The Situation of Pneumonia among Super-elderly Patients in Japan

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Abstract

Background: Pneumonia is ranked as the third leading cause of death in Japan, especially among the elderly population. It is very probable that the number of deaths related to pneumonia will increase proportionately with the aging global population. Therefore, analysis of the causes of mortality and survival among super-elderly people with pneumonia will help in advancing medical treatments in the future.

Methods: We analyzed the medical histories, comorbidities, severity of pneumonia at admission by the A-DROP scoring system, and the number of days of hospitalization among 126 patients aged 85 years or older (super-elderly patients) hospitalized due to pneumonia from January 1, 2012 to December 31, 2016.

Results: Male patients had a slightly higher mortality rate than female patients (13.7% *vs.* 12.3%, respectively). Normal bacterial flora in the oral cavity were predominantly detected in sputa classified as Geckler 3 to 5 in almost half of the patients. There were no significant differences in age and hospitalization days among survivors and non-survivors. The average A-DROP severity score at admission among non-survivors was significantly higher (3.19;average rank,92.688) than that among survivors (2.12;average rank,56.792) by the Brunner-Munzel test (p<0.001). Renal dysfunction was found to contribute significantly to death by multiple regression analysis of the influence of major underlying diseases on death.

Conclusion: Almost half of the patients were diagnosed with aspiration pneumonia. The A-DROP score is regarded as a good indicator for predicting the prognosis of pneumonia among super-elderly patients. Renal dysfunction is considered a poor prognostic factor among super-elderly patients hospitalized with pneumonia.

Keywords: Pneumonia; Super-elderly patients; Aspiration; A-DROP score

Introduction

The elderly population of Japan is increasing rapidly. Multiple factors related to aging, such as comorbidities, nutritional status and disorders of swallowing have been identified among elderly people [1]. Since 2011, pneumonia has ranked third among all causes of death in Japan, after surpassing cerebrovascular disease. Particularly, among individuals older than 90 years, pneumonia is the leading cause of death [2]. According to Miki et al., the mortality rate due to pneumonia exceeds 1,000 per 100,000 population older than 85 years [3]. Thus, pneumonia is a more serious disease among elderly people than among young people. The treatment of pneumonia is a serious problem among elderly people. However, there few reports on pneumonia among super elderly people (patients aged 85 years or older). We feel that verification cannot keep up with the actual condition of super elderly pneumonia. Therefore, this study aimed to analyze the situation of pneumonia among super-elderly patients admitted to our hospital in order to improve its treatment.

Methods

A total of 122 super-elderly patients (males 73 [59.8%], females 49 [40.2%]) who were diagnosed with pneumonia and admitted to the Department of Respiratory Medicine and Allergology, Kindai University Nara Hospital (Ikoma, Japan) from January 1, 2012 to December 31, 2016 were included in the analysis.

We divided the study population into six groups according to their existing comorbidities; gastrointestinal disease, cardiovascular disease, hematological disease, cerebrovascular disease, respiratory disease, and renal dysfunction were investigated. The gastrointestinal disease group included those with histories of gastrointestinal cancer, resection of various digestive organs, chronic liver disease, chronic pancreatic disease, chronic gallbladder disease, and chronic diseases of the esophagus, stomach, and intestinal tract. The cardiovascular disease group, excluding patients with essential hypertension, included those with histories of ischemic heart disease, cardiomyopathy, cardiac surgery, and arrhythmias. The hematological disease group included patients with blood cell

abnormalities due to bone marrow dysfunction and collagen diseases. The cerebrovascular disease group included patients with histories of cerebral infarction, cerebral hemorrhage, brain tumor, and dementia. The respiratory disease group included those with chronic obstructive pulmonary disease, asthma, bronchiectasis, and sino-bronchial syndrome. The renal dysfunction group included patients with estimated glomerular filtration rates less than 90 ml/min/1.73m^2. Acute stage diseases were excluded in each group.

Pneumonia was defined by the presence of infiltrative shadows on chest roentgenogram or computed tomography scan. The symptoms of fever, cough, and sputum production were confirmed by medical examination by interview. Sputum microscopic examination was performed after using a suction device or induction by inhalation of hypertonic saline solution to obtain sputa from patients who could not produce sputa on their own. However, sample collection by trans-tracheal aspiration or endoscopy was not performed. Direct smears and cultures of sputa were examined for the identification of pathogenic microorganisms. Only sputa classified as Geckler 3 to 5 were regarded as specimens, and the number of bacteria and the presence of phagocytosis were taken into consideration in identifying the pathogenic bacteria.

The A-DROP scoring system from the Japanese Respiratory Society, which is a modified version of the CURB-65 criteria of the British Thoracic Society, was used as the criteria for evaluating the severity of pneumonia at admission [4]. The diagnostic criteria comprise five items, including age (male aged 70 years or older; female aged 75 years or older), dehydration or blood urea nitrogen concentration of more than 210 mg/dl, transcutaneous oxygen saturation of 90% or less, confusion, and blood pressure of 90 mmHg or lower. It represents the severity of pneumonia in terms of total points, with 1 point allocated per item, and 0 points if none of the items are present.

The study protocol of this observational study was approved by the Institutional Review Board of Kindai University Nara Hospital.

Statistical analysis

Statistically significant differences between survivors and non-survivors were assessed using the Brunner-Munzel test. Multiple regression analysis was used to evaluate whether or not the underlying diseases contributed to the deaths of pneumonia patients. p values<0.05 were considered statistically significant.

Results

The age distribution of the patients is shown in Table 1. The oldest male patient was 99 years old, while the oldest female patient was 100 years old. Among the 122 patients, 8 were admitted from care homes and 1 was from a hospital for chronic phase recuperation. The identified pathogenic bacteria are shown in Table 1. In 56 out of the 122 patients, the normal flora of the oral cavity were detected in sputa classified as Geckler 3 to 5. There were quite a few cases in which proper samples

could not be collected. Among non-survivors, opportunistic bacteria such as methicillin-resistant *Staphylococcus aureus* and *Pneumocystis jirovecii* were identified.

There were 10 non-survivors among the 73 male patients (mortality rate, 13.7%), whereas there were 6 non-survivors among the 49 female patients (mortality rate, 12.3%). Mortality rates in men tended to be higher than that among females. The results of the analysis of the statistical significance of differences in age, duration of hospital stay, and severity score at hospitalization between survivors and non-survivors are shown in Figure 1. The average rank of age among all non-survivors was 70.531 (average 90.0), and 60.137 (average 88.4) among survivors using the Brunner-Munzel test (p=0.3338). The average rank of the duration of hospitalization among all non-survivors was 69.781 (average 33.4) and 60.250 (average 24.7) among survivors using the Brunner-Munzel test (p=0.3903). The average rank of severity score at hospitalization among all non-survivors was 92.688 (average 3.19) and 56.792 (average 2.12) among survivors using the Brunner-Munzel test (p<0.001). The comparison between survivors and non-survivors showed no significant difference in age or duration of hospital stay. On the other hand, the pneumonia severity score at hospitalization was significantly higher among non-survivors than that among survivors.

Table 2 shows the number of patients with underlying disease in the 6 groups and the multiple regression analysis results

Table 1: Detected pathogenic bacteria of the pneumonia patients.

	All	Male	Female
Streptococcus pneumoniae	10(1)	4	6(1)
Pseudomonas aeruginosa	7(1)	6(1)	1
MRSA	7(2)	2(2)	5
Heamophilus Influenzae	7(1)	3	4(1)
Klebsiella sp.	4(1)	2(1)	2
Staphylococcus aureus (not MRSA)	4	3	1
Escherichia coli	3	0	2
Moraxella catarrhalis	2	2	1
non fermentative GNR	1	0	1
Chlamydophila pneumoniae	1	1	0
Pneumocystis jirovecii	1(1)	1(1)	0
Pasturella multocida	1	1	0
Oral bacterial flora	56(7)	34(4)	22(3)
difficult to expectorate	18(2)	14(1)	4(1)
			Number of Death cases in ()

Table 2: Analysis of whether each underlying disease is an influencing factor for death or not.

Underlying Disease	Survival cases	Death cases	p
Gastro intestinal disease	24	3	0.837
Cardiovascular disease	34	8	0.846
Blood Disease	11	3	0.654
Cerebrovascular disease	16	2	0.345
Respiratory disease	55	5	0.461
Renal dysfunction	8	4	0.043*
p values were calculated by multiple regression analysis.			
*marked statistically by significant result.			

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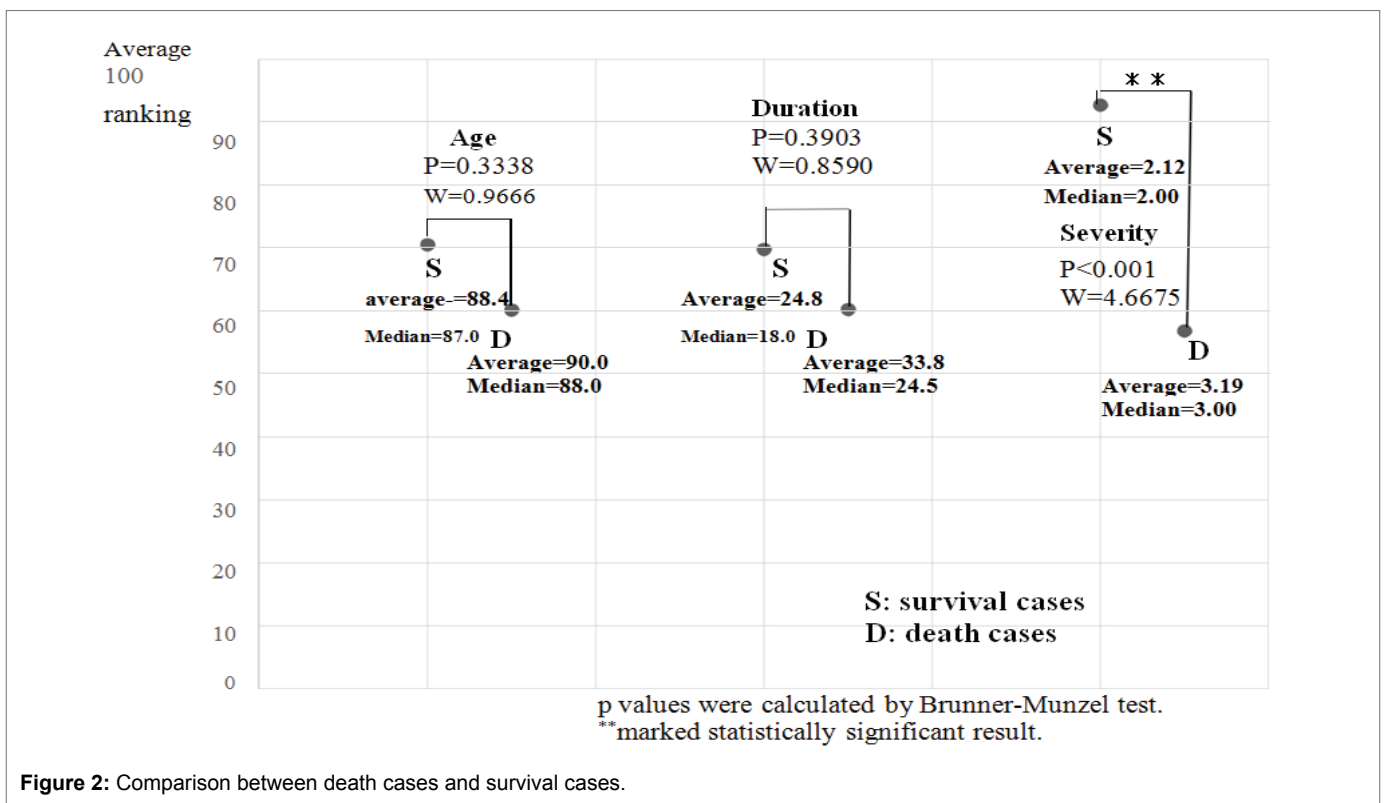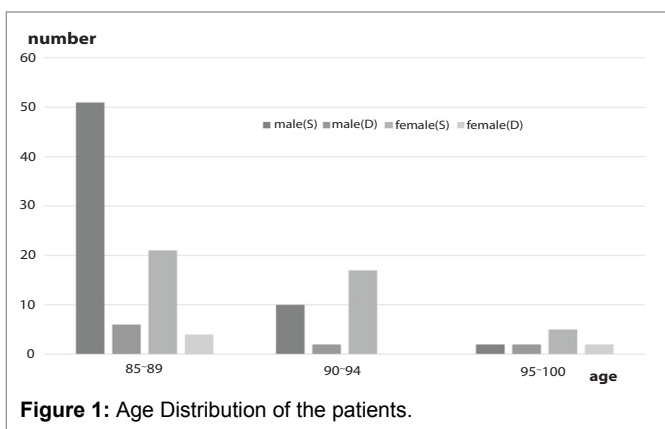
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as death factors. It can be seen that respiratory diseases were the most common underlying diseases, affecting almost half of the patients; however, renal dysfunction contributed most significantly to death.

Discussion

There have been no clinical reports of pneumonia among super-elderly individuals. It is known that as people age, their ability to expel sputum is reduced, putting them at risk of aspiration. Also, it is known that as the number of co-morbid conditions increases, the reserve capacity of each organ decreases [5]. Therefore, it was speculated that the prevalence rate of aspiration pneumonia would be high among elderly people. It is presumed that when the oral cavity resident bacteria were detected from sputum that could be judged to

Figure 1: Age Distribution of the patients.

contain lower respiratory tract components, the oral cavity bacteria were transferred to the lower tract by aspiration. In other words, considering the results shown in Table 1, it is likely that nearly half of the patients aged 85 years or older with pneumonia had aspiration pneumonia, supporting the initial guess [6,7]. Therefore, efforts to prevent aspiration are considered necessary for elderly people, as are routine efforts to prevent lifestyle-related diseases among middle-aged people. In other words, it is important for elderly people to engage in habits that reduce their risk of aspiration, such as exercises of the tongue and mouth, keeping the mouth clean [8], and eating slowly with adequate chewing [9].

Considering the results shown in Figure 2, the A-DROP score at hospitalization was significantly higher among non-survivors than that among survivors. Based on this, the A-DROP score at the time of admission can be said to be useful for determining the prognosis among pneumonia patients older than 85 years. The reason why there was no significant difference in the duration of hospitalization between survivors and non-survivors is that the non-survivors were not only long-term hospitalization cases, but also experienced a sudden worsening of their conditions and died shortly after admission. Among elderly patients, it was considered that a decrease in organ reserves could result in death shortly thereafter. As shown in Table 2, renal dysfunction was identified to contribute significantly to mortality. Thus, when diagnosing pneumonia in super-elderly individuals [10] with renal dysfunction, it is necessary to bear in mind that their prognosis may be worse. It

Figure 2: Comparison between death cases and survival cases.

is considered that further useful information can be obtained if we consider grouping of underlying diseases in more detail or dividing it by concrete functional evaluation, so we set it as a future task.

Conclusion

Among super-elderly patients with pneumonia, aspiration pneumonia accounts for almost half; thus, methods of preventing aspiration on a daily basis are important. The severity of pneumonia at hospitalization correlates well with prognosis; however, when there is impairment of renal function, attention should be paid to sudden changes even if the severity score is low.

Conflicts of interest

The authors have no conflicts of interest or financial ties to disclose.

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