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ORIGINAL ARTICLE

Correlation between physical activity levels of patients with intermittent claudication estimated using the Baltimore Activity Scale for Intermittent Claudication and a pedometer

Relação entre o nível de atividade física estimado pelo Baltimore Activity Scale for Intermittent Claudication e a pedometria em pacientes com claudicação intermitente

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Abstract

Background: The levels of physical activity of patients with intermittent claudication (IC) are usually reduced. The Baltimore Activity Scale for Intermittent Claudication (BASIC) was designed to measure physical activity levels of patients with IC, but its validation was conducted against only two days of monitoring with an accelerometer, and it remains unclear whether BASIC provides information about weekly physical activity levels. **Objective:** To analyze the correlation between physical activity levels of patients with IC estimated using BASIC or a pedometer for one week. **Methods:** This study included 150 patients with IC aged 30 to 80 years. Sociodemographic data, comorbidities, cardiovascular risk factors and BASIC scores were recorded. Pedometers were used for seven consecutive days, and data were analyzed for three different periods (all days, weekdays and weekends). **Results:** BASIC scores and mean number of steps were correlated on all days (rho=0.343, p<0.001), weekdays (rho=0.336, p<0.001) and weekends (rho=0.317, p<0.001). **Conclusion:** In patients with IC, physical activity levels estimated using BASIC correlate with weekly physical activity levels.

Keywords: peripheral arterial disease; physical activity; evaluation; questionnaire.

Resumo

Contexto: Os pacientes com claudicação intermitente apresentam níveis reduzidos de atividade física. A *Baltimore Activity Scale for Intermittent Claudication* (BASIC) foi validada para quantificar o nível de atividade física destes pacientes. No entanto, esta validação se baseou em apenas dois dias de monitoramento com acelerômetros, de modo que ainda permanece incerto se a BASIC fornece informações sobre os níveis de atividade física semanal. **Objetivo:** Analisar a correlação entre o nível de atividade física estimada pela BASIC e o nível obtido pelo pedômetro em uma semana, em pacientes com claudicação intermitente. **Métodos:** Foram estudados 150 pacientes com claudicação intermitente, com idade entre 30 e 80 anos. Foram obtidos os dados sociodemográficos e verificada a presença de comorbidades e de fatores de risco cardiovascular, e a BASIC. O pedômetro foi utilizado por sete dias consecutivos, sendo a análise feita em três diferentes períodos de monitorização (todos os dias, dias da semana e do fim de semana). **Resultados**: Foi observada correlação entre a BASIC e a média de passos de todos os dias (rho=0,343; p<0,001), dos dias de semana (rho=0,336; p<0,001) e dos dias do final de semana (rho=0,317; p<0,001). **Conclusão**: Em pacientes com claudicação intermitente, o nível de atividade física estimado pela BASIC se correlaciona com o nível de atividade física semanal.

Palavras-chave: doença arterial periférica; atividade física; avaliação; questionário.

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INTRODUCTION

The mains cause of peripheral arterial disease (PAD), the partial or total obstruction of arteries that supply blood to the upper and lower limbs, is atherosclerosis[1]. In Brazil, the prevalence of PAD is 10.5% among patients older than 18 years[2]. The most frequent symptom of PAD is intermittent claudication (IC), which may include pain, muscle cramps, burning and tingling. IC occurs in the limb affected by the disease during the practice of physical activities and disappears at rest[1].

Previous studies have shown that patients with IC have low levels of physical activity[3]. This conditions is directly associated with low fitness and poor quality of life[4,5], as well as with greater risk of disease worsening and mortality among this population[6]. Therefore, the amount of physical activity of patients with IC is greatly relevant. Previous studies have used movement sensors, such as pedometers[7-9] and accelerometers[10], to measure the level of physical activity of these patients. However, these instruments are limited for use in clinical practice, and questionnaires have been developed to measure the amount of physical activity in patients with IC[6,11-13].

The Baltimore Activity Scale for Intermittent Claudication (BASIC)[12] was developed to measure the level of physical activity of patients with PAD and limitations due to IC symptoms. In a validation study, Gardner and Montgomery[12] found a strong correlation between the level of physical activity measured using BASIC and that estimated using an accelerometer on two different days (r=0.76). Despite validation, it remains unclear whether BASIC provides information about the level of weekly physical activity of these patients. Therefore, this study analyzed the correlation between the level of physical activity estimated using BASIC and that resulting from the use of a pedometer for one week in a group of patients with IC.

METHODS

Patients

From February to July 2011, 440 patients were seen in our University Hospital. Inclusion criteria were age from 30 to 80 years, ankle brachial index (ABI) below 0.90, limited walking capacity due to IC symptoms, and no mental disability identified by the MINI questionnaire of mental health[14]. According to these criteria, of the 440 patients seen, 158 were recruited for the study, but eight were excluded because they did not return for the second collection visit. The final sample comprised 150 patients. All patients received instructions to continue their usual medications during the study.

Study procedures were explained to patients before data collection, and all patients signed informed consent terms. This study was approved by the Ethics in Research Committee of Universidade de Pernambuco (268/10) and of Hospital de Clínicas of the School of Medicine of Universidade de São Paulo (0188/11), both in Brazil.

Ankle-brachial index

To measure ABI, systolic blood pressures of the arm and ankle were measured simultaneously by two examiners with the patient at rest. Brachial blood pressure was recorded for the arm with the higher pressure measured using the auscultation technique, and ankle pressure was measured using vascular Doppler scans (Medmega DV610, Brazil) of both legs. A mercury sphygmomanometer was used for the measurements. ABI was calculated by dividing the systolic blood pressure of the ankle with the higher pressure by the systolic blood pressure of the arm. These procedures have been described in detail elsewhere[15].

Walking capacity evaluation

To evaluate walking capacity, the patients underwent a treadmill (WTL model, Imbrasport, Brazil) test using a specific progressive protocol for individuals with IC, in which speed is constant at 3.2 km/h and grade is increased 2% at each two minutes until maximal pain[16]. All individuals were already familiar with this protocol before the study. The test was interrupted when the individual was not able to walk anymore due to pain in the lower limbs. During the test, the time when the patient reported the onset of pain (claudication distance) and the maximum distance that the patient was able to walk despite the pain (total walking distance) were recorded.

Baltimore Activity Scale for Intermittent Claudication

BASIC has five questions about IC symptoms (Figure 1). The respondents select the answer that best describes their symptoms and the level of physical activity for each question. Values range from 0 to 2 points, and the total score is the sum of the points in the five questions. Total scores range

from 0 to 10, where zero stands for the lowest level of physical activity, and ten, the highest[12]. BASIC reproducibility in the Brazilian population ranges from moderate to strong (0.43 to 0.85)[11].

Level of physical activity measured using pedometer

The level of physical activity was measured by calculating the number of steps that each patient took. For that purpose, a pedometer (YAMAX DigiWalker SW-200, YAMAX Corporation, Tokyo, Japan) was used for seven consecutive days. Patients received instructions about how to use the device correctly. Mean number of steps taken was analyzed for three periods: all the days of the week, weekdays and weekends[17]. In a subsample of 25 patients, the reproducibility of pedometer data was evaluated seven days later, and the intraclass correlation coefficient was r=0.72.

Statistical analysis

All analyses were conducted using the Statistical Package for the Social Sciences (SPSS) 17.0. The Kolmogorov-Smirnov test was used to test data normality. The Spearman rank correlation coefficient was used to analyze the association between BASIC scores and pedometer findings. A correlation coefficient above 0.70 was classified as a strong association between variables; from 0.69 to 0.30, as moderate; and below 0.30, as weak.

A paired *t* test was used to compare the mean number of steps on weekdays and on weekends. The level of significance was set at $p<0.05$, and data were described as mean ± standard deviation and relative frequency.

Name: _____ **Date:** _____

Total BASIC score (0-10): _____

Please, circle the letter that best describes your answer to each question.

1. How many blocks can you walk before you feel pain?
A. Less than 1 block
B. 1 to 2 blocks
C. More than 3 blocks

2. What happens when you feel pain while you walk?
A. Stop walking
B. Walk at slower pace
C. Keep walking at same pace

3. How often do you walk at a fast pace?
A. Rarely/never
B. Sometimes
C. Often

4. How often do you climb and go down the stairs?
A. Rarely/never
B. Sometimes
C. Often

5. How often do you walk up and down hills?
A. Rarely/never
B. Sometimes
C. Often

Figure 1. Baltimore Activity Scale for Intermittent Claudication (BASIC).

RESULTS

Patient general characteristics are shown in Table 1.

Mean patient age was above 60 years. Most participants were men and overweight. The most prevalent comorbidity was hypertension, followed by dyslipidemia, heart disease and diabetes. Smoking was reported by 24% of the patients.

Mean levels of physical activity estimated using BASIC and the pedometer are shown in Table 2. Mean BASIC score was 4.2±1.9, and mean number of steps a day in a week was 6.041±3.166; the number of steps was significantly higher on weekdays than on weekends ($p<0.05$).

Figure 2 shows the results of the correlation between BASIC scores and pedometer results. The correlations between BASIC scores and the different periods of pedometer monitoring were moderate, ranging from 0.32 to 0.34.

Table 1. Characteristics of patients with intermittent claudication (n=150).

Variables	Values
Age, Yrs	64±9
Body mass index (kg/m²)	26.2±4.5
Ankle-brachial index	0.59±0.14
Claudication distance (m)	176±154
Total walking distance (m)	412±298
Men (%)	63
Hypertension (%)	92
Diabetes (%)	43
Dyslipidemia (%)	87
Obesity (%)	60
Abdominal obesity (%)	36
Heart disease (%)	56
Smoking (%)	23

Data described as mean ± standard deviation or relative frequency.

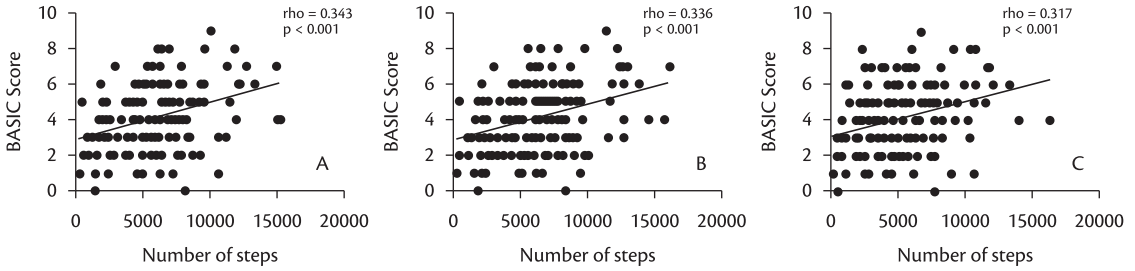

Figure 2. Correlations (rho) calculated between the level of physical activity estimated using the Baltimore Activity Scale for Intermittent Claudication (BASIC). Graph A – all days; Graph B – weekdays; Graph C – weekends.

Table 2. Mean number of steps measured by a pedometer during different monitoring periods and of the Baltimore Activity Scale for Intermittent Claudication (BASIC).

Variables	Mean ± standard deviation
BASIC score	4.2±1.9
All days (number of steps)	6,041±3,166
Weekdays (number of steps)	6,352±3,295*
Weekends (number of steps)	5,221±3,229

*Statistically significant difference from mean number of steps on weekends (p<0.05).

DISCUSSION

The main finding of this study was that the level of physical activity estimated using BASIC was correlated with the level of weekly physical activity measured using the pedometer. Moreover, this correlation was also found when weekdays or weekends were analyzed separately, which suggests that BASIC is consistent and represents data obtained in different periods of a week.

The correlation between the level of weekly physical activity according to BASIC and the pedometer was 0.34. These data are lower than those found in the study conducted by Gardner and Montgomery[12], who found a correlation of 0.76 when validating BASIC during two days in comparison with accelerometer results. The differences between correlation coefficients may be linked to the method used to validate BASIC (pedometer vs. accelerometer). Both pedometer and accelerometer are instruments used to monitor human movement. However, pedometers are specific to evaluate the usual level of physical activity by counting the number of steps, whereas accelerometers are more complete in their evaluation of physical activity because they measure, in addition to the number steps, the intensity and duration of the movements of upper and lower limbs[18].

Although a pedometer was used, the results of this study revealed that BASIC had a moderate and significant correlation with the level of weekly physical activity measured. Studies that measured the level of physical activity in other populations using questionnaires also found moderate correlations with movement sensors. Benedetti et al.[19] evaluated 29 patients older than 60 years and found a correlation of r=0.24 between the International Physical Activity Questionnaire (IPAQ) and the number of weekly steps. Similar results were found in a group of elderly patients with Alzheimer (r=0.57) and physically active elderly women (r=0.27)[20,21], Therefore, the correlation found in our study (rho=0.34) was similar to that found in studies that analyzed conventional instruments to measure physical activity.

Our study may be the first to describe the pattern of physical activity of patients with IC on weekdays and weekends. The patients had a lower level of physical activity on weekends than on weekdays, which is in agreement with other studies with elderly patients[22,23]. It is important to note that significant correlations were found between BASIC scores and mean number of steps on weekdays (rho=0.34) and on weekends (rho=0.32). These results might indicate that less active patients on weekdays may also be less active on weekends.

In practical terms, the moderate correlations found in this study suggest that most patients that had a higher number of steps during the week were also those with a higher BASIC score. In a similar way, most patients with the lowest number of steps during the week were those that had the lowest questionnaire scores. Therefore, in most cases, BASIC was a good indicator of physical activity and provided additional data to understand the clinical conditions of the patients. Its main advantage is that this information may be obtained rapidly during only one visit, in contrast to other measures of physical activity levels,

such as movement sensors, that require the use of a device for one week.

The results of this study should be analyzed cautiously due to some limitations. The sample comprised patients with IC, and the results may be different in groups of different patients, such as those with PAD without IC. Moreover, all patients were recruited in a vascular reference center, where patients are strongly encouraged to practice unsupervised physical activity and to quit smoking, which may have affected results. The level of physical activity was measured using a pedometer, which has a series of limitations, such as not counting movements of the upper limbs or during activities other than walking, such as water sports. However, as walking is the primary treatment for patient with IC[1], the use of a pedometer is justified in this population.

In conclusion, the results of this study revealed a moderate correlation between the level of activity estimated using BASIC and the level of weekly physical activity measured when using a pedometer, regardless of the time of the week considered, which suggests that BASIC is a good alternative to measuring the level of weekly physical activity of patients with IC.

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