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Original article

Epidemiologic survey of locomotive syndrome in Japan

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ABSTRACT

Background: The authors have developed a screening tool, the 25-Geriatric Locomotive Function Scale (GLFS-25), for the early detection of locomotive syndrome (LS). However, few studies have examined the prevalence of LS in the general population. This study estimated the prevalence of LS in Japan using the GLSF-25 and investigated age specific mean values for this scale.

Methods: A nationwide cross-sectional questionnaire survey was conducted to reveal standard values for the GLFS-25 and to estimate the total number of individuals with LS in Japan. Subjects were individuals selected from residents aged 40–79 years in Japan by a stratified, two-stage random sampling method in 2014. The survey period was from February to March 2014. A total of 9028 subjects were invited to participate. The GLFS-25 was used to estimate the prevalence of LS. We also investigated the degree of recognition of LS.

Results: Answers for the questionnaire were obtained from 5162 subjects (57.2%); 22.1% of responders had heard of LS. According to the GLSF-25, 614 subjects were regarded as having LS, representing a prevalence of 11.9%. When standardizing this value with the age distribution of the Japanese population, the total number of individuals with LS between the 40s and 70s in Japan was estimated to be approximately 7.5 million. Age specific standard values on the GLFS-25 were 4.4 in the 40s, 5.5 in the 50s, 7.1 in the 60s, and 12.7 in the 70s. The prevalence of LS increased with age and was particularly high in subjects aged 70–79.

Conclusions: The degree of recognition of LS was 22%. This study demonstrated sex- and age specific standard values of the GLFS-25 and estimated the total number of individuals with LS in Japan based on a representative population.

1. Introduction

With the advent of the “super-aged society,” the number of elderly who need nursing care is increasing sharply, leading to a heavy financial burden on society [1,2]. To reduce the number of elderly people requiring nursing care, the Japanese Orthopaedic Association (JOA) proposed a new concept of locomotive syndrome (LS) in 2007 [2]. LS refers to conditions under which the elderly will require nursing care service in the near future because of functional deterioration in the locomotive organs.

The authors have developed a screening tool, the 25-question Geriatric Locomotive Function Scale (GLFS-25), for the purpose of early detection of LS [3]. GLFS-25 is a self-administered, relatively comprehensive measure that consists of 25 questions regarding activities of daily living, social functioning, and mental health during the last month. In GLFS-25, the 25 items are graded using a 5-point scale ranging from no impairment (0 points) to severe impairment (4 points), and then added to produce a total score (minimum 0, maximum 100). Higher scores are associated with worse locomotive function. A previous study confirmed the validity and reliability of GLFS-25, and an optimal cutoff for identifying LS was set at 16 [3,4]. Several studies have investigated the mean values of GLFS-25 [5,6]; however, these values were obtained from relatively small community-based studies, and little is known of the nationwide prevalence of LS. We showed the standard value of GLFS-25 and estimated the total number of individuals with LS in Japan based on a nationwide, cross-sectional, Internet survey [7].

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Those results can help provide epidemiologic information for the Japanese government to decide on a policy regarding LS. However, there is some criticism against Internet-based surveys because of the selection bias introduced based on the non-representative nature of Internet population samples. To provide more exact epidemiologic information on LS, we conducted a cross-sectional survey involving a representative sample selected from Japanese residents. This study aimed to clarify the prevalence of LS in Japan, describe the degree of recognition of LS, and determine age-specific mean values for the GLSF-25.

2. Materials and methods

2.1. Subjects

This study was part of the JOA-Subsidized Science Project Research 2013 and conducted on commission from the JOA. The protocol was approved by the Institutional Review Boards of the JOA and Jichi Medical University.

The study population consisted of all residents aged 40–79 years in Japan who were able to respond to questionnaires. Sampling was performed by a stratified, two-stage random sampling method [8–10]. As a first step, the nation was divided into 45 layers through a 9-area distribution (Hokkaido, Tohoku, Kanto, Hokuriku, Tokai, Kinki, Chugoku, Shikoku, and Kyushu area) and 5-city size distribution (1; 21 largest cities in Japan (Table 1), 2; cities of ≥200,000, 3; cities of ≥100,000, 4; cities of <100,000, 5; rural districts), and 350 points were selected on the basis of the population of each regional block and/or city-scale-classified layer. The number of sampling points for each group was determined by the population ratio (Table 1). As a second step, 24 subjects per point were randomly selected from "the Basic Resident Registration" in 2013 to obtain more than 4500 effective representative samples [7,8].

We conducted a cross-sectional survey involving questionnaire placement along with visits to the subjects' homes. The survey was handed to respondents by a trained data collector (Nippon Research Center, Ltd, Tokyo, Japan) who collected the completed survey 1 week later. The survey period was from February to March 2014. The questionnaires included the GFLS-25 [3] and one question about the name value of LS (Question: Do you know what LS is? Answer: 1. I know what it is; 2. I have only heard its name; 3. I do not know what it is).

2.2. Statistical analysis

On the basis of the population with regard to age in Japan in 2013 (Statistics Bureau, Ministry of Internal Affairs and Communications), data were standardized using the direct method to estimate the prevalence of LS in Japan. We also investigated age-specific mean values for the GLSF-25. Differences in group comparisons were determined by the Mann–Whitney *U* test or Kruskal–Wallis test (Bonferroni collection). Probability values less than 0.05 were considered statistically significant. SPSS version 18.0 for Windows (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses.

Table 1
Number of survey points in Japan (total number = 350).

Area	Population size of the cities				
	21 largest cities[a]	≥200,000	≥100,000	≤100,000	Rural areas
Hokkaido	5	2	3	3	3
Tohoku	3	7	3	8	5
Kanto	45	29	23	20	7
Hokuriku	2	5	2	6	1
Tokai	10	9	9	9	3
Kinki	17	17	8	11	3
Chugoku	5	5	5	4	2
Shikoku	0	4	2	4	2
Kyushu	8	8	5	12	6

[a] The 21 largest cities in Japan are Sapporo, Sendai, Saitama, Chiba, Tokyo, Yokohama, Kawasaki, Sagamihara, Niigata, Shizuoka, Hamamatsu, Nagoya, Kyoto, Osaka, Sakai, Kobe, Okayama, Hiroshima, Kitakyushu, Kumamoto, and Fukuoka.

3. Results

A total of 9028 individuals were invited to participate in this survey, and answers for the questionnaire from 5162 were analyzed. Written informed consent was obtained from all the responders. Reasons for the 3866 non-responders included refusal to take part in the survey ($n = 2458$), absence during the investigation period ($n = 657$), sickness ($n = 92$), and other ($n = 659$). There were no statistical differences in gender or age distribution between responders and non-responders. Distributions of responders' sex, age, and geographic location are shown in Table 2.

3.1. Name value of locomotive syndrome in early 2014

Of 5162 responders, 309 (6.0%) knew what LS was, 829 (16.1%) knew the name of LS, and 4024 (78.0%) did not know what LS was (Table 3). The recognition rate for LS was 22.1%. Recognition was highest in females in their 60s.

3.2. Standard values of the 25-question Geriatric locomotive function

The sex- and age-specific standard values of GFLS-25 are summarized in Table 4. The age-specific standard values with 95% confidence intervals (95% CI) of GLFS-25 were 4.4 (95% CI: 4.1, 4.8) in the 40s, 5.5 (95% CI: 5.0, 6.0) in the 50s, 7.1 (95% CI: 6.6, 7.7) in the 60s, and 12.7 (95% CI: 11.6, 13.8) in the 70s, showing an increase with age. The standard value of GLFS-25 in the 70s was significantly higher than that in other age groups ($P < 0.001$, Kruskal–Wallis test, Bonferroni collection). The standard value of GLFS-25 in women was significantly higher than that in men ($P < 0.001$, Mann–Whitney *U* test).

3.3. Prevalence of locomotive syndrome

The age-specific prevalence of locomotive syndrome defined by GLFS-25 with a cutoff value of 16 is shown in Fig. 1. The prevalence of LS was 4.6% in the 40s and gradually increased up to 24.5% in the 70s. The overall mean prevalence of LS was 11.9% (614/5162).

Table 2
Distribution of responders' sex, age, and geographic location.

Area	Males by age				Females by age			
	40s	50s	60s	70s	40s	50s	60s	70s
Hokkaido	21	32	38	24	34	36	29	30
Tohoku	37	53	48	38	43	67	76	51
Kanto	235	174	235	200	227	203	262	206
Hokuriku	41	28	44	23	41	27	36	35
Tokai	68	64	94	47	94	74	79	79
Kinki	104	81	81	69	110	84	123	96
Chugoku	27	47	49	42	41	45	51	33
Shikoku	7	19	32	14	17	28	34	20
Kyushu	74	70	112	64	86	73	94	62