British Journal of Medicine & Medical Research
19(6): 1-7, 2017; Article no.BJMMR.31090
ISSN: 2231-0614, NLM ID: 101570965

SCIENCEDOMAIN *international*
www.sciencedomain.org

The Importance of Chronic Musculoskeletal Pain as a Factor Associated with Locomotive Syndrome in the Elderly

Daniela Regina Brandão Tavares[1*], Ana Laura de Figueiredo Bersani[1], Jane Erika Frazão Okazaki[1], Maria Carolyna Fonseca Batista Arbex[1], Virginia Fernandes Moça Trevisani[2,3] and Fania Cristina dos Santos[1]

[1]Discipline of Geriatrics and Gerontology, Pain and Osteoarticular Diseases Group, Federal University of São Paulo (UNIFESP), SP, Brazil.
[2]Brazilian Society of Rheumatology, Discipline of Rheumatology, Federal University of São Paulo (UNIFESP), Brazil.
[3]Santo Amaro University (UNISA), Brazil.

Authors' contributions

This work was carried out in collaboration between all authors. Author DRBT designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors ALFB, FCS, JEFO, MCFBA and VFMT managed the analyses of the study. Authors VFMT and FCS managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2017/31090
Editor(s):
(1) Nicolas Padilla-Raygoza, Department of Nursing and Obstetrics, Campus Celaya Salvatierra University of Guanajuato, Mexico.
Reviewers:
(1) Timothy Hui, Loma Linda University, Loma Linda, California, USA.
(2) Ayhan Goktepe, Selcuk University, Konya, Turkey.
Complete Peer review History: http://www.sciencedomain.org/review-history/17562

Original Research Article

Received 19th December 2016
Accepted 14th January 2017
Published 19th January 2017

ABSTRACT

Background: Locomotive Syndrome (LS) refers to a high risk of disability and dependency care due to a disorder in locomotive organs. It is increasing particularly because of populational aging. Chronic musculoskeletal pain in the elderly is also an important risk factor for disability and may be related to LS. The analysis of this relationship was the object of this research.
Methods: It was an observational, descriptive and analytical study, comprising 100 elderly people in São Paulo. Socio-demographic aspects and data about pain, falls, physical activity, self-perception of health and functionality were assessed. Additionally, the Brazilian version of "25-

**Corresponding author: E-mail: daniela74_tavares@hotmail.com;*

Question Geriatric Locomotive Function Scale," the GLFS 25-P, was applied for the screening of LS as well as the verbal description scale of pain. In the statistical analysis, the 2-sample Test for Equality of Proportions, the Chi-square test and multivariate analysis were performed.
Results: LS was present in 63% of the elderly, and musculoskeletal pain in 61% of them, this being predominantly severe in intensity. A significant association of LS with chronic pain (p=0.001) was found, as well as osteoarthritis of knee, hip and spine, falls, physical inactivity, worsening self-perception of health and functional dependence for instrumental activities. In a multivariate analysis, chronic musculoskeletal pain was the variable most strongly related to LS (OR 15.92, IC 95% 3.08-82.27).
Conclusion: Chronic musculoskeletal pain emerged as an important factor associated with LS in the elderly, which could highlight the role of analgesic strategies also aimed at the prevention or therapeutics of this syndrome in aging.

Keywords: Elderly; locomotive syndrome; musculoskeletal pain; GLFS-25.

1. INTRODUCTION

The global population has gone through major changes in its age structure in the last 50 years. In Brazil, IBGE data from 1960 showed a total of 3.3 million elderly people aged 60 or older, while the 2010 data showed a total of 20.5 million (10.8% of the population) [1]. As a result of populational aging, disorders of locomotive organs, either in bones, joints or muscles, also tended to grow [2].

The Locomotive Syndrome (LS) concept, proposed by the Japanese Orthopaedic Association (JOA) in 2007, was recently introduced in our environment [3]. LS refers to older people that, due to osteoarticular disorders, are at high risk of becoming care dependent at some point in their lives. Dysfunction in any of the locomotive organs, if not properly managed, could lead to major walking difficulty in the long term and, thus, make the elderly dependent on care [4].

Osteoarthritis of the knee, spine and hip, as well as osteoporosis, are the main causes of LS. Osteoarticular disorders usually come with chronic pain, which is also an important factor that generates the loss of quality of life [5]. According to Kanzaki *et al*, the prevalence of chronic knee pain in the Japanese population reached 32.7% and grew with the increasing age [6].

GLFS-25, the main diagnostic tool in LS, is able to address matters from the aspects related to the capacity of mobility up to pain, social interaction and cognition, and has already demonstrated significant association with quality of life, according to “European Quality of Life Scale-5 Dimensions” (EQ-5D) [7].

Therefore, chronic musculoskeletal pain, as well as LS, are important thopics to be studied in the aging population. The objective of this study was to evaluate the association between LS and the presence of chronic musculoskeletal pain etiology in the elderly.

2. MATERIALS AND METHODS

This is an observational, descriptive and analytical study approved by the Ethics Committee of the Federal University of Sao Paulo / UNIFESP (CEP n°921.390/2014).

A sample size capable of estimating the prevalence of LS in 9.6% was calculated, as recently verified in literature [8]. To explore the associations of LS with related factors, the sample guaranteed a statistical power higher than 80%, with an alpha error of 5% and a relative risk of 2.0. A universe of 340 elderly people was the basis for the calculation, corresponding to the number of new patients in the outpatient unit of the Discipline of Geriatrics and Gerontology – DIGG/UNIFESP, in the year 2015. The following is the equation used:

$$n = \frac{N \times Z^2 \times p \times (1 - p)}{(N-1) \times e^2 + Z^2 \times p \times (1 - p)} = \frac{340 \times 3.84 \times 0.096 \times 0.904}{(340 - 1) \times 0.0025 + 3.84 \times 0.096 \times 0.904} = 96$$

* n= sample size, N= universe, Z= constant critical value to achieve the desired confidence level of 95% (1.96), e= maximum acceptable margin of error (5%), p= prevalence based on literature (9.6%).

Thus, an n of 96 participants was obtained but a final increase of 5% was considered in the event of loss.

This study included individuals from both genders, aged 60 or older, who were able to answer the questionnaires. Those with cognitive impairment, acute or decompensated chronic disease, limiting sensory deficits, history of fracture in the lower limb or spine in the last 6 months and total disability for locomotion were excluded. Everyone signed the Informed Consent.

Information was collected about socio-demographic aspects (age, gender, civil status, ethnicity and education) and dependence for basic activities of daily living (BADL) and instrumental activities of daily living (IADL), respectively, according to the Katz Index (Independence = 5-6 ; Dependence = ≤ 4) and Lawton scale (Independence = 26-27; Mild Dependence = 21-25; Moderate Dependence = 16-20; Severe Dependence ≤ 15) [9,10].

We obtained data about chronic musculoskeletal pain in locomotive organs (for 6 months or more), and, furthermore, the etiologic diagnoses given to those pains, particularly osteoarthritis (OA) of the hip, knee and spine, fibromyalgia and osteoporosis. The participants were, also, asked about the occurrence of falls, tracking their frequency over the past year, self-perception of health that was classified as poor, fair, good or excellent, and the regular practice of physical activity (a minimum of 150 minutes of weekly exercises).

Measurements of pain intensity were performed using a Verbal Descriptor Scale (VDS), which classified the pain as mild, moderate, severe or very severe. The screening of LS was conducted through the GLFS 25-P (25-question Geriatric Locomotive Function Scale), a fairly simple instrument already translated, validated and cross-culturally adapted for Brazil [3]. We used the cutoff score of 16, which is the same score suggested for the original instrument. This tool proved to be valid and reliable in the early detection of LS in elderly patients, consisting of 25 items, graded from 0 to 4, and with a maximum score of 100 [7].

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences), version 17. In characterizing the distribution of the relative frequency of qualitative variables, the 2-sample Test for Equality of Proportions was used. The chi-square test was used to evaluate the association of LS with the other variables studied. Also, a multivariate analysis of the associations found in the univariate model, was performed. The level of significance was set at 5%.

3. RESULTS

It was included 100 participants, being 63% of them diagnosed with LS. A mean age of 82 ± 1.5 years (between 61 and 100) was observed and they were predominantly females (73%), white (50%), widowed (52%), and with a low level of education (average 5.1 years of study) (Table 1).

Chronic musculoskeletal pain was present in 61% of elderly people with a majority of severe intensity pain (42.6%), followed by moderate (32.8%), very severe (19.7%) and mild (4.9%) pain. And, for the etiologic diagnosis of chronic musculoskeletal pain in the locomotive system, 61% of them had OA in the spine, 62% in the knee, 33% in the hip, osteoporosis in 61% and fibromyalgia in 15%.

From a functional point of view, there was found to be a majority of elderly independence for BADL (96%) and mild dependence for IADL (41%). Regarding the presence of falls and the practice of regular physical activity, 15% were classified as recurrent fallers (2 or more falls in the last year) and 85% as sedentary, respectively. And, for self-perception of health, 5% referred to as poor, 53% as fair, 36% as good and 6% as excellent.

Analyzing the correlation of variables, it was initially obtained that 83.6% of elderly people with chronic musculoskeletal pain had LS, with statistical significance ($p < 0.001$). OA of the knee, hip and spine also correlated in a statistically significant manner to LS ($p=0.001$; $p=0.015$; and $p=0.037$, respectively) (Table 2). And, similarly, IADL functionality was significantly associated with LS ($p<0.001$), with the greater the dependency on that function, the higher the GLFS 25-P score.

For the presence of falls and lack of regular physical activity (sedentary lifestyle), significant correlations were again ascertained with LS ($p=0.02$; $p <0.001$, respectively). Significant association with a worse self-perception of health ($p <0.001$) was also verified (Table 3).

Table 1. Sample characterization

		n	%
Age (years)			
Average (*CI)	82 (1.5)		
**Min-Max	61-100		
60 - 70		9	9
71 - 80		28	28
81 - 90		53	53
> 90		10	10
Gender			
Male		27	27
Female		73	73
Ethnic group			
Caucasian		50	50
Latin-american		39	39
African descendant		11	11
Civil status			
Married		35	35
Single		8	8
Widowed		52	52
Separated		5	5
Education (years)			
Illiterate		16	16
1 - 4		57	57
5 - 8		11	11
9 - 11		3	3
≥ 12		13	13
Chronic musculoskeletal pain			
Yes		61	61
No		39	39
Pain intensity - VDS			
Mild		3	4.9
Moderate		20	32.8
Severe		26	42.6
Very severe		12	19.7
Falls in the past year			
None		58	58
1		27	27
≥ 2		15	15
Physical activity			
Yes		15	15
No		85	85
Self-perception of health			
Bad		5	5
Normal		53	53
Good		36	36
Excellent		6	6
BADL			
Independence		96	96
Partial dependence		4	4
IADL			
Independence		40	40
Mild dependence		41	41
Moderate dependence		13	13
Severe dependence		6	6

**CI = Confidence Interval, **Min-Max = Minimum - Maximum*

In multivariate analysis, we verified that chronic musculoskeletal pain was the factor most strongly related to LS (OR 15.92, CI 95% 3.08-82.27). Also, in this multivariate model, the worst self-perception of health was significantly correlated with LS (OR 0.23, CI 95% 0.07-0.79) (Table 4).

4. DISCUSSION

There is a growing concern in keeping the elderly free of disabilities for a longer time along with the demographic transition process and the increased prevalence of chronic degenerative diseases. It is known that functional independence is strongly related to autonomy in mobility, thus, the early recognition and management of LS in elderly individuals, as well as rapid intervention in their risk factors, is extremely important [11].

In the sample evaluated, the prevalence of LS was considered quite high (63%), suggesting a large portion of the elderly are under a high risk of becoming dependent of care for disabilities of the locomotive system, which therefore increases costs, for both the individual as well as public health. As previously mentioned, in Japan, there has been an increased frequency of LS, especially with aging, with a rate of 4.4% of those aged 40 to 49, 5.5% of those aged 50 to 59, 7.1% of those aged 60 to 69 and 12.7% of those aged 70 to 79 [12].

The high prevalence of LS found here could be explained by the fact that the elderly come from a tertiary center where those with more comorbidities are more frequent, including those related to mobility impairments.

It is important to note that, despite the high prevalence of LS among the elderly who were assessed, they were classified predominantly as independent for BADL (96%) and mild dependent for IADL (41%), suggesting that the diagnosis of LS through the GLFS 25-P tool can show earlier evidence of increased risk of major disorders in individuals associated with aging.

Referring to chronic musculoskeletal pain and its association with LS, there was a strong association between them, corroborating other findings, particularly those of Iizuka et al., in which locomotive dysfunction was significantly associated with lower back pain ($p<0.01$), shoulder pain ($p<0.05$) and knee pain ($p<0.001$) [5]. According to Kanzaki et al., chronic pain was considered important because of locomotive

dysfunction, and OA stood out as one of its main causes [6].

The associations between LS and OA of the knee, hip and spine in this series also support the findings of the literature [13]. One study highlights OA of the knee as one of the most prevalent causes of LS [14]. In Japan, OA is the fourth leading cause of locomotive injury, followed by falls and osteoporotic fractures, with consequent dependence in ADLs [15].

In addition to chronic musculoskeletal pain, LS also correlated to physical inactivity, falls, and dependence in IADL, however such correlations were not sustained in a multivariate model [16,17]. In the latter, only musculoskeletal pain and a worse self-perception of health were found as risk factors for LS.

The association between LS and self-perception of health has not yet been reported in the literature. Self-perception of health has been described as an indicator related to the decline of functional autonomy and mortality among the elderly [18]. Previous studies, such as Vagetti et al., demonstrated that worst quality of life indices are associated independently with negative self-perception of health among older adults, thereby inferring another negative aspect of LS [19]. Moreover, worst quality of life indices have already been linked to LS, but such indices were not obtained here, setting it as a limitation of this study [20,21].

Table 2. Association between LS and chronic musculoskeletal pain, and their etiological diagnostics

		With LS	Without LS	p-value
Chronic musculoskeletal pain	Yes	51	10	<0.001
	No	12	27	
OA of the knee	Yes	37	9	0.001
	No	26	28	
OA of the hip	Yes	18	3	0.015
	No	45	34	
OA of the spine	Yes	34	12	0.037
	No	29	25	
Osteoporosis	Yes	40	21	0.505
	No	23	16	
Fibromyalgia	Yes	9	1	0.062
	No	54	36	

Table 3. Association between LS, physical activities, falls, self-perception of health and funcionality

		With LS	Without LS	p
Physical activity	Yes	3	12	<0.001
	No	60	25	
Falls	None	30	28	0.02
	1	22	5	
	≥ 2	11	4	
Self-perception of health	Excellent	1	5	<0.001
	Good	15	21	
	Normal	42	11	
	Bad	5	0	
BADL*	Independence	59	100	0.118
	Dependence	4	0	
IADL**	Independence	15	25	<0.001
	Mild dependence	29	12	
	Moderate dependence	13	0	
	Severe dependence	6	0	

**BADL: Independence = 5-6; Dependence = ≤ 4*

***IADL: Independence = 26-27; Mild Dependence = 21-25; Moderate Dependence = 16-20; Severe Dependence ≤ 15*

Table 4. Multivariate analysis

Variable	Coefficient	p-value	Odds ratio	CI (95%)*
Constant	0.0468	0.964		
Chronic musculoskeletal pain	2.7673	0.001	15.92	3.08 - 82.27
OA of the knee	0.4347	0.609	1.54	0.29 - 8.16
OA of the hip	-0.8645	0,628	0,42	0,01 - 13,98
OA of the spine	-0,2363	0.79	0.79	0.14 - 4.51
Physical activity	-0.4556	0.664	0.63	0.08 - 4.95
Falls	0.5437	0.526	1.72	0.32 - 9.25
Self-perception of health	-1.4506	0.019	0.23	0.07 - 0.79

** CI = Confidence Interval*

More researches involving the LS theme in the elderly and their correlations are still needed, especially longitudinal samples, which could allow a better definition of causalities. Still, clinical trials with analgesic therapeutics in chronic musculoskeletal pain would be interesting, and may positively impact the evolution of this emerging syndrome among the elderly.

5. CONCLUSION

Chronic musculoskeletal pain was noted as an important factor associated with LS in the elderly, implying the need for analgesic strategies aimed at the prevention or treatment of this important syndrome associated with aging.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Mudança Demográfica no Brasil no início do século XXI [Internet]. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística (IBGE). [Capítulo: Transição da estrutura etária no Brasil: oportunidades e desafios para a sociedade nas próximas dácadas]; 2015.
   Available:http://biblioteca.ibge.gov.br/visualizacao/livros/liv93322.pdf
   [Acesso em 17 Outubro 2015]
2. Nakamura K. The concept and treatment of locomotive syndrome: Its acceptance and spread in Japan. J Orthop Sci. 2011; 16(5):489-91.
   DOI: 10.1007/s00776-011-0108-5
3. Tavares DR, Santos FC. Locomotive syndrome in the elderly: Translation, cultural adaptation, and Brazilian validation of the tool 25-question geriatric locomotive function scale. Rev Bras Reumatol; 2016.
   PII: S0482-5004(16)30045-6
   DOI: 10.1016/j.rbr.2016.05.006
4. Hirano K, Imagama S, Hasegawa Y, Ito Z, Muramoto A, Ishiguro N. Impact of low back pain, knee pain, and timed up-and-go test on quality of life in community-living people. J Orthop Sci. 2014;19(1):164-71.
   DOI: 10.1007/s00776-013-0476-0
5. Iizuka Y, Iizuka H, Mieda T, Tajika T, Yamamoto A, Takagishi K. Population-based study of the association of osteoporosis and chronic musculoskeletal pain and locomotive syndrome: The Katashina study. J Orthop Sci. 2015; 20(6):1085-9.
   DOI: 10.1007/s00776-015-0774-9
6. Kanzaki N, Otsuka Y, Izumo T, Shibata H, Nagao H, Ogawara K, Yamada H, Miyazaki S, Nakamura Y. Glucosamine-containing supplement improves locomotor functions in subjects with knee pain – a pilot study of gait analysis. Clin Interv Aging. 2016;11:835-41.
   DOI: 10.2147/CIA.S103943
7. Seichi A, oshino Y, Doi T, Akai M, Tobimatsu Y, Iwaya T. Development of a screening tool for risk of locomotive syndrome in the elderly: The 25-question Geriatric Locomotive Function Scale. J Orthop Sci. 2012;17(2):163-72.
   DOI: 10.1007/s00776-011-0193-5
8. Yoshimura N, Nakamura K. Epidemiology of locomotive organ disorders and symptoms: An estimation using the population-based cohorts in Japan. Clinic Rev Bone Miner Metab. 2016;14:68–73.
   DOI: 10.1007/s12018-016-9211-7
9. Katz S, Ford AB, Moskowitz RW, Jackson BA, Jaffe MW. Studies of illness in the aged. The index of ADL: A standardized measure of biological and psychosocial function. JAMA. 1963;185:914-9.
   DOI: 10.1001/jama.1963.03060120024016

10. Lawton MP, Brody EM. Assessment of older people: Self-maintaining and instrumental activities of daily living. Gerontologist. 1969;9(3):179-86.
DOI: 10.1093/geront/9.3_Part_1.179

11. Nakamura K. A "super-aged" society and the "locomotive syndrome". J Orthop Sci. 2008;13(1):1-2.
DOI: 10.1007/s00776-007-1202-6

12. Seichi A, Kimura A, Konno S, Yabuki S. Epidemiologic survey of locomotive syndrome in Japan. J Orthop Sci. 2016; 21(2):222-5.
DOI: 10.1016/j.jos.2015.12.012

13. Chiba D, Tsuda E, Wada K, Kumagai G, Sasaki E, Nawata A, Nakagomi S, Takahashi I, Nakaji S, Ishibashi Y. Lumbar spondylosis, lumbar spinal stenosis, knee pain, back muscle strength are associated with the locomotive syndrome: Rural population study in Japan. J Orthop Sci. 2016;21(3):366-72.
DOI: 10.1016/j.jos.2016.02.006

14. Matsumoto H, Hagino H, Wada T, Kobayashi E. Locomotive syndrome presents a risk for falls and fractures in the elderly Japanese population. Osteoporos Sarcopenia. 2016;2(3):156-63.
DOI: 10.1016/j.afos.2016.06.001

15. Ministry of health, labour and welfare. Outline of the results of National Livelihood Survey;2010.
Available:http://www.mhlw.go.jp/toukei/saikin/hw/k-tyosa/k-tyosa10/4-2.htm

16. Nakamura M, Hashizume H, Oka H, Okada M, Takakura R, Hisari A, Yoshida M, Utsunomiya H. Physical performance measures associated with locomotive syndrome in middle-aged and older japanese women. J Geriatr Phys Ther. 2015;38(4):202-7.
DOI: 10.1519/JPT.0000000000000033

17. Seichi A, Hoshino Y, Doi T, Akai M, Tobimatsu Y, Kita K, Iwaya T. Determination of the optimal cutoff time to use when screening elderly people for locomotive syndrome using the one-leg standing test (with eyes open). J Orthop Sci. 2014;19(4):620-6.
DOI: 10.1007/s00776-014-0581-8

18. Silva RJ, Smith-Menezes A, Tribess S, Rómo-Perez V, Virtuoso JS Jr. Prevalence and factors associated with negative health perception by the Brazilian elderly. Rev Bras Epidemiol. 2012;15(1):49-62.
DOI: 10.1590/S1415-790X2012000100005

19. Vagetti GC, Moreira NB, Barbosa VC, Oliveira V, Cancian CF, Mazzardo O, Campos W. Aspects of quality of life associated with self-rated health: A study of elderly women from a physical activity program in low-income neighborhoods in Curitiba in the state of Paraná, Brazil. Cien Saude Colet. 2013;18(12):3483-93.
DOI: 10.1590/S1413-81232013001200005

20. Hirano K, Imagama S, Hasegawa Y, Ito Z, Muramoto A, Ishiguro N. The influence of locomotive syndrome on health-related quality of life in a community-living population. Mod Rheumatol. 2013;23(5): 939-44.612-9.
DOI: 10.1007/s10165-012-0770-2

21. Ikemoto T, Inoue M, Nakata M, Miyagawa H, Shimo K, Wakabayashi T, Arai YC, Ushida T. Locomotive syndrome is associated not only with physical capacity but also degree of depression. J Orthop Sci. 2016;21(3):361-5.
DOI: 10.1016/j.jos.2016.01.003

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/17562