Association between walking speed reserve and fear of falling in stroke survivors

Associação entre velocidade de reserva e medo de quedas em indivíduos pós acidente vascular encefálico

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ABSTRACT

Objective: Stroke survivors may have residual mobility impairments and an inability to improve walking speed in daily life and can result in falls, one of the most common complications after a stroke. The ability to improve walking speed is determined by the difference between the fast and self-selected walking speed, the walking speed reserve (WRS). So, the objective is to investigate the relationship between the WRS capacity and the fear of falling in stroke survivors. **Methods:** This is a cross-sectional study with fifty five stroke survivors. The WRS was determined by the 10 meter walk test (10MWT, in m/s), and the fear of falling was assessed by Falls Efficacy Scale International (FES-I in points). Pearson's correlation was used to investigate the association between the WRS and fear of falling. **Results:** 54.5% were male, with a mean age of 62.5 (SD 14.9) years and 41% were community walkers (≥0.8m/s). The WRS was 0.17±0.17m/s, and the mean FES-I score was 31.79±9.88. A negative and statistically significant association was found, with a reasonable magnitude between the WSR and the FES-I score (r= -0.38; p= 0.005). **Conclusion:** Stroke survivors who have greater WSR capacity, have a lower score on the FES-i scale, indicating less fear of falling.

Keywords: Stroke, Walking Speed, Accidental Falls, Fear

RESUMO

Objetivo: Os indivíduos pós AVE podem ter déficits residuais de mobilidade e incapacidade de aumentar a velocidade de caminhada na vida diária e podem resultar em quedas, uma das complicações mais comuns após um AVE. A capacidade de aumentar a velocidade de caminhada é determinada pela diferença entre a velocidade de caminhada máxima e auto-selecionada, a velocidade de reserva (VR). Assim, o objetivo é investigar a relação entre a VR e o medo de cair em indivíduos pós AVE. **Métodos:** Trata-se de um estudo transversal com cinquenta e cinco indivíduos pós AVE. A VR foi determinada pelo teste de caminhada de 10 metros (TC10m, em m/s), e o medo de cair foi avaliado pela Falls Efficacy Scale International (FES-I em pontos). A correlação de Pearson foi usada para investigar a associação entre a VR e o medo de cair. **Resultados:** 54,5% eram do sexo masculino, com média de idade de 62,5 (DP 14,9) anos e 41% eram deambuladores comunitários (≥0,8m/s). A VR foi de 0,17±0,17m/s, e o escore médio da FES-I foi de 31,79±9,88. Encontrou-se associação negativa e estatisticamente significativa, com magnitude razoável entre a VR e o escore da FES-I (r= -0,38; p= 0,005). **Conclusão:** Os indivíduos pós AVE que têm maior VR, apresentam uma pontuação mais baixa na escala FES-i, indicando menor medo de cair.

Palavras-chaves: Acidente Vascular Cerebral, Velocidade de Caminhada, Acidentes por Quedas, Medo

Acta Fisiátr. 2023;30(4):213-217

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INTRODUCTION

Stroke survivors have long-term disabilities and can lead to many dysfunctions (e.g., muscle weakness, loss of dexterity) leading to reduction of functional capacity, and impairment on movement control, limitation of balance and postural control.[1] In general, individuals after stroke present reduced self-selected walking speed, and inability to improve walking speed in daily life.[2,3]

The ability to improve walking speed is defined as walking reserve speed (WRS), which is clinically measured as the difference between the self-selected and fast walking speed.[4] The WSR in daily life is important in response to environmental demands,[5] e.g., cross the street into the signal time, catch a bus, or to pick up a phone. So, an inability to improve walking speed in daily life and can result in falls, one of the most common complications after a stroke.[6] It is well-known that after a stroke there is a high risk of falling in all chronicity stages status.[7]

The incidence of fear of falling in stroke survivors, with and without a history of falls, ranged from 12% to 92% and 12% to 65%, respectively.[8] The falls recurrence and the concern to develop subsequent injuries, contribute to the development of the fear of falling contributing to the unnecessary restriction of activities, and the functional decline.[9] The literature suggests physical training, including functional balance training and gait rehabilitation, can effectively reduce the fear of falling in people with stroke.[10] Fear of falling was considered a factor that negatively influences rehabilitation and is also a risk factor for fall.[8]

So, it is widely recognized that WSR is an integral daily practice by individuals in general, and the absence of this ability poses a significant risk for falls in stroke survivors.[7] This risk factor can induce a fear of falling in individuals lacking this capability, and if these variables are interconnected, they could significantly affect the rehabilitation process. As such, this factor could demand careful consideration during the evaluation and treatment of stroke survivors.

OBJECTIVE

To investigate the relationship between WRS and the fear of falling in stroke survivors.

METHOD

This cross-sectional study was approved by the Ethics Committee (80069917.9.0000.5134). All participants provided signed the consent term before data collection. Participants were recruited by telephone contact from lists of previous research from Federal University of Minas Gerais and Faculty of Medical Sciences of Minas Gerais. It was a convenience sample stopped in 55 individuals because it had a good sample power analyzed by GPower software. Recruitment and laboratory evaluations took place from March 2018 to April 2019.

The sample was composed of stroke survivors. They were included based on to the following criteria: a) chronic stroke (at least six months after stroke),[11] b) ≥ 18 years of age c) ≥ 18 in the Mini-Mental State Examination,[12] d) walking speed at least 0.1 m/s, e) be able to follow verbal commands, and f) to provide and sign the informed consent form.

All data were collected by two researchers, trained in a laboratory prior to data collection, regarding all tests performed in the study. The evaluations with each individual lasted a of one hour.

Clinical and demographic data were obtained to characterize the sample through the self-developed questionnaire.

10WT was used for self-selected and fast speed[13,14] assessment, in m/s, and the difference between these speeds results in the WRS in m/s.[5] The ten-meter walking test was performed in a hall with 14 meters, 2 meters at the beginning of acceleration, and 2 meters at the end of the slowdown. The time used to covered the intermediate ten meters was used to calculated the speed.[14] Verbal command to catch up a bus was standardized according Nascimento et al.[15] recommendations. Ten-meter walking test is valid (r= 0.76 to 0.78)[16] and reliable (ICC= 0.94 for self-selected walking speed and ICC=0.97 for fast walking speed)[17] for stroke survivors.

The Falls Efficacy-International (FES-I) scale is a questionnaire that was used to evaluate the fear of falling. It was composed of sixteen questions about the fear of falling in diverse day-by-day situations, for example go answer the phone. The score ranges from 16 to 64 points, and the higher score represents the highest fear of falling.[18] This questionnaire has adequate measurement properties for older adults and geriatric care (ICC= 0.58 to 0.96; Cronbach's alpha= 0.96),[19,20] and for stroke survivors (Pearson separation value 3.07; CCI= 0.90).[21]

Descriptive statistics and Kolmogorov-Smirnov test were performed for all variables. The association between variables was investigated using Pearson's correlation coefficients:[22] 0-0.25: little or none; 0.26-0.50: reasonable; 0.51-0.75: moderate to good; and > 0.75: good for excellent relationship. All analyses were performed by an independent researcher in the SPSS software (version 19.0) with a significance level of 5%.

RESULTS

Fifty-five stroke survivors were included in the study 54.5% were male, with a mean age of 62.5 (SD 14.9) years and mean time after stroke of 66.8 (SD 55.9) months. 41% were community walkers (≥0.8m/s). The mean of WRS was 0.17± 0.17 m/s. The average FES-i score was 31.79 (SD 9.88). The participants' characteristics are described in Table 1.

Table 1. Participants' characteristics

Characteristic	n= 55
Age (years), mean (SD)	62.5 (14.9)
Gender (men), n (%)	30 (54.5)
Chronicity of stroke (months), mean (SD)	66.8 (55.9)
Affected cerebral hemisphere (left), n (%)	29 (52.7)
Type of stroke (ischemic), n (%)	44 (80)
Physical activity before stroke (yes), n (%)	28 (50.9)
Physical activity after stroke (yes), n (%)	32 (58.2)
Mini Mental State Examination (score), mean (SD)	24.9 (3.4)
Walk level (community walker, ≥0.8m/s), n (%)	23 (41.8)
Self-selected speed (m/s), mean (SD)	0.7 (0.3)
Fast speed (m/s), mean (SD)	1.0 (0.5)
Walking reserve speed (m/s), mean (SD)	0.17 (0.17)
Falls Efficacy Scale - International (score), mean (SD)	31.8 (9.9)
Falls reported on the last 6 months (yes), n (%)	3 (5.4)

SD: Standard deviation

A negative and statistically significant association was found, with a reasonable magnitude between the WSR and the FES-i score (r= - 0.38; p= 0.005). The association between those variables is shown in Figure 1.
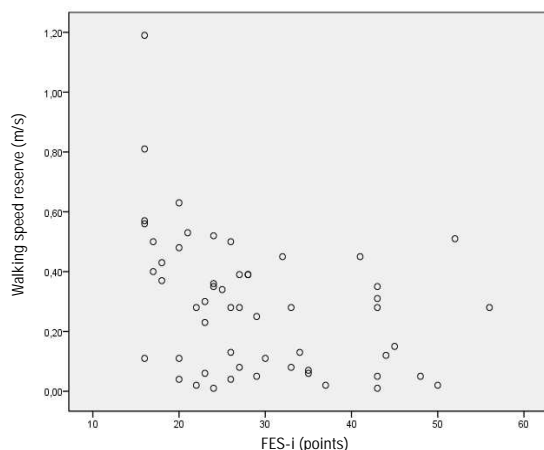
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Figure 1. Scatter Plot between fear of falling and walking speed reserve (r= -0.38; p<0.01)

DISCUSSION

The ability to increase walking speed to adapt the environmental demands is important for successful, safe, and adaptable community ambulation in stroke survivors.[5] The results of the present study demonstrated the stroke survivors who have a greater WSR, presents less fear of falling. Stroke survivors who experience to maximize their ability to walking in the community need to be able to accelerate in their response to daily environmental demands.[23]

A previous study which included 47 stroke survivors, mean of walking speed in seconds 0.82 m/s measured by 10MWT and a mean FES-i score 30.55 (SD 10.54) demonstrated that 10MWT was significantly associated with the number of steps a day and frequency of steps. In addition, FES-i score was significantly associated the number of steps a day, gait frequency and frequency of steps.[24] Our study were composed with stroke survivors, average FES-i score 31.79 (SD 9.88), self-selected walking speed 0.7 (SD 0.3) m/s, and fast walking speed 1.0 (SD 0.5) m/s. And, demonstrated a negative and statistically significant association was found, with a reasonable magnitude between the WSR and the FES-i score. One could hypothesize that individuals with less fear of falling have more chance to take more steps, and improve the walking speed. And, with elderly individuals, a study showed that walking speed has an association with the fear of falling, with a moderate and negative association between walking speed and FES-i scores (r= -0.503).[25] These results corroborate with current founds and confirm that individuals with less fear of falling have high walking speed.

A study with older people showed that 73.7% need to increase their walking speed to perform safely activities like cross the road, an environmental need in a community field. And, 12.8% are unable to reach the speed 1.2 m/s (required to cross the road).[26]

Thus, WSR is an important ability to improve social participation and the activity of daily life, even if that activity is performed inside the house, e.g., walking faster to go to the bathroom. As an important ability, including for stroke survivors, need to mention that the inability to increase speed in stroke survivors is common,[27] such as elderly individuals.[26] The present study demonstrated that twenty-two (40%) individuals are unable to improve walking speed, and another study even demonstrated that seventy-three (59%) stroke survivors were unable to increase their walking speed.[5] This may limit the ability of these individuals to

be functional ambulators in the community.

Fear of falling is one of the most common syndrome after stroke[28] and its cause is multifactorial. Fear of falling is associated with falls and creates a vicious cycle that could generate devastating consequences for stroke survivors.[29] In the sample evaluated by de Oliveira et al.[25] the majority reported a small fear of falling, accompanied by a reduced history of falls in the last six months. This is an important finding because the fear of falling is a barrier to community participation,[30] even because stroke survivors avoid felling fear.[31] Fear of falling is a predictor of falls in community-dwelling older adults.[31] And FES-i score was significantly associated the number of steps a day, gait frequency, frequency of steps,[24] and with walking speed.[25]

WSR and the FES-i score showed a negative and statistically significant association, with reasonable magnitude. The reasonable magnitude can be explained by the fear of falling not being the only variable influencing the WSR. To the best of our knowledge, there are no study demonstrating which variables can influence the WSR in stroke survivors. A recent review demonstrated that low age, less lower limb impairment, absence of sensorial deficit and hemianopsia, trunk control, hip extensors strength ≥3 are some predictive factor for walking improvement.[32] Also, another study demonstrated that 6-minute walking test, Fugl-Meyer and Berg Balance Scale are predictors of home versus community ambulators and limited versus unlimited community ambulators.[33] Walking speed is important to return to employment, and individuals able to walk faster than 0.93 m/s were significantly more likely to return to work after stroke.[34]

The results of this study present important clinical implication. The fear of falling makes individuals more careful, and we hypothesized these individuals may have less chance to improve walking speed in environmental demands during daily life. Walking speed, WSR and fear of falling show correlation and could be integrated at the clinical practice. So, an alternative variable to investigate when the stroke survivors have difficulty to improve walking speed is the fear of falling.

To the best of our knowledge, this is the first study that investigates the association between WSR and fear of falling. The present study has strengths: a) data were collected by two well-trained researchers; and b) a randomized approach was used to collect the data. A few limitations are related to our study: 1. individuals were evaluated in a laboratory setting, that is, it cannot extrapolate to the individual context; 2. only stroke survivors more than 6 months after stroke, and able to walk without assistive devices were included, that is, it cannot extrapolate the current results to other population with different characteristics. Therefore, the results of the present study cannot be generalized beyond this population of individuals.

CONCLUSION

Stroke survivors who have greater WSR capacity, have a lower score on the FES-i scale, indicating less fear of falling.

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