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Prevalence and associated factors of facial palsy and lifestyle characteristics: data from the Korean National Health and Nutrition Examination Survey 2010–2012

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ABSTRACT

Objectives: To report the nationwide prevalence of facial palsy (FP) of grade III or worse in the House–Brackmann (H–B) grading system in South Korea and assess the associated factors.

Design: Cross-sectional analysis of a nationwide health survey.

Settings: South Korea.

Methods: We obtained data from the 2010 to 2012 Korea National Health and Nutrition Examination Surveys, which were cross-sectional surveys of the South Korean civilian population living in households and aged ≥1 year (N=23 533). A field survey team performed interviews, physical examinations and laboratory tests. Facial expression was evaluated based on the H–B grading system.

Results: Among the population aged ≥1 year, the prevalence of FP of grade III or worse in the H–B grading system was 0.12% (95% CI 0.07% to 0.17%). FP was more prevalent in women (p=0.01) and the prevalence rate increased with age (p<0.001). In participants aged ≥19 years, age, female gender, history of cardiovascular disease and the serum total cholesterol level were associated with FP in a multivariable analysis. In the evaluation of lifestyle, the individuals with FP had a higher rate of depressive mood and were more restricted in their daily activities.

Conclusions: Considering the significance of facial expression in psychosocial activities, public acknowledgement and further intervention are required to support patients with this distressing condition.

Strengths and limitations of this study

- This is the first nationwide survey to elucidate the prevalence and associated factors of facial palsy (FP) of grade III or worse in the House–Brackmann (H–B) grading system.
- The population of patients with FP of grade III or worse (0.12% of this survey) was compared with the participants without FP (99.88% of this survey) and sample weights were applied in all analyses to reflect national population estimates.
- Multivariable analysis with the logistic regression model was applied to elucidate the factors associated with FP.
- A limitation of our study is that some potentially associated factors were not available in the evaluation, similar to other large-scale cross-sectional surveys.

significant changes may occur, with impaired facial expression. Abnormal facial movement and diminished facial expression can pose challenges in face-to-face communications.[3] Bell's palsy, herpes zoster oticus, trauma, surgical removal of vestibular schwannoma and iatrogenic damage of the facial nerve are common conditions that restrict facial expression.[4] The incidence of the five major aetiologies in the USA[5] is as follows: Bell's palsy (25 cases per 100 000 annually),[6] infection including herpes zoster oticus, Lyme disease and otitis media (7.7 cases per 100 000 annually),[7–9] neoplastic aetiologies (6.8 cases per 100 000 annually),[7] neurologic aetiologies including cerebrovascular accidents (6.8 cases per 100 000 annually)[8 10] and traumatic aetiologies (4.1 cases per 100 000 annually).[11 12]

Several previous studies have been conducted to evaluate this clinical implication of

INTRODUCTION

The face plays a major role during interpersonal communication, and facial expression is of interest from both an evolutionary[1] and a social standpoint.[2] A critical facial expression is produced by the contraction and coordination of the facial muscles, and this is mainly innervated by the facial nerve. When the function of the facial nerve is disturbed,

facial palsy (FP).[13–15] Leong and Lesser used the Facial Clinimetric Evaluation (FaCE) Scale to evaluate the effect of FP on the quality of life (QoL) of patients with vestibular schwannoma.[15] They suggested that centres dedicated to the management of vestibular schwannoma should offer facial nerve rehabilitation as part of the services they provide.

Although estimated incidences of disorders that cause FP have been reported[5] and the significance of FP on QoL in each individual is well noted, the exact prevalence of FP in the general population has not been reported.

Nationwide epidemiological studies that are conducted by a government organisation can provide powerful data for investigating the national prevalence of diseases.[16] The Korea National Health and Nutrition Examination Survey (KNHANES) assesses the general health and nutritional status of populations in South Korea using interviews on their health and nutrition, and a basic health assessment of the participants.

We aimed to evaluate the prevalence of FP of grade III or worse in the House–Brackmann (H–B) grading system in South Korea based on survey data obtained from the 2010–2012 KNHANES and to investigate associated factors. In addition, we assessed the lifestyle characteristics of individuals with FP.

METHODS
Participants
The KNHANES is a nationwide survey that is conducted annually by the Korea Centers for Disease Control and Prevention to investigate the health and nutritional status of a representative Korean population. This survey is an ongoing cross-sectional survey of the civilian population living in households aged ≥1 year of South Korea and described in elsewhere.[16–18] A field survey team that included an otolaryngologist, an ophthalmologist and nurse examination unit performed interviews and physical examinations. Individuals selected underwent a basic health assessment that included blood pressure measurements, blood and urine collection, pulmonary function test and dental examination, ophthalmologic examination and otolaryngological examination. A history of otological symptoms was surveyed and physical examination, including the tympanic membrane, hearing and balance, was conducted in participants of appropriate ages. Every year 10 000–12 000 people in about 3800 households are selected from a panel to represent the population using a multistage clustered and stratified random sampling method that is based on the National Census Data. One hundred and ninety-two survey sections were randomly sampled and 20 households were selected from each section.[19] The participation rate of selected households in the past several cycles of KNHANES has been high, ranging from 79% to 84%. By using the sample weight, this survey provides representative estimates of the Korean civilian population living in households.

Written informed consent was obtained from all the participants before the survey, and approval for this research was obtained from the institutional review board of the Samsung Medical Center (IRB No. 2013-02-031).

Evaluation of facial expression
In this survey, the facial expression analysis was based on the H–B grading system, which is adopted by the American Academy of Otolaryngology-Head and Neck Surgery.[20] In this system, grades I and II are normal to near-normal, whereas grades III or worse are a status which has definite asymmetry. Therefore, the facial expression of participants was evaluated and categorised as grades I–II and III–VI by a trained otolaryngologist, and those who had grades III–VI were recorded as having FP.

Evaluation of associated factors
Potentially associated factors from the basic health examination, interview and laboratory tests were evaluated for their association with FP. Age, gender, smoking status (non-smoker/ex-smoker or current smoker) and alcohol drinking (less than one a month/more than one a month) were collected. A history of hypertension (yes/no), hyperlipidaemia (yes/no), stroke (yes/no), cardiovascular diseases (CVD) (yes/no), diabetes mellitus (yes/no), which had been diagnosed by physicians, was also collected. In laboratory tests, total cholesterol level (mg/dL), high-density lipoprotein-cholesterol and the white blood cell count (total cell×10^3 counts/µL) were evaluated.

Otological examination and audiometric measurement
An ear examination was conducted with a 4 mm 0° angled rigid endoscope attached to a charge-coupled device camera for all participants to find tympanic membrane perforation and cholesteatoma.

The pure tone air-conduction threshold was obtained in a soundproof booth using an automatic audiometer (GSI SA-203, Entomed Diagnostics AB, Lena Nodin, Sweden). Hearing loss was defined as ≥25 dB loss, on average, of air-conduction hearing thresholds at 0.5, 1, 2 and 3 kHz.[21] Balance function was evaluated by asking subjects about positional vertigo and history of any balance problems.

Evaluation of lifestyle characteristics
The following lifestyle characteristics of patients with FP were assessed with self-reporting questionnaires: QoL (evaluated by EQ-5D score from the EuroQol group[22]), frequency of depressive mood lasting for ≥2 weeks (yes/no), experience of depressive mood and recognition of stress (yes/no), self-reporting subjective feeling about general health (good/fair/poor), hindrance of daily activities (no, some trouble, not able to carry out daily activities) and status of economic activities (employed/unemployed).

Statistical analysis

The participants without FP (99.88% of this survey) were used as a control group to evaluate the factors associated with the participants with FP (0.12% of this survey). The sample weight was adjusted during the statistical analysis. Potentially associated factors were evaluated by univariable analysis. The prevalence and 95% CIs were calculated. In univariable analysis, logistic regression analysis (using PROC SURVEYLOGISTIC in SAS V.9.3; SAS Institute, Cary, North Carolina, USA) was used to test the association between FP and associated factors in a complex sampling design. Only variables with a p value ≤0.20 were selected for multivariable analysis with the logistic regression model. To evaluate the association between FP and potentially associated factors, adjusted ORs with 95% CIs were calculated using logistic regression analysis (using PROC SURVEYLOGISTIC in SAS).

Evaluation of lifestyle characteristics of patients with FP was performed including hearing loss as a possible confounding factor (using PROC SURVEYREG, PROC SURVEYLOGISTIC in SAS).

To reflect national population estimates, sample weights were applied in all analyses. All p values were two-sided, and p<0.05 was considered to be statistically significant.

RESULTS

Prevalence of FP

A total of 23 621 individuals aged ≥1 year participated in the survey between 2010 and 2012. Among them, 23 533 were evaluated for facial expression; the prevalence of FP of H–B grade III or worse was 0.12% (95% CI 0.07% to 0.17%). Of the participants, 10 576 were male and 12 957 female, and weighted sum was a population of 47 656 438. The prevalence of FP increased with age (p<0.001). The prevalence of FP in men and women was 0.07 and 0.17, respectively, and men had a significantly lower prevalence than women (p=0.01) (table 1). No difference in the laterality of FP was found (p=0.73) (table 1).

Analysis of associated factors

As the questionnaire survey and otological examination were available for participants aged ≥19 years (n=17 988), an association analysis was performed in this population. A total of 14 394 participants completed all the questionnaires and physical examination. The prevalence and significance of associated factors, including data from the questionnaire, laboratory tests and the otolaryngological survey and examinations in the study population, are presented in table 2. FP and associated factors were investigated using univariable and multivariable analyses. In the univariable analysis, FP was associated with age, gender, smoking status, alcohol drinking, history of hypertension, stroke, CVD, diabetes mellitus, total cholesterol level in the blood and hearing loss.

After multivariable-adjusted analysis, older age (OR=1.05, 95% CI 1.01 to 1.09), gender (OR=0.17, 95% CI 0.03 to 0.93), history of CVD (OR=4.01, 95% CI 1.02 to 15.71) and serum total cholesterol level (OR=1.01, 95% CI 1.00 to 1.03) remained as factors associated with FP (table 2).

Table 1 Prevalence of facial palsy by gender and age group in participants aged >1 year (n=23 533)

Characteristics	Frequency	Weighted frequency	Facial palsy			
			n	Per cent*	95% CI	p Value
Gender	23 533	47 656 438	44	0.12	0.07 to 0.17	
Male	10 576	23 832 885	16	0.07	0.03 to 0.12	0.01†
Female	12 957	23 823 553	28	0.17	0.09 to 0.25	
Side	23 533	47 656 438	44	0.12	0.07 to 0.17	
Right			25	0.06	0.03 to 0.09	0.73
Left			19	0.06	0.03 to 0.09	
Age (years)						
Total (≥1)	23 533	47 656 438	44	0.12	0.07 to 0.17	<0.001‡
1–9	2873	4 182 333	0	0	0	
10–19	2860	6 437 853	0	0	0	
20–29	1861	6 556 479	0	0	0	
30–39	3284	7 772 849	1	0.03	0 to 0.08	
40–49	3174	8 141 849	2	0.04	0 to 0.09	
50–59	3425	6 830 269	9	0.21	0.05 to 0.36	
60–69	3084	4 037 451	15	0.43	0.12 to 0.73	
70–79	2422	2 901 000	16	0.68	0.26 to 1.09	
80–89	536	779 026	1	0.21	0 to 0.63	
>90	14	17 329	0	0	0	

*Weighted per cent of the Korean population.
†Rao–Scott χ^2 test was used.
‡For the age-related trend test, logistic regression analysis was used.

Table 2 Analysis of factors potentially associated with facial paralysis in a nationwide survey (n=14 394)

Variables	Per cent*	Prevalence	Univariable analysis			Multivariable analysis		
			p Value	OR	95% CI	p Value	OR	95% CI
Age		0.09	<0.001	1.08	1.04 to 1.12	0.02	1.05	1.01 to 1.09
Gender								
Female	75	0.15		Referent			Referent	
Male	25	0.02	0.002	0.13	0.04 to 0.46	0.04	0.17	0.03 to 0.93
Data obtained from the questionnaire								
Smoking, current								
No	70	0.13		Referent			Referent	
Yes	30	0.04	0.04	0.28	0.08 to 0.94	0.68	1.39	0.29 to 6.73
Alcohol drinking								
No	65	0.17		Referent			Referent	
Yes	35	0.03	0.002	0.19	0.07 to 0.55	0.27	0.51	0.15 to 1.69
History of hypertension								
No	60	0.06		Referent			Referent	
Yes	40	0.24	0.01	4.23	1.39 to 12.86	0.81	1.16	0.36 to 3.73
History of hyperlipidaemia								
No	85	0.08		Referent				
Yes	15	0.10	0.81	1.12	0.30 to 4.67			
History of stroke								
No	90	0.08		Referent			Referent	
Yes	10	0.71	0.03	9.12	1.28 to 65.21	0.22	4.40	0.42 to 45.97
History of CVD								
No	75	0.08		Referent			Referent	
Yes	25	0.71	<0.001	5.66	2.23 to 14.35	0.04	4.01	1.02 to 15.71
History of DM								
No	80	0.07		Referent			Referent	
Yes	20	0.36	0.03	5.18	1.18 to 22.70	0.21	2.64	0.57 to 12.17
Laboratory data								
Total cholesterol level (mg/dL) (mean)		0.09	0.01	1.01	1.00 to 1.03	0.04	1.01	1.00 to 1.03
HDL-C (mean)		0.09	0.98	1.00	0.94 to 1.07			
WBC count								
<6.0×10^3/μL	65	0.12		Referent			Referent	
≥6.0×10^3/μL	35	0.05	0.13	0.42	0.13 to 1.31	0.15	0.39	0.11 to 1.38
Otological examination								
TM perforation								
No	100	0.09						
Yes	0	0						
Cholesteatoma								
No	95	0.08		Referent			Referent	
Yes	5	0.33	0.18	4.00	0.53 to 30.18	0.43	2.3	0.30 to 17.91

Table 2 Continued

Variables	Per cent*	Prevalence	Univariable analysis			Multivariable analysis		
			p Value	OR	95% CI	p Value	OR	95% CI
Chronic otitis media								
No	95	0.09		Referent				
Yes	5	0.10	0.85	1.21	0.16 to 9.28			
Hearing loss								
No	70	0.07		Referent			Referent	
Yes	30	0.27	0.04	3.98	1.10 to 14.43	0.80	1.18	0.33 to 4.27
Subjective positional vertigo*								
No	90	0.13		Referent				
Yes	5	0.11	0.85	0.82	0.11 to 6.34			
Missing	5	0.02						
History of any balance problems*								
No	85	0.13		Referent				
Yes	10	0.40	0.17	3.08	0.62 to 15.26			
Missing	5	0.02						

CVD, cardiovascular disease; DM, diabetes mellitus; HDL-C, high-density lipoprotein-cholesterol; TM, tympanic membrane; WBC, white blood cell.
*Per cent of participants with facial palsy.

Analysis of lifestyle characteristics

QoL, assessed with EQ-5D did not show a difference between normal participants and individuals with FP (p=0.11) (table 3). However, the prevalence of a history of depressive mood for ≥2 weeks was greater (31.96%) in participants with FP (p=0.03, OR=2.76; 95% CI 1.09 to 7.03). Hindrance of daily activities was surveyed and 4.76% of individuals with FP reported that they were unable to perform usual daily activities. Those individuals had a high OR for restriction of daily activities compared with normal participants (p=0.01, OR=3.38; 95% CI 1.33 to 8.59).

DISCUSSION

This survey provides the prevalence rate of FP and also an interesting perspective on associated factors and the impact on patients' daily life using the data from the nationwide survey. Nevertheless, several important considerations warrant attention when assessing the results of this survey. First, because this was a large-scale cross-sectional survey, some variables were not available and were not fully elucidated, similar to other cross-sectional studies. In addition, the survey did not fully evaluate the duration and aetiology of FP in each participant. Second, although one of the aims of this study was to elucidate the associated factors and the general characteristics in daily life, a low prevalence of FP can be a limiting factor to demonstrate potentially associated factors. However, as this survey adapted sample weights in all analyses, the statistical power in this survey was sufficient.

The prevalence of FP of H–B grade III or worse was 0.12% in our survey. This is the first epidemiological study to demonstrate the nationwide prevalence of FP, regardless of the aetiology, with a government-centred survey. Facial expression has a key role in face-to-face communications.[3] An impaired facial movement alters the way in which an individual is perceived by, and interacts with, others. Therefore, FP is a significant healthcare problem and clarification of its prevalence has important clinical implications.

Analysis showed that age and gender were significantly associated with FP. FP is one of the consequences of various diseases, and the number of patients with incomplete recovery is cumulative and increases with ageing. Furthermore, age is an important factor resulting in incomplete recovery from Bell's palsy.[23]

In our study, a history of CVD had a strong association with FP (OR=4.01, 95% CI 1.02 to 15.71). This finding is consistent with previous reports stating that neurologic aetiologies, including cerebrovascular accidents, are a major cause of FP. In addition, it is reported that the risk of incomplete recovery from FP is greater in cerebral palsy than in Bell's palsy.[24] The serum total cholesterol level, which is well-known risk factor for CVD also had a significant association with FP in our study (OR=1.01, 95% CI 1.00 to 1.03).[25–28]

Table 3 Lifestyle characteristics of participants with facial paralysis

Characteristics	Facial paralysis		Control		p Value	OR	95% CI
	n (%)	Weighted frequency	n (%)	Weighted frequency			
Quality of life score (EQ-5D)*					0.11		
Frequency of depressive mood lasting for ≥2 weeks†							
No	25 (68.04)	28 942	13 650 (87.27)	28 952 251		Referent	
Yes	9 (31.96)	13 595	2046 (12.73)	4 221 648	0.03	2.76	1.09 to 7.03
Experience of depressive mood and recognition of stress†							
No	24 (61.39)	26 115	11 571 (72.44)	24 029 752		Referent	
Yes	10 (38.61)	16 421	4125 (27.56)	9 144 146	0.31	1.61	0.64 to 4.08
Self-reporting subjective feeling about general health‡							
Good	9 (33.97)	14 450	5271 (34.93)	11 588 582	0.75	1.14	0.51 to 2.51
Fair	17 (45.51)	19 357	7685 (48.20)	15 988 252			
Poor	8 (20.52)	8729	2941 (16.87)	5 597 064			
Hindrance of daily activities‡					0.01	3.38	1.33 to 8.59
No	26 (77.30)	32 882	14 561 (92.92)	30 912 573			
Some trouble	6 (17.94)	7631	1362 (6.31)	2 032 713			
Not able to carry out daily activities	2 (4.76)	2204	164 (0.77)	228 611			
Status of economic activities†							
Employed	18 (59.59)	25 346	9646 (65.32)	21 668 878		Referent	
Unemployed	15 (40.41)	17 190	6441 (34.68)	11 505 020	0.69	1.12	0.53 to 2.64

*Linear regression.
†Logistic regression using binary logistic model regression.
‡Logistic regression using cumulative logistic model.

We evaluated the lifestyle characteristics of individuals with FP. The presence of hearing loss, which often accompanies FP was accounted for as a confounding factor. Compared with the normal population, those with FP had a frequent history of depressive mood for ≥2 weeks and a higher rate of hindrance in carrying out daily activities. Although QoL assessed with EQ-5D showed no difference between those with FP and normal participants, our result reflects the poor lifestyle characteristics of individuals with FP, in accordance with previous studies.[29–31] In this analysis, we could not account for every possible confounding factor, such as the duration and aetiology of FP, or other comorbidities. This might have impeded a demonstration of detailed lifestyle characteristics in participants with FP.

In summary, the overall prevalence of FP of H–B grade III or worse is 0.12% in the general population of South Korea. This condition is more prevalent in women, those who are older, those with a history of CVD and higher serum total cholesterol level. Individuals with FP had the higher rate of depressive mood and greater restriction of daily activities. Although FP is rare, public acknowledgement and parallel intervention to modify the associated factors are required to support patients with this distressing condition.

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