress. The study revealed that an area of ≥ 10% ischemia in the nuclear image due to stress was associated with an average death rate of CAD or IM of 4.9%, in addition to accurately predicting the increased risk of heart disease according to the scintigraphic images, and that these risks are increased in the male population18. However, in these studies, no method was used to assess the autonomic status of the heart as we did in our study.

Hayano et al. [17] compared HRV with coronary angiography findings in 56 patients (55% of them without prior AMI). Regardless of the location of coronary lesions and ventricular function, there is a correlation between the severity of angiographic lesions and the presence of decreased HRV. In this way, patients with coronary artery disease, who undergo successful angioplasty and normalize the previously ischemic wall, present an increase in HRV with values close to the normal group. The authors interpreted that the existing ventricular alterations previously led to a greater afferent mechanoreceptive nerve discharge, which contributed to the existing dysautonomia. Differently from our work, they used a coronary angiography that evaluates the function and degree of obstruction of the coronary arteries, while we evaluated the perfusion of the cardiac third, as well as the presence of areas of ischemia, through CPM. For this reason the importance of early diagnosis of myocardial ischemia, as well as the autonomic alterations of the heart.

In our study we compared the parasympathetic activity by HRV analysis in the time domain (RMSSD, PNN50), with the left myocardial perfusion state using MPS, in order to find a correlation between an autonomic disorder with decreased perfusion, which consequently leads to an increased risk of AMI, we found no significant correlation between the two methods, and Reis et al. [10] based on Kleiger et al. observed a global mortality after AMI 5.3 times higher in the group with lower HRV (SDNN<50 ms), quantified by time domain indices, independent of other factors, such as ventricular arrhythmia frequency, left ventricular ejection fraction (LVEF) and the use of beta-blockers and digital.

According to Rocha et al. [11], the reduction of HRV in patients with stable angina has already been found in other studies, which showed the SDNN and SDANN indices of the HRV analysis, were lower than the normal values of a population without stable angina. In another study Mamoru, et al (2012) studied eighty-seven patients with suspected or diagnosed stable angina for diagnosing CAD using MPS, the results showed that SDS (summed difference score) was significantly associated with coronary stenosis , increasing the risk for AMI. These studies have shown that the presence of stable angina may be a strong predictor for HRV changes and myocardial perfusion, increasing the risk of heart disease. In this context, comparing with our study, an individual with stable angina, may have serious compromised blood supply to the heart, as well as changes in HRV, which justifies the purpose of our study.

In the literature, some studies [12,17] were found, relating myocardial scintigraphy using iodine-123-metaiodobenzylguanidine (123 I-MIBG), which directly studies myocardial nerve activity, with HRV analysis evaluating the autonomic activity of the heart, and the results showed an association between autonomic alteration, with a decrease in HRV14, which results in greater potential risks for heart disease. The study by Scholte et al. [12], evaluated the cardiac risk of CAD in patients with asymptomatic T2DM, comparing HRV with myocardial scintigraphy with 123 I-MIBG, in this study, the authors concluded that scintigraphy was more sensitive early detection and stratification of CAD in patients with no change in perfusion. In our study, we compared perfusion findings with VCF, and there was no significant correlation between autonomic control and myocardial perfusion, as well as detection of CAD, although scintigraphy results in some patients had perfusion deficits.

Other studies [16,18,19] analyzed HRV with angiographic findings, considering areas of coronary occlusion closely related to HRV decrease, predisposing the individual to a shorter life expectancy.These studies differ from our study, since our objective was to evaluate autonomic activity by HRV analysis and correlate with left ventricular perfusion conditions through CPM using the MIBI 99mTc, but no significant correlation was found.

The wide possibility of non-invasive methods capable of evaluating directly or indirectly the internal functions of the organism, is gaining a considerable importance today, since the heart is the vital organ that exerts one of the main organic functions for the maintenance of the life. Heart Rate Variability is a promising clinical tool widely used to assess and identify health impairments. While myocardial perfusion scintigraphy evaluates the functional impairment due to coronary lesions, being able to inform the perfusion conditions of the viability of the cardiac muscle and also to show possible deficits of blood supply.

However, no similar studies were found in the literature, which makes this study pioneer. We must take into account the limitation of this study, such as the small number of subjects in the sample, and some variables that were not evaluated.

CONCLUSION

There was no correlation between cardiac autonomic modulation by HRV linear parameters with myocardial perfusion scintigraphy in patients with or without prior diagnosis of ischemic heart disease.

REFERENCES

1. Slomka PJ, Berman DS. I Diretriz sobre Cardiologia Nuclear, 2005. JACC Cardiovasc Imaging. 2010.
2. Tamarappoo BK, Dey D, Nakazato R, et al. Comparison of the extent and severity of myocardial perfusion defects measured by CT coronary angiography and SPECT myocardial perfusion imaging. JACC Cardiovasc Imaging. 2010;3:1010-9
3. Milan Lomsky, Lena Johansson, Peter Gjertssonet, et al. Normal limits for left ventricular ejection fraction and volumes determined by gated single photon emission computed tomography-a comparison between two quantification methods. Clin Physiol Funct Imaging. 2008;28:169-73.
4. Chalela, WA, Meneghetti JC. Atualização da Diretriz da Sociedade Brasileira de Cardiologia sobre Cardiologia Nuclear. Arquivos Brasileiros de Cardiologia. 2005.
5. Vanderlei LC, Pastre CM, Hoshi RA, et al. Noções básicas de variabilidade da frequência cardíaca e sua aplicabilidade clínica. Rev Bras Cir Cardiovasc 2009;24.
6. Cambri LT, Fronchetti L, De-Oliveira FR, et al. Variabilidade da frequência cardíaca e controle metabólico. Arq Sanny Pesq Saúde. 2008;1:72-82.
7. Godoy MF, Roveri Pde O, Santos MA, et al. Obstructive coronary disease in patients with chronic liver disease awaiting liver transplantation. Arq Bras Cardiol. 2011;96:26-30.
8. Kunz VC, Souza RB, Takahashi AC, et al. The relationship between cardiac autonomic function and clinical and angiographic characteristics in patients with coronary artery disease. Rev Bras Fisioter. 2011;15:503-10.
9. Kochiadakis G, Marketou M, Koukouraki S, et al. Cardiac autonomic disturbances in patients with vasovagal syndrome: comparison between iodine-123- metaiodobenzylguanidine myocardial scintigraphy and heart rate variability. Europacev. 2012;14:1352–8.
10. Reis AF, BG Bastos, ET Mesquita, et al. Disfunção Parassimpática, Variabilidade da Frequência Cardíaca e Estimulação Colinérgica após Infarto Agudo do Miocárdico. Arq. Bras. Cardiol. 1998;70.
11. Rocha RM, Albuquerque DC de, Filho FM, et al. Heart rate variability and circadian rhythm in patients with stable angina. Revista da SOCERJ. 2005;18:429-42.
12. Scholte AJ, Schuijf JD, Delgado V, et al. Cardiac autonomic neuropathy in patients with diabetes and no symptoms of coronary artery disease: Comparison of 123I-metaiodobenzylguanidine myocardial scintigraphy and heart rate variability. Eur J Nucl Med Mol Imaging. 2010;37:1698-705.
13. Schinkel AF, Boiten HJ, van der Sijde JN, et al. 15-Year outcome after normal exercise (99m) Tc-sestamibi myocardial perfusion imaging: What is the duration of low risk after normal scan. J Nucl Cardiol. 2012;19:901-6.
14. Azevedo JC de, Félix RC, Corrêa PL, et al. Medium term prognostic value of stress myocardial perfusion scintigraphy in a chest pain unit. Arq Bras Cardiol. 2007;88:602-10.
15. Shaw LJ, Berman DS, Picard MH, et al. Comparative definitions for moderate-severe ischemia in stress nuclear, echocardiography, and magnetic resonance imaging. JACC: Cardiovascular Imaging, 2014;7:593-604.
16. Migra M, Knazeje M, Ochodnicky M, et al. The detection of early myocardial changes in asymptomatic diabetic individuals by 99mTc – Myoview gated-SPET and heart rate variability measurement, Bratisl Lek Listy 2014;115:216-20.
17. Hayano J, Sakakibara Y, Yamada M, et al. Decreased magnitude of heart rate spectral components in coronary artery disease. Its relation to angiographic severity. Circulation.1990;81:1217-24.
18. Sakari S, Vanninen E, Hedman A, et al. Myocardial 123I-metaiodobenzylguanidine washout and heart rate variability in asymptomatic subjects. Ann Noninvasive Electrocardiol. 2012;17:8-13.
19. Mamoru N, Morita S, Yoshida R, et al. Detection of coronary artery disease using automated quantitation of myocardial perfusion on single-photon emission computed tomography images from patients with angina pectoris without prior myocardial infarction. Circ J. 2012;76:2280-2.