Abstract

Using the Oral Assessment Guide to Predict the Onset of

Pneumonia in Residents of Long-Term Care and Welfare

Facilities: A One-Year Prospective Cohort Study

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Graduate School of Dentistry,
Health Sciences University of Hokkaido

Yamanaka Masahiro

【Introduction】

Pneumonia remains a major problem in elderly individuals. According to the Japanese vital statistics, in 2021, pneumonia (6.4%) was the fourth leading cause of death in the Japanese population. Previous studies have also reported that residents of long-term care facilities are at a high risk of pneumonia onset among elderly. Countermeasures against pneumonia are urgently needed for elderly residents in long-term care facilities. On the other hand, providing appropriate oral health care can help to prevent pneumonia occurrence in residents of long-term care facilities. In particular, improving oral assessments promotes oral health care for patients, and it is therefore important to perform oral evaluations using an oral assessment tool. The relationship between risk evaluation using an oral assessment tool and pneumonia for residents in long-term care facilities has not yet been fully elucidated. Therefore, we focus on the Oral Assessment Guide (OAG). It is because that OAG is suitable for evaluating the oral health of elderly individual and has proven to be reliable and valid. Moreover, this tool is useful for sharing information about oral health among different medical teams in that residents of long-term care welfare facilities are sometimes admitted and discharged from hospitals.

Therefore, we propose the following research question: Can the OAG serve capable of evaluating the risk of pneumonia onset? In order to answer this research question, we examine the relationship between the total scores of the OAG and a one-year incidence of pneumonia in residents of long-term care facilities in Japan, before the onset of the COVID-19 pandemic.

【Material and Methods】

The study design was a one-year prospective cohort study. This study included nine long-term care facilities and used the method of snowball sampling, where the purpose of the study was explained in advance, and consent and cooperation for participation in the study were obtained from the nine facilities, located in Hokkaido, Japan. In addition, direct surveys by facility visitation were conducted in Japan

before the COVID-19 pandemic (from July 2018 to February 2020). The subject selection criteria included that the degree of life independence was evaluated as ≥grade III for those who had a diagnosis of dementia, according to the guidelines of the Ministry of Health, Labour, and Welfare of Japan. The exclusion criteria included individuals who had undergone dental therapeutic intervention during the year after the baseline survey in order to exclude the improvement of the OAG score through dental treatment. Basic information on subjects [age, gender, number of oral medications, presence or absence of medical history (cerebrovascular disease, cardiovascular disease, diabetes), and presence or absence of oral health care] was extracted from medical record information. Two dentists evaluated and scored the oral health of the subjects by OAG. The dependent variable was the occurrence of pneumonia one year after the baseline survey, the explanatory variable was the total OAG score, and the adjustment variables were age, gender, number of medications, presence or absence of medical history (cerebrovascular disease, cardiovascular disease, diabetes), and presence or absence of oral health care. The normality of the scale data was tested and confirmed using the Kolmogorov–Smirnov test. Then, a logistic regression analysis was performed, with pneumonia onset after 1 year of the baseline survey as the dependent variable; the total OAG score as the explanatory variable; and age, gender, number of oral medications, presence or absence of a medical history (cerebrovascular disease, cardiovascular disease, and diabetes), and the presence or absence of oral health care as the modulator variables. Prior to the logistic regression analysis, the correlation between the moderator variables was verified using the Spearman's correlation coefficient, and the presence or absence of multicollinearity was examined. In model 1, we evaluated a logistic single regression analysis of dependent and explanatory variables; in model 2, age and gender were inserted into model 1. In model 3, a multiple logistic regression analysis was performed with the number of oral medications, presence or absence of a medical history, and the presence or absence of oral health care inserted into model 2. Evaluations were performed based on the odds ratio (OR) and 95% confidence interval (CI). Furthermore, the conformity of the regression model was examined using the Hosmer–Lemeshow and chi-squared tests.

We used IBM SPSS Statistics® (version 24.0, IBM Corporation, Somers, NY). This study was conducted with the approval of The Health Sciences University of Hokkaido Dental Ethics Review Committee (approval number: 178).

【Results】

At baseline, there were 267 study subjects. The total number of dropped out after one year from the baseline survey at each site was 72 (dropout rate: 27.0%). 11 patients who met the exclusion criteria were excluded from the analysis. The total number of subjects for analysis was 184 (31 males, mean age 85.0 ± 8.3 years, 153 females, mean age 87.9 ± 6.1 years). There were no statistically significant differences in the male/female ratio at baseline or at the one-year follow-up endpoint. Eight of the analyzed patients (6 males and 2 females) developed pneumonia, and the number of patients differed between centers. All scale data for the explanatory variables were non-normal, and all correlation coefficients between explanatory variables were less than 0.8, indicating no multicollinearity. Logistic regression analysis revealed that the total OAG scores were OR: 1.56, 95% CI: 1.16-2.11, $p < 0.01$ for Model 1, OR: 1.57, 95% CI: 1.11-2.22, $p < 0.05$ for Model 2, and OR: 2.56, 95% CI: 1.11-2.22, $p < 0.05$ for Model 3. 3, OR: 2.29, 95% CI: 1.27-4.14, $p < 0.01$. Furthermore, after examining the conformity of the regression model using the Hosmer–Lemeshow test.

【Discussion】

The OR of pneumonia onset was 2.29 after being adjusted for pneumonia risk factors. The results suggest that the OAG could be used as an explanatory variable for pneumonia onset in residents of long-term care and welfare facilities in Hokkaido, Japan.

It has been reported that residents of long-term care facilities are at a higher risk of pneumonia onset than the elderly who live in the community. Accordingly, the subjects of the present study were at

a high risk of pneumonia onset; however, there was only a slight onset of pneumonia in this population. This may be because many subjects sampled in our inclusion and exclusion criteria had minimal cognitive impairment and were in stable health. Risk factors for pneumonia in the elderly include comorbidities (cardiac disease, cerebrovascular disease, pulmonary disease, diabetes, malignant tumor), gender (male), smoking habits, nasogastric tube feeding, dysphagia, sedatives, and painkillers. On the other hand, oral care has been reported to decrease the incidence of pneumonia. Gender (male) and cerebrovascular disease were risk factors in this population as in previous studies. These two variables could not be adjusted for because the subjects in this study were able to take food orally and were not receiving nasogastric tube feedings, nor were they receiving sedatives or analgesics. Antipsychotic and anticholinergic medications used to treat symptoms of dementia, urinary incontinence, depression, pain, and insomnia have been reported to increase the risk of pneumonia. However, in this study, medication status was only adjusted for the number of medications taken, not the type of medication. Despite the limitations of the study, such as the small sample size and the fact that all risk factors for pneumonia in previous studies were not adjusted for, the OAG total score suggested the possibility of being able to screen for the risk of developing pneumonia.

【Conclusions】

The OR of pneumonia onset was 2.29 after adjusting for pneumonia risk factors. This suggested that the OAG could be used as an explanatory variable and a screen for pneumonia onset in residents of long-term care and welfare facilities in Hokkaido, Japan before spreading COVID-19.