Assessment of Risk of Falls in Elderly Patients with Osteoarthritis of the Knee and Low Back Pain

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Abstract: This study aimed identify which groups of elderly are at higher risk of falls, with osteoarthritis (OA), low back pain or both conditions. 29 elderly were distributed in three groups: OA of the Knee (OAK), Low Back Pain (LBP) and the two events concomitantly (OL). Evaluation tools applied were: Mini Mental State Examination (MMSE), Visual Analogue Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Roland Morris Functional Performance Questionnaire, Gait Speed (GS), Timed Get Up and Go Test (TGUGT) and Berg Balance Scale (BBS). No differences were found in the three groups for assessment by GS, TGUGT and BBS instruments. A significative difference was found by RMQ in groups LBP and OL, WOMAC found difference in pain domain between groups OL and OAK and VAS analysis showed significative difference between group OL to the others groups. No significative difference was found between groups by the assessment of balance.

Key words: Berg Balance Scale (BBS), Gait Speed (GS), Visual Analogue Scale (VAS), Mini Mental State Examination (MMSE), Low Back Pain (LBP)

INTRODUCTION

The increasing life expectancy in the wordwide has demanded greater efficiency in elderly care (Valim-Rogatto et al., 2009; Avelar et al., 2010; 2011; Tsonga et al., 2011). The demographic transition also causes significant changes in epidemiologic profile, changing the model of health characterized by infections contagious diseases to a higher proportion of chronic degenerative diseases (Valim-Rogatto et al., 2009; Gananca et al., 2010; Maraschin et al., 2010; Avelar et al., 2011; Falsarella et al., 2011; Kao et al., 2011). A requirement for maintaining a healthy aging is the maintenance of functional capacity, wich englobes individual independence and his active participation in society. Falls are factors that may contribute to reduce functional capacity and can cause significant consequences as disability, health impairment, changes in quality of life, immobility, restrictions of activities, institutionalization, psychological damage and death (Pedrinelli et al., 2009; Valim-Rogatto et al., 2009; Maraschin et al., 2010; Charansonney, 2011). A fall may be defined as an unintentional event that results in a change of individual’s position to a lower level in relation to its initial position, without skilled time correction (Gine-Garriga et al., 2009; Queiroz et al., 2009; Alvares et al., 2010; Chen et al., 2010; Ferreira and Yoshitome, 2010; Ricci et al., 2010; Charansonney, 2011; Correa et al., 2012). This event can be caused by several intrinsic and extrinsic factors, creating a multicausal phenomenon in wich can be detached the presence of comorbidities as intrinsic factors (Valim-Rogatto et al., 2009; Ferreira and Yoshitome, 2010; Paula et al., 2010; Ricci et al., 2010).
With advancing age, a chronic degenerative disease, the Osteoarthritis (OA), usually is detected. The knees are the joints most often affected and for their relevance in corporal biomechanics it may trigger a negative impact on functionality. Like presence of knee pain, characteristic of OA, back pain is also usually common and these symptoms can reflect on quality of life of elderly people (Pedrinelli et al., 2009; Valim-Rogatto et al., 2009; Avelar et al., 2010; 2011). The manifestation of low back pain is characterized by painful sensations and discomfort among the inferior gluteal line and costal border that can irradiated to the lower limbs (LL). Low back pain is also associated with restrictions of many activities, decrease in functional capacity and can lead to falls (Maraschin et al., 2010; Ricci et al., 2010).

Falls usually are associated with aging and this situation constitute a great problem in public health due high costs, physical and psychological consequences (Valim-Rogatto et al., 2009). In this way, it is necessary to identify the relationship between falls and conditions like OA and low back pain to guide elderly people which are affected by them. In addition, the risk of falls may be minimized with such information. This study aimed identify which groups of elderly patients are at higher risk of falls, the patients with OA, low back pain or both conditions.

**MATERIALS AND METHODS**

This study is according with ethical principles for research involving human as described by the Declaration of Helsinki and was approved by the Ethics Committee of Federal University of the Jequitinhonha and Mucuri Valleys. It was a clinical cross-sectional study and the sample was obtained by verbal invitation on the Association of Retirees and Pensioners of Diamantine/MG. The study included elderly aged over 60 years, both sexes, living in Diamantine/MG, with diagnosis of OA in at least one knee, based on clinical criteria of American College of Rheumatology, clinical manifestation of low back pain or both conditions, which were not in physical therapy, who had not recent trauma at knees or spine and that present medical conditions and cognitive requirements for the application of balance assessment tools (Avelar et al., 2010; 2011; Falsarella et al., 2011; Kao et al., 2011).

Exclusion criteria were patients with uncompensated cardiovascular, neurological or psychiatric disease, amputation of lower limbs, unable to stand up alone without another person or device aid, severe visual or hearing impairment uncorrected, using medications that may interfere in balance and subjects who had no sphincter control (urinary or fecal). Were contacted 90 volunteers, of whom 61 did not participate due exclusion criteria or lack of interest? In this way 29 volunteers constituted the sample and they were divided into three groups: ten subjects in knee OA group (OAK), nine in Low Back Pain group (LBP) and ten subjects in knee OA and low back pain group (OL).

Subjects received instructions to proceed on the assessment day, such as use bathroom before tests, wear comfortable clothes and usual shoes, drink water before, make a light meal or snack, avoid strenuous activities for at least 2 h before exam and no caffeine 24 h before the assessment. These instructions were given in order to avoid any influence on the outcome of this study (Tarnopolsky, 2010; Avelar et al., 2011; Santos et al., 2011b).

All subjects were informed about the nature of this research and were invited to sign the Term of Informed Consent. For the assessment the volunteer was conducted to a private room where tests were done for identification of low back pain and to confirm the clinical criteria for OA based on American College of Rheumatology. A physical therapy evaluation form was applied to register data of each volunteer (Avelar et al., 2010; 2011; Falsarella et al., 2011; Kao et al., 2011). The evaluation tools applied were: Mini Mental State Examination (MMSE), Visual Analogue Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for subjects with OA (OAK and OL groups), Roland Morris Functional Performance Questionnaire (only for LBP and OL groups), Gait Speed (GS), Timed Get Up and Go Test (TGUGT) and Berg Balance Scale (BBS).

The MMSE is an important tool for cognitive screening and in this study was used the scores considering educational level of subjects (Avelar et al., 2011; Karuka et al., 2011). The Roland Morris Questionnaire (RMQ) consists of 24 items with scores zero or one (no or yes, respectively), to each one and demonstrates functional consequences resulting from low back pain. For example, score above 14 indicates subject inability. The WOMAC applied in OAK and OL groups in order to verify level of pain, stiffness and physical function (functionality) perceived by volunteers in 72 h before the assessment. As higher score worse are the symptoms (Avelar et al., 2010; 2011; Falsarella et al., 2011; Neto et al., 2011; Kao et al., 2011). The VAS was used to assess the perception of pain in 24 h prior the exam. The subject was required to mark his level of pain in a line of ten cm. The highest level of pain is near from the end of the line (10 cm).
GS was calculated in a route of 10 m, but the 2 m initial and final were disregarded due its relationship with acceleration and deceleration. In this way, GS was calculated dividing the time spent for this activity by 6 m. In this study, GS lower 1m s\(^{-1}\) was considered as risk of falls (Salminen et al., 2009; Novaes et al., 2011; Tsonga et al., 2011). TGUGT assesses sitting balance, transfer (sitting/standing and standing/sitting), stability during walking and changing direction. The time spent on this activity is associated with subject’s performance. The scores indicate functional mobility, for example: Executing TGUGT in ten seconds or less indicates functional independence and no risk of falls, among 11 and 20 seconds indicates parcial dependence as a moderate risk of falls and above 20 sec indicates functional dependence in many activities of daily living and a high risk of falls (Queiroz et al., 2009; Gine-Garriga et al., 2009; Chen et al., 2010; Karuka et al., 2011; Avelar et al., 2011; Silva et al., 2011). The BBS evaluates postural control necessary to some activities. Each task can be punctuated from zero (unable to perform the task) to four (performing task independently). Higher scores indicate better performance (Avelar et al., 2010; Karuka et al., 2011).

A descriptive statistics was implemented in order to provide measures of central tendency and variability of the sample. The Shapiro-Wilk test was used to detected Gaussian distribution for the variables: age, MMSE, RMQ, WOMAC and GS. An ANOVA (one way), with Tukey Post-Hoc test for data with normal distribution, was employed to compare means by the three groups (OAK, LBP and OL). The non parametric Kruskal Wallis test was applied to the variables that have not normal distribution (BBS and TGUGT). Data were analyzed using SPSS 19.0. For all cases was considered \( p \leq 0.05 \).

RESULTS

The sample of this study was 29 volunteers aged between 60 and 86 years. The average age was 70.10±6.6 years. In each group the average age was: 70.88±8.0 in LBP group, 71.30±5.5 in OAK group and 68.20±6.4 in OL group. The MMSE mean was 25.27±2.68 points and the average of punctuation in groups LBP, OAK and OL was respectively: 25.22±1.48, 26.00±3.05 and 24.60±3.16. There was no significant difference in sample for age (\( p = 0.54 \) and \( F [26.2] = 0.62 \)) and for MMSE punctuation (\( p = 0.52 \) and \( F [26.2] = 0.66 \)).

Table 1: Values obtained by each group in the application of the assessment tools

| Variable     | LBP    | OAK    | OL     | p      |
|--------------|--------|--------|--------|--------|
| Roland Morris| 7.88±4.53 | -      | 15.10±4.53 | 0.003* |
| WOMAC - Pain | -      | 28.00±17.82 | 41.50±13.55 | 0.038* |
| WOMAC - Stiffness | -    | 32.00±27.17 | 39.50±18.92 | 0.483 |
| WOMAC - Physical Function | - | 30.28±22.05 | 43.67±15.68 | 0.135 |
| VAS          | 3.55±2.600 | 3.10±2.9900 | 6.30±2.7900 | 0.037* |
| GS           | 1.32±0.3200 | 1.34±0.3500 | 1.31±0.2100 | 0.967 |
| TGUGT        | 9.27±2.100 | 9.54±2.3300 | 10.02±2.2400 | 0.705 |
| BBS          | 52.44±4.66 | 50.80±4.360 | 49.70±3.650 | 0.109 |

Fig. 1: Significative difference between groups LPB and OL on the scores of RMQ

Fig. 2: Significative difference between groups OAK and OL only on WOMAC pain domain

In this study, sample was mostly composed by female individuals (84%), 41.37% of total sample presents with comorbidities and in groups LBP, OAK and OL respectively 70, 66.67 and 90% of volunteers performed physical activity for at least thirty minutes three times a week.
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Fig. 3: OL Group showed a significative difference level of pain on VAS compared to the others groups

The values obtained by each group in the application of the assessment tools were listed in Table 1.

Statistical analysis identified no significant differences in the three groups for the assessment by GS, TGUGT and BBS instruments. A significative difference was found by RMQ in groups LPB and OL (Fig. 1), the WOMAC found diference only in pain domain (Fig. 2) between groups OL and OAK and the analysis of VAS shows significative difference between groups OL to the others groups (Fig. 3).

DISCUSSION

This study aimed to determine which groups of elderly patients with OA, low back pain and two concurrent events are at higher risk of falls. For this was used a selection of instruments and questionnaires easily reproducible, with copyright or public domain and that present low cost and good reliability. In this sample was considered elderly above 60 years because the study was conducted in Brazil that is considered a country in development. The sample composition was consisted predominantly of female volunteers as can be seen in other studies and indicates a feminization process of the population that become more evident with advancing age due female longer life expectancy (Alvares et al., 2010; Ferreira and Yoshitome, 2010; Maraschin et al., 2010; Paula et al., 2010; Silva et al., 2011; Tsonga et al., 2011).

Low back pain can cause changes in subject’s functional capacity, in physical performance and may be a factor in risk to falls. A research demonstrated low correlation between low back pain and functional performance measure (Ocarino et al., 2009), but in this present study was found a significative difference by RMQ in OL group that sugests low back pain has a negative impact into functional performance. In this context, the RMQ application showed worse functional performance in elderly people who presents the two events (OA and low back pain) and this may predispose them to risk of falls (Ricci et al., 2010).

The clinicals criteria for OA of American College of Rheumatology consist of pain, stiffness, crackle, age over 38 years and bony enlargement to the physic exam.

The literature indicates that OA causes higher functional limitation in women and represent a risk of falls 2.4 times higher than in a elderly without OA. The data of the present study showed significative difference only in pain domain of WOMAC for the OL group. This is consistent with studies that show pain as main symptom of OA and its association with functional inability and falls (Avelar et al., 2010; Santos et al., 2011a; Falsarella et al., 2011; Kao et al., 2011). Furthermore, OL group presents a significative difference in level of pain by VAS, subjects in OL group showed a higer level of pain in contrast with the others groups.

Presence of pain may trigger antalgic postures and lameness that affect posture, gait and balance, especially in elderly. According a study by Ricci et al. (2010) and Cruz et al. (2011) subjects with pain have a higher risk of falling. Another study aimed verifies if chronic pain could lead to a reduction of functional capacity, predisposing elderly community to a higher risk of falling. The authors concluded that chronic pain is associated to a higher risk (Leveille et al., 2009). The results of the present study indicate that OL group presented higher scores in contrast with the others groups, suggesting a higher risk of falls to this group.

Balance in elderly is often stricken and to maintain stability usually they reduce GS as well as step length (Gine-Garriga et al., 2009; Queiroz et al., 2009; Chen et al., 2010; Novaes et al., 2011). A confortable speed to gait in elderly is described as 0.60-1.45m s$^{-1}$. The volunteers in this study showed 1.32m s$^{-1}$ of average in GS, it means a pattern without risk of falls (Salminen et al., 2009; Novaes et al., 2011; Tsonga et al., 2011). The present study do not observed differences in TGUGT between groups and TGUGT average was 9.62 sec, time considered normal for healthful adults. As described in literature, this instrument is an useful tool to evaluate changes of balance in healthy elderly (Gine-Garriga et al., 2009; Goncalves et al., 2009; Queiroz et al., 2009; Chen et al., 2010; Avelar et al., 2011;
Karuka et al., 2011). Some studies indicate correlation between BBS and other functionals measures such as the TGUGT and GS. Sample in this study had mean score in BBS of 50.93 points and there was no difference between groups.

Possible reasons for the results of the present study may be some characteristics of the sample, as follows: actives subjects, without visual changes, few comorbidities and no cognitive impairment. Many researches indicate that physical activity produces positive effects on overall health of subjects, ensuring researches indicate that physical activity produces comorbities and no cognitive impairment. Many actives subjects, without visual changes, few comorbidities higher will be the risk of falls. Some recomendations to next studies consisting in a larger sample, a longitudinal study and a control group.

CONCLUSION

It may be conclude that in this study there was found no significative difference between groups with the assessment of balance by instruments used, but group OL (that presented the two events: OA in knees and low back pain) showed worst performance than others groups and this may be represent a higher predisposition to falls. Furthermore the sample was fairly homogeneous and presents few factors of risk to falls. Some recomendations to next studies consisting in larger sample, a longitudinal study and a control group.

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