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Characterization of falls in adults with established rheumatoid arthritis and associated factors

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Abstract

Background: Rheumatoid arthritis patients may have an increased risk of falls due to changes caused by the disease such as muscle weakness, joint impairment, reduced mobility and postural instability. The aim of this study was to prospectively analyze the occurrence of falls in RA patients and its risk factors.

Methods: A cohort of 86 RA patients were assessed over 1 year for disease activity using the Disease Activity Score (DAS-28), for functionality using the Health Assessment Questionnaire (HAQ), for the characterization of falls and for the use of medications, and they were subjected to the Berg Balance Scale (Berg), Timed Up and Go (TUG), 6-Minute Walk (6MWT) and Short Physical Performance Battery (SPPB) tests. The Kolmogorov-Smirnov, Spearman's correlation, Student's t, Mann-Whitney and chi-square tests were performed with a significance level of $P \leq 0.05$.

Results: A total of 86 patients were evaluated, of which 48.8% had at least one fall and 75.6% reported having a fear of falling. No association of falls with age, disease duration, functional capacity, disease activity or physical performance was found. Patients with poorer performance in the physical tests had more functional impairment, higher disease activity and more advanced age. No differences in physical or functional performance, disease activity, gender or fear of falling were found between fallers and non-fallers; only a greater amount of medications used was found in the group of fallers.

Conclusions: The occurrence of falls was high and associated with a previous history of falls and polypharmacy, with no association with disease activity or duration, functional capacity, physical performance, age or gender.

Keywords: Postural balance, Physical aptitude, Rheumatoid arthritis, Accidental falls

Background

Falls have a multifactorial etiology in the elderly, mainly due to intrinsic factors such as decreased muscle strength, balance deficits, and gait pattern changes. These age-related changes can also be observed in other diseases [1–3].

Rheumatoid arthritis (RA) is a chronic systemic inflammatory autoimmune disease of joint predominance, with a high prevalence of falls occurring in 14.3 to 54% of patients over a one-year period, which are high values compared to the general population [4–19]. This increased risk of falls may be due to pain, edema, deformities, loss of muscle strength or gait changes, and prospective studies have shown associations with altered balance, use of psychotropic medications, fear of falling and previous falls [4–8]. However, findings regarding several other risk factors, the characterization of falls and the consequences of falls in RA patients are still scarce or contradictory.

The aim of this study was to prospectively analyze the occurrence of falls in RA patients for 1 year and to investigate whether physical fitness and balance tests, medication use, previous history of falls, disease activity and functionality are associated with falls.

Methods

Sample

A prospective study based on the sample of a previous retrospective study composed of 99 patients diagnosed

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with RA was conducted at the Rheumatology outpatient clinic of the Marília School of Medicine [19, 20].

Adults with a diagnosis of RA according to the American College of Rheumatology (ACR) classification criteria of 1987 and/or the 2010 ACR/EULAR (European League Against Rheumatism) RA classification criteria were included [21]. Patients with cognitive impairments precluding them from answering the questionnaires, using a wheelchair or with other physical disabilities that impeded the execution of the tests were excluded.

The study was approved by the Research Ethics Committee of the Marília School of Medicine, protocol CAAE: 22845513.3.0000.5413. All participants signed the informed consent form.

Procedure

The rheumatologist confirmed the RA diagnosis and performed the measurements to assess disease activity, and the nurse collected the blood samples. Next, the anthropometric data were measured, and the functional questionnaires and physical tests were applied by the nurse and the physical therapist.

From the initial evaluation, the patients were followed up for 1 year by quarterly telephone contact to record the occurrence of falls and their characteristics. After 12 months, the disease activity and functionality assessments and physical tests were repeated.

Instruments

Patients were assessed for disease activity using the Disease Activity Score (DAS-28) [21], for functional capacity using the Health Assessment Questionnaire (HAQ) [22, 23] and for the occurrence of falls using a fall characterization questionnaire [19, 20].

The following physical tests were performed:

The Berg Balance Scale was used to determine risk factors for loss of independence and falls in the elderly. The scale has 14 items common to daily life, scored from 0 to 4, with a higher fall risk associated with lower scores. The predictive value of falls in the elderly ranges from 45 to 48 [24–27].

The Short Physical Performance Battery (SPPB) was used to assess standing balance, walking ability and sit-to-stand performance. The three items are scored from 0 to 4, with poorer physical function associated with lower scores. Standing balance is evaluated in three positions with progressive difficulty - feet together, with the hallux leaning against the medial edge of the opposite heel and with the hallux leaning against the posterior edge of the opposite heel. Walking is evaluated by measuring time, in seconds, for a distance of four meters. In the sit-to-stand evaluation using a chair, the action is performed five times with the arms crossed in front of the chest, and time is also recorded in seconds [28, 29].

The Timed Up and Go Test (TUG) was used to assess body balance and risk of falls, especially in the elderly. The test begins with the patient sitting on a chair, then getting up, walking a three-meter distance, making a 180° turn, returning and sitting on the same chair. The different lengths of time spent indicate the following: ≤10 s - elderly without balance alteration and with low risk of falls; between 10 and 20 s - elderly with no significant balance alteration but presenting some weakness and medium risk of falls; and ≥ 20 s - elderly with a high risk of falls [30]. Other studies consider a higher risk of falls between 10 and 14 s [24, 31, 32].

The 6-Minute Walk Test (6MWT) was used to assess functional capacity and exercise tolerance through the distance an individual is able to walk on a hard, flat surface for 6 min. In healthy adults, the reference values are 580 m for men and 500 m for women [33, 34].

Statistical analysis

The Kolmogorov-Smirnov (KS) test was used to evaluate the normality of the data distribution. Values were expressed as the mean and standard deviation (SD) for variables with normal distribution and as the median and percentages for the others. Correlations were analyzed using Spearman's test, and other analyses were conducted using Student's t-test, the Mann-Whitney U-test and chi-square tests with a significance level of $p < 0.05$. The statistical program used was SPSS v.21 (IBM Armonk, NY, USA, 2012).

Results

A total of 99 patients were included in the study, but 13 were lost – three died, three had medical follow-up unit changes, three were not found, two were bedridden, one refused to participate, and one suffered an ankle sprain – leaving 86 patients. The majority of the sample consisted of white married women with a mean age of 55 ± 11.8 years (Table 1).

There were 67 fall episodes in the one-year follow-up period; 48.8% of these patients fell at least once, and 75.6% reported the fear of experiencing a fall episode. Falls occurred most often at home (58.2%), in the morning (41.8%), while the patients walked (65.7%) and due to tripping and slipping (65.5%), and fracture occurred in three falls (4.4% of the total).

No association was found between the number of falls and age, disease duration, functional capacity, disease activity or physical performance. Patients with poorer performance on the physical tests had more functional impairment, higher disease activity and advanced age. The higher disease activity was associated with poorer

Table 1 Characteristics of the sample of patients with rheumatoid arthritis

Participants, n		86
Women, n (%)		76 (88.4)
Age (years), mean ± SD (min-max)		55 ± 11.8 (23–88)
BMI (kg/m^2), mean ± SD (min-max)		27.7 ± 5.3 (15.35–40.04)
Self-reported ethnicity, n (%)	White	54 (62.8)
	Mixed	20 (23.3)
	Black	12 (14)
Marital status, n (%)	Married	52 (62.8)
	Single	14 (16.3)
	Divorced	10 (11.6)
	Widowed	8 (9.3)
Duration of disease (years), median (P25–75) (min-max)		10 (5–16.5); (2–40)
Self-reported associated diseases (%)	HBP	53.5
	Osteoporosis	17.4
	DM	12.6
	Labyrinthitis	11.6
	HF	8.1
	Fibromyalgia	7.0
	Hypothyroidism	7.0
	Depression	3.4
Falls in the previous year (%)		37.4
Walking aids (%)		9.3

n: number; %: percentage; SD: standard deviation; min: minimum; max: maximum; BMI: body mass index; kg: kilogram; m^2: square meter; P25–75: 25th percentile and 75th percentile; HBP: high blood pressure; DM: diabetes mellitus; HF: heart failure

physical performance, poorer functional capacity and longer disease duration (Table 2).

There was no significant difference in functional capacity or disease activity in the initial evaluation and after 1 year. However, in the physical tests, better performance was observed in the final evaluation when compared to the initial evaluation (Table 3).

When divided into groups according to the occurrence of falls, considering fallers as patients with at least one fall episode during the follow-up period, no significant differences were found between fallers and non-fallers regarding physical or functional performance, disease activity, gender or fear of falling (Tables 4 and 5). The number of medications used and history of falls differed significantly between fallers and non-fallers (Table 5).

Discussion

The incidence of falls in this sample of RA patients was high (48.8%) compared to that found in the literature, which shows ranges from 14.3 to 54% in retrospective studies and from 18.8 to 50% in prospective studies [4–9, 11–19]. The incidence of falls

Table 2 Correlations between the number of falls with clinical variables and functional tests

	Number of falls, *r* (P)	Age, *r* (P)	HAQ, *r* (P)	DAS28, *r* (P)
Age	0.059 (0.592)	–	− 0.109 (0.317)	0.034 (0.755)
RA duration	− 0.077 (0.483)	0.187 (0.087)	0.066 (0.550)	0.224 (0.039)*
HAQ	0.151 (0.165)	−0.109 (0.317)	–	0.468 (0.000)*
DAS28	0.004 (0.973)	0.034 (0.755)	0.468 (0.000)*	–
Berg	−0.127 (0.244)	−0.367 (0.001)*	− 0.541 (0.000)*	−0.422 (0.000)*
6MWT	−0.124 (0.260)	−0.244 (0.024)*	− 0.495 (0.000)*	−0.294 (0.006)*
TUG	0.064 (0.558)	0.243 (0.025)*	0.557 (0.000)*	0.363 (0.001)*
SPPB	−0.121 (0.266)	−0.291 (0.007)*	− 0.658 (0.000)*	−0.404 (0.000)*

RA: rheumatoid arthritis; HAQ: Health Assessment Questionnaire; DAS28: Disease Activity Score 28; Berg: Berg Balance Scale; 6MWT: 6-min walk test; TUG: Timed Up and Go; SPPB: Short Physical Performance Battery; r: Spearman's correlation; P: significance level

Table 3 Initial and final scores on physical, functional and disease activity tests

	Initial	Final	P
HAQ, median (P25–75)	0.62 (0.12–1.25)	0.62 (0.12–1.37)	0.318
DAS28, mean (±SD)	3.40 (±1.17)	3.58 (±1.32)	0.215
6MWT (meters), mean (±SD)	391.27 (±103.78)	429.52 (±129.01)	0.001
Berg, median (P25–75)	53 (49.75–56)	55 (50.75–56)	0.019
TUG (seconds), median (P25–75)	8.89 (7.59–11.69)	8.75 (7.14–11.28)	0.071
SPPB, median (P25–75)	10 (8–12)	11 (9–12)	0.001

HAQ: Health Assessment Questionnaire; DAS28: Disease Activity Score 28; 6MWT: 6-min walk test; Berg: Berg Balance Scale; TUG: Timed Up and Go; SPPB: Short Physical Performance Battery; P25–75: 25th percentile and 75th percentile; SD: standard deviation; P: t test significance level

observed was also high compared to that of non-institutionalized elderly individuals, which ranges from 15.9 to 56.3% [2]. Although age is an important risk factor for falls, the association between falls and advanced age was not observed in this sample, which is in agreement with previous RA studies [4–6, 12, 15, 35].

Comparing fallers with non-fallers, there was again agreement with other RA studies but a difference from what occurs in the elderly - there was no predominance of falls among females. It is possible that no difference was observed between men and women because both genders have decreased muscle mass and similar patterns of medication consumption [5–7, 15, 35].

The use of several medications may increase the occurrence of falls due to interactions between medications or their side effects. In the present study, we found a significant difference between fallers and non-fallers in relation to polypharmacy. Armstrong et al. [15] reported an association between a higher number of medications and a higher risk of falling, while Stanmore et al. [36] found that using four or more medications more than doubles the risk of falling in RA patients. An association has also been found between falls and the use of medications such as antihypertensives, diuretics, sedatives, antidepressants and antipsychotics [6, 8, 15, 36–39].

Table 4 Differences between disease activity and physical and functional performance in fallers and non-fallers

	Fallers ($n = 42$)	Non-fallers ($n = 44$)	Test	P
HAQ	0.81 (0.22–1.75)	0.50 (0.12–1.34)	U = 763.5	0.164
DAS28	3.70 (±1.49)	3.47 (±1.16)	$t = -0.798$	0.427
6MWT	376.31 (±100.74)	405.88 (±105.79)	$t = 1.320$	0.190
Berg	53 (47.75–55.25)	54.5 (50–56)	U = 787	0.229
TUG	9.27 (7.89–11.62)	8.73 (7.35–12.08)	U = 852	0.660
SPPB	10 (7.75–11)	10.5 (9–12)	U = 784.5	0.219

HAQ: Health Assessment Questionnaire; DAS28: Disease Activity Score 28; 6MWT: 6-min walk test; Berg: Berg Balance Scale; TUG: Timed Up and Go; SPPB: Short Physical Performance Battery; P: significance level; t: t test; U: Mann-Whitney U-test
Values are expressed as the mean (± standard deviation) or median (25th - 75th percentile)

The history of falls was associated with the occurrence of new falls, which indicates the need for special attention in the evaluation of RA patients who have already fallen [4, 6, 7, 36].

Most of the sample presented moderate disease activity, which, similar to the study by Bohler et al. [12], was associated with poorer performance in most physical tests, but not the occurrence of falls. Koerich et al. [40] argued that the level of disease activity may influence physical performance (Berg and TUG), suggesting an increased risk of falling or dependence in performing activities of daily life. The lack of association between poor physical performance and disease activity with the presence of falls may be related to the time of evaluation, which usually occurs at the beginning or end of the study and not at the time of the falls. Another reasonable explanation is that the increased disease activity results in restriction of activities and therefore reduces the individuals' exposure to situations with a risk of falls.

Other studies have indicated functional disability as a risk factor for falls, but in our study, although it was associated with poorer performance in physical tests, it was not correlated with falls [4, 9, 12, 13, 19, 20, 35]. In a prospective study with 80 patients in Japan, Hayashibara et al. [6] found no relationship between functional disability and the presence of falls and explained that the

Table 5 Differences between number of medications, history of falls, gender and fear of falling between fallers and non-fallers

		Occurrence of falls (n)			
		No	Yes	χ^2	P
Polypharmacy	Up to three medications	20	9	5.55	0.018
	Four or more	24	33		
History of falls	Yes	10	22	8.087	0.004
	No	34	20		
Gender	Female	38	38	0.354	0.552
	Male	6	4		
Fear of falling	Present	31	31	0.120	0.729
	Absent	13	11		

X^2: chi-square; P: significance level

findings were due to the fact that five of the eight HAQ categories assess the function of the upper limbs.

Although the physical tests used in the present study are aimed at the elderly population, RA patients may present an early decrease in muscle strength, physical activity and balance in a pattern similar to that of elderly individuals, anticipating the risks resulting from the aging process. This may explain the finding that performance on physical tests was correlated with age: the older the patient, the poorer the physical performance. Although the four physical tests were significantly correlated among themselves, no significant association was found between any of the tests and the occurrence of falls. While some studies found an association between poorer performance on physical tests and a greater occurrence of falls or risk of falling, others found no such association [6, 11, 12, 16, 19, 36, 37]. The lack of standardization in the choice of tests for the RA population may be an important factor to be considered when analyzing these results, a gap that was observed by Santana et al. [41].

Several studies suggest that prospective studies be conducted to minimize memory bias [13–15, 19]. Cummings et al. [42], in a prospective, 12-month study of the elderly, found that 13–32% of the participants who fell did not report the episode at the end of the evaluation period. The follow-up strategies used were calendars, journals, fall log cards and self-reports to the researcher at the time of the fall. The present study has a methodological advantage, as it obtained the information quarterly by telephone, which improved the reliability of the report of falls and facilitated detailed clarification regarding the characteristics [4–8, 36].

Conclusions

The occurrence of falls in RA patients is high and is associated with a previous history of falls and polypharmacy, showing no association with disease activity or duration, functional capacity, physical performance, age or gender. In addition, the performances in the physical tests were associated with each other, and a poorer physical condition was related to greater disease activity, poorer functional capacity and older age.

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Authors' contributions

The rheumatologist (MRA) confirmed the RA diagnosis and performed the measurements to assess disease activity, and the nurse (FVBOC) collected the blood samples. Next, the anthropometric data were measured, and the functional questionnaires and physical tests were applied by the nurse and the physical therapist (MAL). All authors read and approved the final manuscript.

Ethics approval and consent to participate

The study was approved by the Research Ethics Committee of the Marília School of Medicine, protocol CAAE: 22845513.3.0000.5413. All participants signed the informed consent form.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests

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