Evaluation of body balance in rheumatoid arthritis patients

Avaliação do equilíbrio corporal de pacientes com artrite reumatoide

Evaluación del equilibrio corporal de pacientes con artritis reumatoidea

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ABSTRACT | Postural control, stability in voluntary movements in response to external disturbances and proprioception are basic elements for maintaining balance. People with Rheumatoid Arthritis (RA) have difficulty maintaining postural control, undermining the balance in the Activities of Daily Living (ADL's), making it an important risk factor for falls. The present study aimed to evaluate the body balance of individuals with RA, according to the level of disease activity. We evaluated 24 individuals with 54.66±9.52 years. All underwent a questionnaire identification and medical history, anthropometric measurements, blood sampling for analysis of C-Reactive Protein (CRP), determining the level of disease activity using the DAS-28 and equilibrium through tests: Berg Balance Scale (BBS) and TUG. Patients were divided into three groups: low, moderate and high disease activity. The results of equilibrium tests showed that, although the sample has presented low risk for falls, the group in high disease activity had higher frequency distribution (57.2%) in scores between 48–52 in the BBS compared to the moderate activity group, whose frequency distribution prevailed in the scores between 53 and 56 (92.3%-p≤0.05). It was also observed differences in the time of the TUG execution between groups high (11.86±4.62 s) and moderate (9.71±0.90 s) disease activity (p≤0.05). These data show that the level of disease activity can influence the achievement of the BBS and TUG tests, suggesting an increased risk of falls or even a dependency in performing their ADL's due to the increased level of disease activity.

Keywords | Arthritis, Reumatoid; Postural Balance; C-Reactive Protein; Activities of Daily Living.

RESUMO | Controle postural, estabilidade nos movimentos voluntários, reação às perturbações externas e propriocepção constituem elementos básicos para a manutenção do equilíbrio. Pessoas com Artrite Reumatoide (AR) têm dificuldade em manter o controle postural, prejudicando o equilíbrio nas Atividades de Vida Diárias (AVD's), tornando-se um importante fator de risco para quedas. O presente estudo teve por objetivo avaliar o equilíbrio corporal de indivíduos com AR, em função do nível de atividade da doença. Foram avaliados 24 indivíduos com 54,66±9,52 anos. Todos foram submetidos à aplicação de questionário de identificação e história clínica, avaliações antropométricas, coleta de amostra sanguínea para análise de Proteína C-Reativa (PCR), determinação do nível de atividade da doença por meio do *Disease Activity Score* (DAS-28) e avaliação do equilíbrio através dos testes: Escala de Equilíbrio de Berg (EEB) e Timed Up and Go (TUG). Os pacientes foram divididos em três grupos: baixa, moderada e alta atividade da doença. Os resultados dos testes de equilíbrio demonstraram que, embora a amostra tenha apresentado baixo risco para quedas, o grupo em alta atividade da doença apresentou maior distribuição de frequência (57,2%) nos escores entre 48–52 na EEB, em comparação ao grupo moderada atividade, cuja distribuição de frequência predominou nos escores entre 53 e 56 (92,3%-p≤0,05). Também foi verificada diferença no tempo de execução do TUG, entre os grupos alta (11,86±4,62s) e moderada (9,71±0,90s) atividade da doença (p≤0,05). Estes dados evidenciam que o nível de atividade da doença pode influenciar na realização dos testes EEB e TUG, sugerindo um aumento do risco

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de quedas ou até mesmo uma dependência na realização de suas AVD's em função do aumento do nível de atividade da doença.

Descritores | Artrite Reumatoide; Equilíbrio Postural; Proteína C-Reativa; Atividades Cotidianas.

RESUMEN | Control postural, estabilidad en los movimientos voluntarios, reacción a las perturbaciones externas y propiocepción constituyen elementos básicos para la manutención del equilibrio. Personas con Artritis Reumatoidea (AR) tienen dificultad en mantener el control postural, perjudicando el equilibrio en las Actividades de Vida Diarias (AVD's), volviéndose un importante factor de riesgo de caídas. El presente estudio tuvo por objetivo evaluar el equilibrio corporal de individuos con AR, en función del nivel de actividad de la enfermedad. Fueron evaluados 24 individuos con 54,66±9,52 años. Todos fueron sometidos a la aplicación de cuestionario de identificación e historia clínica, evaluaciones antropométricas, colecta de muestra sanguínea para análisis de Proteína C-Reactiva (PCR), determinación del nivel de actividad de la enfermedad por medio del *Disease Activity Score* (DAS-28) y evaluación del equilibrio a través de los tests: Escala de Equilibrio de Berg (EEB) y Timed Up and Go (TUG). Los pacientes fueron divididos en tres grupos: baja, moderada y alta actividad de la enfermedad. Los resultados de los tests de equilibrio demostraron que, aunque la muestra haya presentado bajo riesgo de caídas, el grupo en alta actividad de la enfermedad presentó mayor distribución de frecuencia (57,2%) en los escores entre 48-52 en la EEB, en comparación con el grupo moderada actividad, cuya distribución de frecuencia predominó en los escores entre 53 y 56 (92,3%-p≤0,05). También fue verificada diferencia en el tiempo de ejecución del TUG, entre los grupos alta (11,86±4,62s) y moderada (9,71±0,90s) actividad de la enfermedad (p≤0,05). Estos datos evidencian que el nivel de actividad de la enfermedad puede influenciar en la realización de los tests EEB y TUG, sugiriendo un aumento del riesgo de caídas o aun una dependencia en la realización de sus AVD's en función del aumento del nivel de actividades de la enfermedad.

Palabras clave | Artritis Reumatoidea; Balance Postural; Proteína C-Reactiva; Actividades Cotidianas.

INTRODUCTION

Scientific evidence points to the occurrence of falls mostly among the older population. However, these falls are not restricted to people of advanced age, being common to other groups such as patients with arthritis rheumatoid (AR)[1-3].

The history of falls in people with AR has been reported in literature. In the study by Armstrong *et al.*[4], conducted with 253 patients with AR, 33% of them referred having fallen in the previous year — 52% more than once. Fessel e Nevitt[5] reported that 31% of a sample with 540 patients with AR had fallen at least once in one year and 16% twice or more.

We may say that patients with AR are at increased risk for falls[6], and therefore at risk for serious injuries and fractures, regardless of age[1-3]. These data reflect the impact in public health in terms of morbidity and use of health care services, including the increase in hospitalization rates[7]. People with AR have difficulties to maintain postural balance, that is, to keep their balance in daily activities such as walking and climbing stairs[8,9].

This impairment of the postural balance is associated with changes in different functions of the musculoskeletal and sensory systems[10]. The main factors leading to mobility, equilibrium and postural balance loss[4], considering consequences of fallings in cases of AR, are associated with muscle strength reduction[11,12], proprioceptive deficit[13] and joint lesion, which causes pain and swelling to the lower limbs[14], besides psychological factors[5].

Although some of these risk factors are common in older people, others are specific for AR due to the joint injury and the inflammatory process[15]. The presence of pain and swelling in the joint are therefore factored as objective evidence of inflammation that can affect the dynamic balance and the muscle strength[6]. The severity of the inflammation together with the levels of pro-inflammatory cytokines reflect directly in the disease activity level, playing an important role in its systemic effect and, thus, influencing the risk of falls in people with AR[16].

Considering that the disease activity level is potentially related to the risk of falling, identifying and controlling them is essential to the development of efficient strategies of fall prevention in AR patients. However, until now, there are few studies[17,18] about postural balance in AR patients related to the disease activity level available.

Facing this, the present study aims to assess postural balance of AR patients in relation to the disease activity level by using Disease Activity Score (DAS-28).

METHODOLOGY

Twenty-four patients of both sexes (mean age 54.66±9.52) and diagnosed with AR for at least one year participated in the study. They were selected intentionally and referred for the study by rheumatologists affiliated with the Brazilian Public Health System of Florianopolis (SC, Brazil). All individuals were physically able to perform the tests and did not show visual, auditory, vestibular, sensory, proprioceptive and musculoskeletal disorders that could be considered incapacitating factors for the maintenance of balance and development of pace.

The study was approved by the Ethics Committee of UDESC (Protocol 69/2010).

Procedures

The assessment procedures to which patients were submitted were: interview for pre-elaborated survey questionnaires such as: patient identification (name, age, sex, address, phone number, profession), clinical history, main complaint and fall frequency; anthropometric evaluation (body mass, height and body mass index – BMI); blood sample analysis to determine C-Reactive Protein (CRP) serum levels by spectrophotometry; determination of disease activity level by DAS-28; balance tests by Berg Balance Scale (BBS) and Timed Up and Go (TUG), all performed in a place with good lighting and plain regular ground.

Assessment of disease activity level

The disease activity level was assessed by means of DAS-28, which comprises palpation of 28 joints bilaterally (shoulders, elbows, wrists, metacarpal and phalangeal, proximal inter-phalangeal, and knees), aiming at identifying the number of painful and swollen joints. Palpation was made by digital pressure at the joint interlines and passive mobilizations. It is important to note that the number of painful joints does not correspond to the intensity of pain in each patient. DAS-28 also assessed a score of patients' perception of AR activity level in the last seven days based on a Visual Analogue Scale (VAS) ranging from 0 to 100[19]. Added to the previously mentioned parameters, the CRP value was used in the final calculation of DAS-28. To do so, we used an official calculator at www.das-score.nl. Final DAS-28 may range from 0 to 10, with the following classification: DAS≤3.2, low disease activity; 3.2<DAS≤5.1, moderate disease activity; and DAS>5.1, high disease activity[20]. Patients were then divided into three groups, according to disease activity levels.

C-Reactive Protein

The dosage of CRP was made after venous blood sample collection (5 mL) for serum samples. The analysis was made by turbidimetric method, with three specific packs for CRP (PCR turbilátex – Biotécnica). Values were determined by a spectrophometer (BTLyzer 100® Biotécnica), with wave length of 540 m. Results were expressed in mg/L, and values up to 6.0 mg/L were considered normal.

Balance assessment

The balance of AR patients was measured by BBS and TUG.

Berg Balance Scale

BBS was translated into Portuguese and adapted to Brazilian culture by Miyamoto *et al.*[21], and is considered a reliable tool for the assessment of functional balance of older people. This scale assesses the abilities of sitting, standing, reaching out, turning around oneself, looking back over one's shoulder, standing in unipodal support and climb stairs. All items hold a scale with five alternatives from 0 (unable to perform) to 4 (normal performance), with total score of 56 point[22]. Scores are divided in three groups: 0–20, 21–40 and 41–56. Patients scoring 41 to 56 are at low risk for falls, from 21 to 40, at moderate risk, and below 20, at high risk[23].

Timed Up and Go

TUG is a fast monitoring to detect problems in balance that may affect daily life. This test assesses balance when the subject is sitting, switching position to standing up, stability at pace and change in course at pace without compensatory strategies. Time spent by the patients to stand up from a chair, walk a 3-meters distance, turn around, walk back towards the chair and sit down again was measured. According to Soares *et al.*[24], people who are independent and present no changes in postural balance perform the test in 10 seconds at most; those who are independent in daily activities perform the test in 20 seconds, and those who need more than 30 seconds to accomplish all tasks are considered dependent in many activities and in mobility[25].

Statistical analysis

To characterize participants, a table with the frequency of categorical variables was made, with absolute (n) and relative (%) frequency values. For continuous variables, a descriptive analysis with mean and standard deviation values was applied. Shapiro-Wilk test was used to assess the normality of quantitative data distribution between groups in BBS and TUG, as well as Mann-Whitney and Student's T test for independent samples, respectively. Statistical analysis was made in the software SPSS v.20.0, with significance level set at p≤0.05.

Table 1. Mean±SD or frequency (%) of sociodemographic, anthropometric and clinical data of participants (n=24)

Data	
Sociodemographic	
Age (years)	54.66±9.52
Sex	
Female	22 (91.66%)
Male	2 (8.33%)
Racial origin	
Caucasian	23 (95.8%)
Black	1 (4.2%)
Marital status	
Married	12 (50%)
Single	6 (25%)
Divorced	4 (16.7%)
Widow/widower	2 (8.3%)
Profession	
Home	10 (41.7%)
Retired	5 (20.8%)
Other	9 (37.5%)
Anthropometric	
Body mass (kg)	71.55±14.11
Height (m)	1.61±0.09
BMI (kg/m^2)	28.00±5.62
Clinical	
Diagnosis (years)	10.70±6.98
Main complaint	
Pain	12 (50%)
CRP (mg/L)	10.69±11.78
DAS-28	4.47±1.16
Falls	
No falls	18 (75%)
Infrequent	5 (20.8%)
Very frequent	1(4.2%)

BMI: body mass index; CRP: C-Reactive Protein; DAS-28: Disease Activity Score

RESULTS

We assessed 24 patients, being 22 females (91.66%) and 2 males (8.33%). Mean age was 54.66±9.52 years, and mean time for AR diagnosis was 10.70±6.98 years. At physical evaluation, mean body mass was 71.55±14.11 kg; mean height was 1.61±0.09 m, and mean BMI was 28.00±5.62 kg/m^2, representing overweight. Most subjects (95.83%) were Caucasian and 50% of them were married.

Out of the 24 individuals, 41.66% were householders, 20.83% were retired and 37.50% had other professions. The main complaint was pain (50%), especially in the hands, wrists, knees and feet. As to disease activity level, mean DAS-28 was 4.47±1.16, which characterizes the sample at a moderate level of disease activity. CRP values were also high (mean 10.69±11.78 mg/L), which reinforces the presence of inflammation in the patients assessed. The frequency of falls was considered low (20.83%) or insignificant (75%) for the sample size (Table 1).

After dividing groups by DAS-28 results, we observed a higher frequency (54.16%) of patients classified in the moderate level of disease activity. The comparison between groups showed that the one classified as high disease activity level presented a significant difference as to moderate and low level groups for DAS-28 values, number of swollen joints and overall health perception. We also observed a significant difference in the number of painful joints between groups of high and low activity levels (Table 2).

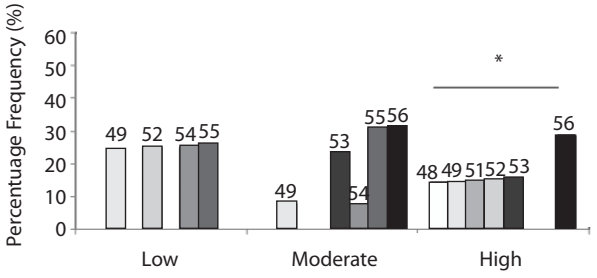
The characterization of the balance by BBS related to DAS-28 is shown in Figure 1. Results show that all patients were at low risk for falls. However, there was a significant difference (p≤0.05) between groups of high and moderate activity level, but the high level group presented a higher frequency distribution (57.2%) in scores 48–52 of BBS compared to moderate level group, whose distribution was held in the scores 53–56 (92.3%).

Values obtained in TUG ranged from 6.44 to 16.54 seconds, with overall mean of 10.70±6.98. Mean times for the performance of TUG in low, moderate and high disease activity level groups were 10.33±1.84 s; 9.71±0.90 s and 11.86±4.62 s, respectively. In comparison between groups, there was a significant difference (p≤0.05) in test execution time for the high activity level group related to the moderate activity level one. According to Soares *et al.*[24], because most patients from the high activity level group (57.14%) performed TUG

Table 2. Mean±SD or frequency (%) of patterns assessed by DAS-28 for groups with low, moderate and high disease activity

Groups	Low activity	Moderate activity	High activity
Frequency (%)	4 (16.7%)	13 (54.2%)	7 (29.2%)
Disease activity score (DAS-28)	2.42±0.32	4.44±0.51#	5.68±0.31*
Number of swollen joints	1±1.41	5.30±3.66#	7.57±2.69*
Number of painful joints	2.25±2.87	7.76±4.78#	16±6.21#
C-reactive protein (mg/L)	4.17±3.19	9.17±6.90	17.38±18.51
Overall health perception	22.5±15	44.61±15.06#	64.28±12.72*

*Significant difference (p≤0.05) between high activity group and low to moderate activity groups; #Significant difference (p≤0.05) between high or moderate activity groups and low activity group. Student's T test for independent samples; DAS-28: Disease Activity Score



*p≤0.05, high activity level group related to moderate activity level group, Mann-Whitney test

Figure 1. Distribution of frequencies in the scores of Berg Balance Scale in the groups of low, moderate and high disease activity levels

in more than 10 seconds, they can be classified as independent only for basic task. In the moderate level group, on the other hand, most individuals (76.92%) performed TUG in less than 10 seconds, being therefore classified as totally independent.

DISCUSSION

The sample characterization showed a prevalence of females, white-skinned individuals aging from 40 to 60 years, without a paid work and presenting overweight. Patients' most frequent complaints of joint pain were in the hands, wrists, knees and feet. DAS-28 results showed predominance of moderate disease activity level (54.16%). These findings agree with data previously described in the literature on the subject[26,27].

An observational study by Sany *et al.*[22], conducted with 1,629 patients with AR and showing characteristics of the disease and healthcare, indicated a high rate of patients with moderate disease activity level (46%).

Results of BBS and TUG showed that participants did not present significant impairment to their postural balance. Contrary results have been described in literature, which shows that AR patients have difficulties in postural balance that are usually manifested in daily activities[8,28], putting them at greater risk for falls compared to healthy people[29,30].

According to Hayes e Johnson[31], TUG has a moderate to high correlation to BBS. This finding was also reported by Shumway-Cook *et al.*[32], which shows that the time required to accomplish TUG is strongly related to the level of functional mobility. Patients capable of completing TUG in less than 20 seconds are classified as independent in basic tasks and have high scores at BBS. These data corroborate our study, where all participants performed TUG in less than 20 seconds and also had good scores in BBS, being therefore classified as low-risk patients for falls.

However, in comparison between groups as to DAS-28, we found a significant difference between moderate and high disease activity level groups. The group classified as low level did not show significant difference compared to the others in the balance tests. On the other hand, this group also presented normal values for CRP, fewer painful and swollen joints, and better overall health perception, contributing to a better performance of the balance tests. The small size of this group (16.6%) impaired the comparison of data obtained from TUG and BBS with the other groups.

In frequency distribution for BBS scores, although individuals were classified as low-risk for falls, the high disease activity level group had significantly lower scores compared to moderate one. TUG results also showed a significant difference in the time of test execution in the comparison between the high and the moderate groups. These findings show that the level of disease activity and consequent increase in inflammation cause swelling and pain to the joint, which leads the patient to a higher perception of the disease and, thus, to more limitations in balance tests. the study by Sany *et al.*[33] also showed that patients with severe AR had more active levels of the disease, repeated hospitalizations history and occurrence of comorbidities.

According to Suomi[34], 80% of the balance problems in AR patients are reported by those presenting affected lower limbs joints, which is in agreement with our findings, because the pain in the knees and feet was the main complaint (data not shown). Fessel *et al.*[5], in a retrospective study with 570 AR patients showing functional limitation, reported that the risk for falls was

twice increased as compared to a control group without functional limitations.

Nonetheless, this study did not perform a direct balance assessment, although a bigger number of patients were evaluated. A survey was made by phone contact, where patients were asked about the fear or the occurrence of falls in the past 12 months, and about the functional limitations resulting from falls or the fear of falling. They found that the risk and the fear of falling, as well as the limitations related to this fear, was higher among AR patients[5].

Tjon *et al.*[35] investigated the use of visual compensatory strategies and control of attention for maintain balance in the standing position in 18 AR patients (presenting severe knee joint impairment) and did not find increased dependency as to balance compared to control group, which shows that they had a normal balance automacity level despite their severe joint problems on the lower limbs. Such results were attributed to the fact that damages to the joint develop slowly in AR patients, allowing an adaptation to changes in postural and coordination patterns. So, patients did not present significant levels of balance impairment, assessed by BBS and TUG, regardless of the disease activity level, because of this process of postural adaptation.

Regarding BBS, Hayes e Johnson[31] reported that many factor can affect the performance in the evaluation, including AR history, which increases the risk of falls. Despite the relative lack of data about the occurrence of falls in AR patients, there is evidence that the fall is a concern among these patients, as up to 50% of them report having fear of falling and 40% report having changed their daily activities because of this fear[5]. Further studies are needed, though, to determine the response capacity of the scale for AR patients, for its use has been limited. When examining these patients, one should be aware of the potential ceiling effects. Besides that, the scale does not include issues of pace, so velocity of pace and adaptability need to be constantly assessed.

Finally, considering the limitations of the present study regarding sample size, age differences, disease-related factors and absence of stabilometric parameters, direct comparison to other studies is hampered. Therefore, further studies with more representative samples are needed to better determine damages caused to balance in AR patients as regards the disease activity level.

CONCLUSION

The disease activity level may influence the performance of patients with AR in balance tests such as BBS and TUG. Therefore, it is important that health professionals evaluate the level of disability of AR patients related to the disease activity level to establish prevention strategies aiming at the reduction of fall risks and greater independence in these patients' daily activities.

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