Predictors of Atherosclerotic Plaque in Individuals with Asymptomatic Ischemia on Physical Stress Echocardiography

Camila Andrade Maia¹, Igor Lobão Barbosa¹, Antonio Carlos Sobral Sousa¹234, Enaldo Vieira de Melo¹; Thaiane Muniz Martins¹, Irlaneide da Silva Tavares¹, Igor Larchert Mota¹2, Fabiola Santos Gabriel¹2, Carlos José Oliveira Matos¹2, Joselina Luzia Menezes Oliveira²45

Departamento de Medicina, Universidade Federal de Sergipe (UFS), São Cristóvão, Sergipe; Centro de Ensino e Pesquisa e Laboratório de Ecocardiografia (ECOLAB) da Fundação São Lucas, Aracaju, Sergipe; Fellow of the American College of Cardiology³, Washington DC - EUA; Núcleo de Pós-Graduação em Medicina da UFS, São Cristóvão, Sergipe - SE; Instituto Dante Pazzanese de Cardiologia⁴, São Paulo, SP - Brazil

Abstract

Background: Myocardial ischemia may occur in asymptomatic patients without a history of coronary artery disease (CAD). Stress echocardiography (SE) is a method with good diagnostic accuracy, while coronary cineangiography (CCA) is the gold standard method to detect obstructive CAD. However, many patients with ischemia on functional tests show nonobstructive lesions on CCA.

Objective: To assess the presence of predictors of obstructive atherosclerotic plaques in asymptomatic individuals with an SE positive for myocardial ischemia.

Methods: Cross-sectional study with 278 asymptomatic individuals who underwent SE and CCA, divided into groups G1 (obstructive atherosclerotic lesions ≥ 50%) and G2 (plaques below 50% or nonexistent). Quantitative variables were compared with Student’s t test or Mann-Whitney test for independent groups, according to the normality of the sample. For categorical variables, we used the chi-square test or Fisher’s exact test, as appropriate. Logistic regression was used to identify independent predictors of atherosclerotic lesions.

Results: The numbers of patients in G1 and G2 were 233 (83.3%) and 45 (16.2%), respectively. The mean age was higher in G1 (60.9 ± 9.56 years versus 51.8 ± 10.05 years, p < 0.001). G1, when compared with G2, had more patients with hypertension (65.2% versus 48.9%, respectively, p = 0.03) and dyslipidemia (77.3% versus 57.8%, respectively, p = 0.006). G2, when compared with G1, had a higher frequency of mild obesity (33.3% versus 14.2%, respectively, p = 0.002), which emerged as a protective factor for atherosclerotic lesions.

Conclusion: The predictors of atherosclerotic plaques in asymptomatic patients with ischemia on SE were age, male gender, and fixed ischemia. (Int J Cardiovasc Sci. 2016;29(6):460-470)

Keywords: Plaque, Atherosclerosis; Coronary Artery Disease; Myocardial Ischemia; Coronary Angiography; Echocardiography, Stress.

Introduction

Coronary artery disease (CAD) is currently the leading cause of mortality in Brazil and worldwide. Therefore, one of the most frequent challenges of everyday cardiology practice is the evaluation of patients with symptoms indicating myocardial ischemia.¹ The greater the number or severity of independent risk factors (hypertension, diabetes mellitus [DM], dyslipidemia, family history of CAD, smoking, obesity, and sedentary lifestyle), the greater the chance of an individual presenting cardiovascular events or early death.²⁴¹

Silent myocardial ischemia (SMI) may occur in entirely asymptomatic patients, even in the absence of a history of ischemic events.¹² In patients with this type of ischemia, the preventive use of aspirin and strict control of coronary risk factors may reduce the incidence of cardiac events.¹³ However, a high frequency of CAD
has been recently documented in apparently healthy individuals with SMI.\textsuperscript{14}

In clinical practice, asymptomatic patients are frequently evaluated with a stress methodology. However, many patients with tests resulting positive for ischemia have nonobstructive lesions when evaluated at a later time by coronary cineangiography (CCA).\textsuperscript{15}

Thus, it is useful to identify clinical characteristics and/or complementary tests predictive of obstructive coronary lesions in asymptomatic patients with SMI undergoing stress echocardiography (SE). Nonetheless, SMI detected after myocardial infarction has been associated with numerous risk factors for CAD.\textsuperscript{16}

While researching this issue, we were unable to identify studies on SE that have been published about this specific topic. In fact, the findings are not always reproducible if the research methodology is modified. Therefore, the goal of the present study was to identify the presence of predictors of obstructive atherosclerotic plaques on CCA in asymptomatic individuals with an SE positive for myocardial ischemia.

**Methods**

**Design** – This was an observational, retrospective, cross-sectional study.

**Study population** – From January 2000 to December 2012, a total of 9,652 patients with proven or suspected CAD were referred by their physicians to the echocardiography laboratory (ECOLAB) of Clínica e Hospital São Lucas, which is considered to be a referral cardiology institution in the city of Aracaju/Sergipe (Brazil) and holder of accreditation level three (Instituto Qualificação de Gestão, IQG). From the total sample, we selected those individuals who were asymptomatic ($n = 3,645$), of which 366 were positive for myocardial ischemia on SE. Of these, only 278 (7.6\% of the total) volunteers who met the following inclusion criteria were included in the subsequent analysis: having an SE result positive for myocardial ischemia, having undergone CCA, and age greater than or equal to 25 years. When the patient had undergone more than one SE or CCA during the research period, we used only the results of the most recent tests. Based on the presence of an obstructive atherosclerotic lesion on CCA, the eligible patients were divided into two groups: group 1 (G1), consisting of 233 patients with obstructive atherosclerotic lesions ≥ 50\% and group 2 (G2), consisting of 45 individuals with plaques that were < 50\% or nonexistent.

As for the ethical criteria, the study was approved by the Ethics and Research Committee of the Federal University of Sergipe under the CAAE number (1818.0.000.107-06). Prior to participating in the study, all volunteers signed an informed consent form.

**Clinical characteristics** – We used a structured questionnaire to collect clinical data, including weight, height, symptoms, medication used, risk factors for CAD, history of heart disease, and results of laboratory tests previously carried out.

Dyslipidemia was defined as a level of serum total cholesterol greater than 200 mg/dL (after a fasting period of 12 hours) and/or triglyceride levels above 150 mg/dL (after a fasting period of 12 hours) or use of antilipidemic agents (statins and/or fibrates).\textsuperscript{9} The presence of hypertension was considered when blood pressure (BP) levels measured with a calibrated sphygmomanometer and an appropriate cuff were greater than or equal to 140 x 90 mm Hg, or when the patient used an antihypertensive medication.\textsuperscript{6,8,11} The BP was assessed at the time of the initial clinical evaluation by an experienced cardiologist at the service (the sole person responsible for the clinical evaluation, stress test [ST] and SE), in three sequential measurements, with 1 minute intervals, obtained from both upper limbs with the patient standing, sitting, and lying down, with proper care to obtain an actual diagnosis of hypertension in accordance with the VI Brazilian Hypertension Guidelines.\textsuperscript{8}

The presence of DM\textsuperscript{2,3} was defined by the occurrence of fasting plasma glucose levels above 126 mg/dL, or use of insulin and/or oral hypoglycemic agents. In regards to body weight, individuals with a body mass index (BMI) greater than 30 kg/m\textsuperscript{2} were considered obese. A family history of premature CAD was defined as the occurrence of clinical CAD in any first-degree relative before the age of 55 years in men and 65 years in women. Patients who used tobacco in the past month were considered to be smokers.

The medical indications for SE included a cardiological check-up, preoperative evaluation for noncardiac surgery, positive ST without clinical evidence of CAD, and negative ST with clinical characteristics of CAD.

The experimental procedures consisted in a complete clinical investigation (medical history and physical examination), followed by a 12-lead electrocardiogram (ECG) and echocardiography at rest.
Sequentially, we performed the ST on a treadmill and, shortly thereafter, we obtained new echocardiographic images after stress. The decision to recommend CCA after an SE resulting positive for myocardial ischemia was at the discretion of the physicians of the patients, according to their clinical practice.

**Stress echocardiography protocol** - All participants in this study underwent SE, observing the technical aspects classically described by Armstrong et al. The physical effort was interrupted with the emergence of the following symptoms and/or signs: chest pain, dyspnea, muscle fatigue, hypertension (BP ≥ 240 x 120 mmHg), hypotension, presyncope, and severe arrhythmia. The ST was performed according to the Bruce protocol, in which the individual was monitored throughout the test with a 12-lead ECG. The heart rate (HR) was continuously monitored, and the patients were encouraged to exceed 85% of the maximum age-predicted HR. The effort load was expressed in metabolic equivalents (METs). The ST was considered positive for myocardial ischemia in the presence of a horizontal or descending depression of the ST segment ≥ 1 mm in men and ≥ 1.5 mm in women, at 0.08 sec. from the J point. For the echocardiography at rest and immediately after the exercise, the patients were asked to lay in the left lateral decubitus position so that echocardiographic views could be obtained from parasternal and apical acoustic windows. The echocardiographic images were obtained with the equipment Hewlett Packard/Phillips SONOS 5500 with a 2.5 MHz transducer and recorded on a VCR or DVD.

The left ventricular mass (LVM) index (LVMDI) was obtained by calculating the LVM indexed to the body surface area to adjust the differences of the heart size to variations in the patient’s size. We used the following formulas: LVM = 0.8 X [1.04 [(IVSD + LVEDD + LVPWD)3 - (LVEDD)3]] + 0.6 g, in which IVSD is the interventricular septum in diastole, LVEDD is the left ventricular end-diastolic diameter, and LVPWD is the left ventricular posterior wall during diastole; and BS = (W – 60) X 0.01 + H, where BS is the body surface area (in m²), W is the weight (kg), and H is the height (in meters).

The regional motility of the left ventricular wall was assessed semiquantitatively by an experienced echocardiographer with level III training, as recommended by the American Society of Echocardiography. Motility at rest and after exercise was quantified using 16 segments and classified as 1 (normal), 2 (hypokinetic), 3 (akinetic), and 4 (dyskinetic). The left ventricular motility score index (LVMSI) was obtained by adding up the scores of each segment and dividing the final value by 16, which is the total number of left ventricular segments.

Furthermore, we also evaluated the left ventricular systolic function based on the LVMSI, whereby the patients were classified as normal (equal to 1), with mild ventricular dysfunction (between 1.01 and 1.6), moderate ventricular dysfunction (between 1.61 and 2), and severe ventricular dysfunction (greater than 2).

The development of changes in segmental motility induced by stress was considered an indication of myocardial ischemia. The observation of an ischemic response to the SE was thus classified as a) ischemic, in the presence of alterations in the left ventricular segmental motility induced by stress; (b) fixed ischemia, in the presence of segmental abnormality at rest, which remained unchanged after exercise; and c) fixed and induced ischemia, when the effort worsened a previous segmental abnormality or caused the appearance of abnormalities in another left ventricular region. Individuals displaying a hyperdynamic response and preserved motility in all 16 segments were considered normal and, therefore, were excluded from the study.

**Coronary cineangiography** – This test was performed voluntarily by all 278 patients (who were positive for myocardial ischemia on SE). CCAs obtained until 6 months after the SE were considered in the analysis. We used the Judkins technique, preferably through the right femoral artery. The angiograms obtained were analyzed by a skilled interventional cardiologist at our department, using the qualitative score system. After the completion of the method and according to the results, these patients were allocated to group G1, when we observed the presence of obstructive atherosclerotic lesions (≥ 50%) in at least one coronary artery, or G2 when the plaques were < 50% or nonexistent.

**Statistical analysis** - Quantitative variables are described as mean and standard deviation (SD). The Kolmogorov-Smirnov test was used to evaluate the assumption of normality of the analyzed sample. Then, Student’s t test or Mann-Whitney test for independent groups was used according to the normality of the sample. As for categorical variables, we used absolute frequency and percentage and, to compare characteristics of these variables between the two groups, we used the chi-square test or Fisher’s exact test, when appropriate. The association between the occurrence of ischemia on SE and the presence of obstructive atherosclerotic plaques on CCA was evaluated with logistic regression.
to determine the adjusted and unadjusted odds ratios (ORs). For inclusion in the model, we considered crude ORs with \( p < 0.10 \), and to remain in the model, we considered those with \( p < 0.05 \). In order to perform statistical calculations, we used the software Statistical Package for the Social Sciences, version 21 (SPSS 21, Chicago, IL, USA). All tests with \( p \) (two-tailed) < 0.05 were considered as statistically significant.

**Results**

All patients underwent CCA; 233 (83.3%) presented obstructive atherosclerotic lesions and 45 (16.2%) displayed an absence of plaques. Among the changes on SE, there was a greater frequency of ischemic patients (45%, 95% confidence interval [95%CI] 39.2 – 51.1%, \( n = 125 \)), followed by fixed ischemic patients (38.5%, 95%CI 32.7 – 44.2%, \( n = 107 \)) and, to a lesser degree, fixed and induced ischemic patients (16.5%, 95%CI 12.6 – 44.2%, \( n = 46 \)).

There were differences between the groups (G1 versus G2) with regard to gender, obesity, hypertension, age, BMI, dyslipidemia, previous acute myocardial infarction (AMI), coronary artery bypass grafting (CABG) surgery, and angioplasty. The G1 group had patients with higher mean age and a higher frequency of subjects who were male and had hypertension, dyslipidemia, prior AMI, CABG, and angioplasty, while the G2 group showed a higher frequency of obese individuals. There were no differences between the groups with regard to the occurrence of DM, smoking, and family history of CAD (Table 1).

**Clinical characteristics** – We evaluated 278 patients, of whom 192 (69.1%) were men. The mean age was 59.5 ± 10.2 years, ranging from 29 to 85 years in both groups, as shown in Table 1.

**Echocardiographic characteristics** – The patients in group G1 showed a mean LVMSI during rest and stress that was significantly higher (\( p < 0.001 \)) than those in group G2.

The G1 group had 96 (76.8%) ischemic results, 97 (90.7%) fixed ischemias, and 40 (87%) fixed and induced ischemias. The G2 group showed 29 (23.2%) ischemic results, 10 (9.3%) fixed ischemias, and 6 (13%) fixed and induced ischemias, with a significant difference between the groups (\( p = 0.01 \) (Graph 1; Figures 1 and 2)).

<table>
<thead>
<tr>
<th>Variable</th>
<th>GROUP 1 83.3% (233)</th>
<th>GROUP 2 16.2% (45)</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male gender - n(%)</td>
<td>168 (72.1%)</td>
<td>24 (53.3%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Age (years)(^1)</td>
<td>60.9±9.56</td>
<td>51.8±10.05</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>BMI (kg/m(^2))(^1)</td>
<td>26.7±3.73</td>
<td>29.06±4.7</td>
<td>0.003</td>
</tr>
<tr>
<td>Obesity - n(%)</td>
<td>33 (14.2%)</td>
<td>15 (33.3%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Hypertension - n(%)</td>
<td>152 (65.2%)</td>
<td>22 (48.9%)</td>
<td>0.03</td>
</tr>
<tr>
<td>Diabetes mellitus - n(%)</td>
<td>48 (20.6%)</td>
<td>6 (13.3%)</td>
<td>0.259</td>
</tr>
<tr>
<td>Dyslipidemia - n(%)</td>
<td>180 (77.3%)</td>
<td>26(57.8%)</td>
<td>0.006</td>
</tr>
<tr>
<td>Smoking - n(%)</td>
<td>12 (5.2%)</td>
<td>4 (8.9%)</td>
<td>0.324</td>
</tr>
<tr>
<td>Family history of CAD - n(%)</td>
<td>149 (63.9%)</td>
<td>30 (66.7%)</td>
<td>0.727</td>
</tr>
<tr>
<td>Prior infarction - n(%)</td>
<td>56 (24.1%)</td>
<td>4 (8.9%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Bypass - n(%)</td>
<td>44 (19%)</td>
<td>0 (0.0%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Angioplasty + stent - n(%)</td>
<td>43 (18.5%)</td>
<td>0 (0.0%)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

\(^1\)Student’s t test for independent data. Other variables: chi-square or Fisher’s exact test.
Figure 1 – Male patient, aged 57 years with CI: Chronotropic Incompetence (85% of the maximum expected for age, heart rate [HR] = 139 beats per minute). He reached an HR of 110 beats per minute. On stress echocardiography (SE), he presented an akinetic apical septum and hypokinetic antero-apical segment. On coronary cineangiography (CCA), he presented coronary stenosis greater than 50%.

Graph 1 – Result of stress echocardiography (SE) in asymptomatic patients positive for myocardial ischemia and submitted to coronary cineangiography.
Figure 2 – Male patient, aged 57 years with CI: Chronotropic Incompetence (85% of the maximum expected for age, heart rate [HR] = 139 beats per minute). He reached an HR of 114 beats per minute. On stress echocardiography (SE), he presented an akinetic infero-medial septum and hypokinetic infero-apical segment. On coronary cineangiography (CCA), he presented a right coronary stenosis greater than 70%.

**Logistic regression analysis** – The adjusted logistic regression analysis showed that age, male gender, and the presence of fixed ischemia were independent predictors of obstructive atherosclerotic lesions on CCA. Hypertension, DM, and a family history of CAD were not predictive risk factors for atherosclerotic CAD. Obesity emerged as a protective factor for atherosclerotic CAD (Table 3).

**Discussion**

This study reported relevant clinical findings in a significant sample of asymptomatic patients with positive SE for myocardial ischemia and who subsequently underwent CCA. In total, 10% (n = 366) of the asymptomatic patients displayed myocardial ischemia on SE. Another finding was the observation that the clinical characteristics of age, gender, and fixed ischemia were independently associated with positive results for the presence of obstructive atherosclerotic lesions on CCA in asymptomatic patients. On the other hand, obesity, hypertension, dyslipidemia, and BMI were also significant findings but did not emerge as predictors of the presence of atherosclerotic lesions in this population. In a comparison with data from the literature, the study population consisted predominantly of male subjects aged 60 and above; therefore, a population in which CAD is more present.

Of the 487 participants of the Swiss Interventional Study on Silent Ischemia Type I (SWISSI I), 263 were diagnosed with SMI, resulting in a frequency of 54%, which was higher to that found in our study (10%). A review of the literature showed frequencies of SMI between 9% and 57%. This wide range is probably due to differences in the analyzed populations (age of the patients, inclusion or exclusion of patients with high risk factors or symptoms of CAD, and definition of SMI). The different techniques used (ECG at rest, ST, SE, myocardial scintigraphy, or coronary angiography), as well as the number of positive tests required for the diagnosis of SMI, are equally responsible for the wide range of SMI frequencies.

Age was related to the presence of atherosclerotic lesion (Table 1). Since this pathological process becomes...
worse with aging, age may have a strict association with CAD.\textsuperscript{25} The risk of cardiovascular events in elderly individuals aged 80 – 89 years is 16 times higher than in adults aged 40 – 49 years.\textsuperscript{26}

In contrast, in elderly individuals aged ≥ 74 years, the presence and number of risk factors do not seem to be predictors of SMI.\textsuperscript{16} Nevertheless, in relation to chronotropic competence, it seems that elderly patients with chronotropic incompetence have a higher mean age (67.3 ± 6.2 years) when compared with the patients in our study (59.5 ± 10.2 years) (Table 2).\textsuperscript{27}

The SE is a useful method to predict cardiac events in diabetic patients with suspected or diagnosed CAD.\textsuperscript{13} In our study, DM was present in 48 (20.6%) patients with an atherosclerotic lesion on CCA; nonetheless, the occurrence of DM was similar between the groups (since there was no statistically significant difference between both) and was not considered as a predictive factor for atherosclerosis in this group of patients. Elhendy et al.\textsuperscript{28} studied 563 diabetic patients with CAD who underwent SE over an average period of 3 years, of whom 50 (9%) presented a cardiac event during follow-up. Malhotra et al.\textsuperscript{16} found a positive association between DM and SMI, with an OR greater than two times; however, our study found an OR of 1.5 times, but without statistical significance.

The frequency of obesity was higher in the group that displayed plaques that were < 50% or nonexistent on CCA, and this same group showed a higher mean BMI (29.06 ± 4.7 kg/m\textsuperscript{2}) and a younger population (51.8 ± 10.05 years). On logistic regression analysis, obesity emerged as an independent protective factor for atherosclerotic CAD, a finding similar to other studies.\textsuperscript{29-31} Furthermore, there is evidence of a relationship between a high BMI and lower mortality.\textsuperscript{32} This “obesity paradox” has also been observed in patients with congestive heart failure and in individuals undergoing CABG surgery. It is believed that, in obese individuals, this protection arises from the presence of a greater coronary diameter and lower age groups.\textsuperscript{32-34}

As to the echocardiographic characteristics, the G1 group showed a higher and significant mean (p < 0.01) LVMSI at rest and during exercise compared with the G2 group (Table 2). The ejection fraction showed no significant difference between the groups in our population, a result in line with that found in the study by Mahfouz et al.,\textsuperscript{35} who compared asymptomatic hypertensive and normotensive individuals with regard to the occurrence of SMI and diastolic dysfunction. It is worth mentioning that there was no difference in our study with regard to ejection fraction between the groups since this was a sample of patients who were subjected to physical effort and who showed preserved physical capacity. Furthermore, 90% of these patients were covered by supplemental health insurance and, therefore, had a greater chance of adhering to treatment, resulting in better test performance.

Secundo et al.\textsuperscript{26} and Vasconcelos et al.\textsuperscript{37} conducted studies in the same line of research of our own. These authors assessed, respectively, echocardiographic parameters in nonelderly individuals and the occurrence of left bundle-branch block in patients undergoing SE and observed differences in LVMI and LVMSI at rest and during exercise. In contrast, our study found differences in LVMSI at rest and under stress, but the groups were similar with respect to LVMI (102 ± 31.7 versus 98.6 ± 30.6, p = 0.54).\textsuperscript{26,37}

Although we found no differences between the groups regarding the presence of dyspnea during physical effort (p = 0.059), there was a greater frequency of this finding in group G2. It is interesting to note that this same group showed a higher frequency of obesity, which has already been reported in the literature.\textsuperscript{36}

The confluence of cardiovascular risk factors contributes to the development of atherosclerotic disease and the occurrence of cardiovascular events. Therefore, the recognition of risk factors predicting CAD, even in asymptomatic individuals with SMI, should receive special attention in primary prevention, since it has been demonstrated that these patients may present with significant obstructive coronary disease.\textsuperscript{15}

**Limitations**

The present study has limitations. The patients were selected from a single center, which conducts most SE tests in patients covered by supplemental health insurance and in only a small amount of patients covered by the Brazilian Unified Health Care System (Sistema Único de Saúde, SUS), which indirectly resulted in a greater differentiation of the sample in relation to the target population. The definitive exclusion of symptoms based on referrals for SE is difficult in retrospective analyses. Moreover, the coronary risk factors were self-reported at the time that the test was conducted and were not confirmed by an analysis of medical records. There was no anatomical correlation between the degree
Table 2 – Structural and functional findings of stress echocardiography (SE) in patients positive for myocardial ischemia undergoing coronary cineangiography

<table>
<thead>
<tr>
<th>Variable</th>
<th>GROUP 1 83.3% (233)</th>
<th>GROUP 2 16.2% (45)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aorta (cm)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>3.24±0.40</td>
<td>3.4±0.71</td>
<td>0.18</td>
</tr>
<tr>
<td>Left atrium (cm)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>4.06±0.57</td>
<td>3.97±0.58</td>
<td>0.54</td>
</tr>
<tr>
<td>Ejection fraction&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.63±0.08</td>
<td>0.61±0.07</td>
<td>0.23</td>
</tr>
<tr>
<td>LVMI (g/m&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>102±31.7</td>
<td>98.6±30.6</td>
<td>0.54</td>
</tr>
<tr>
<td>LVMSI at rest&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1.21±0.2</td>
<td>1.06±0.1</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>LVMSI at effort&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1.34±0.4</td>
<td>1.1±0.1</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Relative thickness of the LV (cm)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>30.5 ± 5.82</td>
<td>31.2±5.6</td>
<td>0.51</td>
</tr>
<tr>
<td>Segmental alteration at rest - n(%)</td>
<td>137 (58.8%)</td>
<td>17 (37.8%)</td>
<td>0.009</td>
</tr>
<tr>
<td>Segmental alteration during effort - n(%)</td>
<td>135 (57.9%)</td>
<td>33 (73.3%)</td>
<td>0.053</td>
</tr>
<tr>
<td>Time on the treadmill&lt;sup&gt;1&lt;/sup&gt;</td>
<td>7.11 ± 2.81</td>
<td>7.58±2.96</td>
<td>0.335</td>
</tr>
<tr>
<td>Hypertension peak - n(%)</td>
<td>26 (11.3%)</td>
<td>9 (20.5%)</td>
<td>0.09</td>
</tr>
<tr>
<td>Dyspnea on exertion - n(%)</td>
<td>11.7 (27%)</td>
<td>10 (22.2%)</td>
<td>0.059</td>
</tr>
<tr>
<td>Simple arrhythmias - n(%)</td>
<td>74 (31.8%)</td>
<td>18 (40%)</td>
<td>0.28</td>
</tr>
<tr>
<td>Severe arrhythmias - n(%)</td>
<td>9 (3.9%)</td>
<td>0 (0.0%)</td>
<td>0.18</td>
</tr>
<tr>
<td>Chronotropic incompetence - n(%)</td>
<td>21 (49%)</td>
<td>7 (15.6%)</td>
<td>0.402</td>
</tr>
<tr>
<td>Response to ST prior to the SE (positive) - n(%)</td>
<td>64 (27.5%)</td>
<td>13 (28.9%)</td>
<td>0.98</td>
</tr>
<tr>
<td>Ascendant ST - n(%)</td>
<td>29 (12.6%)</td>
<td>4 (8.9%)</td>
<td>0.48</td>
</tr>
<tr>
<td>Rectified ST - n(%)</td>
<td>52 (22.5%)</td>
<td>13 (28.9%)</td>
<td>0.35</td>
</tr>
<tr>
<td>Descendant ST - n(%)</td>
<td>68 (29.4%)</td>
<td>12 (26.7%)</td>
<td>0.708</td>
</tr>
</tbody>
</table>

CCA: coronary cineangiography; LVMI: left ventricular mass index; LVMSI: left ventricular motility score index; ST: stress test; LV: left ventricle. 
<sup>1</sup>Student’s t test for independent data. Other variables: chi-square or Fisher’s exact test.

Table 3 – Multivariate logistic regression with parameters associated with the presence of atherosclerotic lesions on coronary cineangiography

<table>
<thead>
<tr>
<th>Associated parameter</th>
<th>Adjusted OR</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>3.074</td>
<td>1.442/-6.555</td>
<td>0.004</td>
</tr>
<tr>
<td>Age</td>
<td>1.11</td>
<td>1.067/-1.155</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Fixed ischemia</td>
<td>2.536</td>
<td>1.105/-5.820</td>
<td>0.028</td>
</tr>
</tbody>
</table>

OR: Odds ratio; 95% CI: 95% confidence interval. Adjusted model.
of the lesion in the affected coronary, both in the G1 and G2 groups, with possibly affected walls, as regards akinesia, hypokinesia, and dyskinesia. Furthermore, no prediction tests were carried out to obtain predictive values and methodological accuracy.

Conclusion

Age, gender, and the presence of fixed myocardial ischemia were independent predictors of atherosclerotic plaques in asymptomatic patients with ischemia on SE.

Author contributions

Conception and design of the research: Maia CA, Barbosa IL, Sousa ACS, Martins TM, Tavares IS, Mota IL, Gabriel FS, Oliveira JLM; Acquisition of data: Maia CA, Barbosa IL, Martins TM, Mota IL, Gabriel FS, Matos CJO, Oliveira JLM; Analysis and interpretation of the data: Maia CA, Barbosa IL, Sousa ACS, Mota IL, Gabriel FS, Matos CJO, Oliveira JLM; Statistical analysis: Sousa ACS, Mota IL, Oliveira JLM; Writing of the manuscript: Maia CA, Barbosa IL, Sousa ACS, Martins TM, Tavares IS, Mota IL, Gabriel FS, Matos CJO, Oliveira JLM; Critical revision of the manuscript for intellectual content: Sousa ACS, Tavares IS, Mota IL, Matos CJO, Oliveira JLM.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This article is part of the Course conclusion submitted by Camila Andrade Maia and Igor Lobão Barbosa, from Universidade Federal de Sergipe.

References


