ORIGINAL RESEARCH

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# Determinants of Hospital Stay, Mortality, and Readmission in Aspiration Pneumonia Patients

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## Abstract

**Objective:** Aspiration pneumonia (AP) is an important subset of pneumonia in elderly. This study aimed to identify risk factors affecting hospital length of stay (LoS), mortality, and readmission in patients with AP.

**Materials and Methods:** This retrospective observational study analyzed data from 263 patients hospitalized with a diagnosis of AP (n=133) and community-acquired pneumonia (n=130) between December 2020 and November 2023.

**Results:** Dementia/Parkinson's disease (p<0.001), cerebrovascular accident (p<0.001), motor neuron disease (p<0.001), polypharmacy (p<0.001) and sedative drug usage (p<0.001) were common in AP patients as risk factors for aspiration. Additionally, LoS (p<0.001), mortality (p<0.001) and readmission (p<0.001) were common in the AP group. Readmission mortality for the AP group was 57.1%. Multivariate analyses of factors contributing to increased LoS were the presence of a caregiver (p=0.014), need for intensive care unit (ICU) during hospitalization (p=0.006), ICU LoS (p<0.001) and hospital admission within the last 90 days (p=0.02). Risk factors for readmission included high Charlson Comorbidity Index (CCI) (p=0.032), fever at admission (p=0.008) and ICU need during hospitalization (p=0.028). For in-hospital mortality, a lower body mass index (BMI) (p=0.01), more than one caregiver (p=0.045) and increased hospital LoS (p=0.028) were identified as independent risk factors.

**Conclusion:** Extended hospitalization for AP is associated with the recent hospitalization, need for care, ICU admission requirement, and prolonged ICU stay. Fever upon admission, high CCI, and ICU need were associated with an increased risk of readmission, whereas independent indicators of mortality included high care needs, low BMI, and prolonged hospitalization.

**Keywords:** Aging, aspiration pneumonia, demography of older populations, home and community-based services, readmission

## Introduction

Pneumonia represents a significant contributor to adult mortality worldwide (1,2). Aspiration pneumonia (AP) constitutes a subset of pneumonia and stands as one of the most prevalent causes in these demographics (1). Aspiration is characterized by the entry of gastric or oropharyngeal contents into the larynx and lower respiratory tract. In adults, pneumonia can also result from the aspiration of intraoral secretions, particularly during sleep. Studies suggest that 5-66.8% of hospitalized cases with a pneumonia diagnosis are attributable to AP (3). The identification of AP relies on radiological evidence of infiltration following a suggestive history in individuals at risk of aspiration (4). Given the absence of definitive diagnostic criteria, the populations studied may vary across research efforts (1).

AP is a multifactorial condition influenced by several factors, with impaired swallowing function, reduced cough reflex, and compromised immunity identified as primary contributors (2,4,5). Various risk factors associated with AP include age, male gender, dysphagia, diabetes mellitus, degenerative and neurological lung diseases, impaired consciousness, dementia, dehydration, and the use of proton pump inhibitors (PPIs) and antipsychotic drugs (6-8). Additionally, critical conditions such

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as supine position, gastroparesis, and nasogastric intubation have been linked to an increased risk of AP in critically ill patients. The groups at particular risk encompass burn victims, sepsis patients, individuals with traumatic injuries, and those who recovering from surgical procedures (9).

In patients who have undergone intubation, the immediate post-extubation phase is recognized as a precarious period, susceptible to mechanical trauma and drug-related effects (10).

The selection of antibiotics for treatment and the duration of therapy may vary according to the patient's residency and medical history (1). Although numerous publications address the risk factors and treatment modalities for cases of AP, there is a scarcity of studies focusing on factors influencing mortality and assessing readmission. Most published studies have investigated AP under the broader category of community-acquired pneumonia (CAP), with limited analyses specifically targeting patients hospitalized with a diagnosis of AP.

This study aimed to identify the risk factors influencing hospital length of stay (LoS), mortality, and readmission in patients admitted with a diagnosis of AP.

## Materials and Methods

Between December 2022 and November 2023, all hospitalized patients diagnosed with AP or CAP who were older than 18 years were retrospectively screened. Informed consent was read and sign by participants. This study was approved by the Marmara University Faculty of Medicine Clinical Research Ethics Committee (approval number: 09.2023.1380, date: 03.11.2023). According to the Turkish Thoracic Society Community Acquired Pneumonia Guideline criteria for the diagnosis of community-acquired pneumonia, cough, sputum, fever, shortness of breath, accompanied by newly emerging pulmonary infiltration in lung radiology (chest X-Ray or computerized tomography of chest) was defined as the presence of at least two symptoms of wheezing and the presence of an increase in white blood cell or an increase in C-reactive protein (CRP) in the complete blood count analysis supporting these criteria. The diagnosis of AP was accepted as the presence of a witnessed aspiration event or the patient's known dysphagia and difficulty swallowing, which are risky conditions for aspiration, and the diagnosis of pneumonia was based on the radiological and laboratory tests mentioned above (11).

Patient data, including demographic information, cigarette smoking history, occupational and environmental exposures, Charlson Comorbidity Index (CCI), Eastern Cooperative Oncology Group (ECOG) score, medical treatments, presence of fever on admission, CRP and procalcitonin levels on admission, residential and feeding status, alternative feeding during hospitalization and discharge, caregiver information, secondary infections during hospitalization, growth patterns in respiratory cultures, need for intensive care admission, LoS, length of intensive care unit (ICU) stay, discharge status, nutritional status at discharge, and readmission information, were systematically recorded for analysis. All patients diagnosed with AP were evaluated by a neck and head surgeon that was specialist on swallowing functions and detected with any level of swallowing disfunction.

### Statistical Analysis

Descriptive statistics were employed to delineate patient characteristics. Non-parametric continuous variables are presented as medians with interquartile ranges, whereas parametric continuous variables are expressed as mean±standard deviation. Categorical variables are presented as counts and percentages, where applicable. Group disparities were scrutinized utilizing the chi-square test for categorical variables, the t-test for normally distributed continuous variables, and the Mann-Whitney U test for non-normally distributed continuous variables. The association was evaluated using Spearman's correlation. Multivariate logistic analysis, incorporating a forward stepwise likelihood test, was conducted to assess mortality, readmissions, and length of hospital stay. All analyses were performed using IBM SPSS Statistics 29.

## Results

A total of 337 patients hospitalized with the diagnosis of AP or CAP between December 2020 and November 2023 were screened, and 263 patients with complete data were included in the study.

Of these, 133 patients were diagnosed with AP and 71 (53.4%) were male and median age 86 [interquartile range (IQR): 79-91]; 130 patients were diagnosed with CAP, 96 (73.8%) were male and median age 66 (IQR: 58-71). Demographics and characteristic of two groups were shown in Table 1.

When we compared the two groups, dementia/Parkinson's disease ($p<0.001$), cerebrovascular accident (CVA) ($p<0.001$), motor neuron disease ($p<0.001$), polypharmacy ($p<0.001$) and use of sedative drug ($p<0.001$) were significantly more common in the AP group, while diagnosis of gastroesophageal reflux disease (GERD) 35 (26.3%) vs. 56 (43.1%) ($p=0.004$) was common in the CAP group. There were no significant differences in the mean antipsychotic drug use, diagnosis of obstructive sleep apnea syndrome, and chronic respiratory disease between the groups. CCI ($p<0.001$) and ECOG performance status were higher in the AP group. The presence of fever ($p<0.001$), presence of sputum ($p<0.001$) and hypoxemia/cyanosis ($p=0.007$) were common in patients with CAP at the time of hospital admission (Table 1).

When examining the point of origin of the patients, it was found that 56 (42.1%) patients were transferred from home, 34 (25.6%) were transferred from the ICU, 30 (22.6%) were transferred from a nursing home, and 13 (9.8%) were transferred from another hospital in AP group (Table 1). Also, in this group, a closer look at the reasons for hospitalization of patients transferred from the ICU revealed that 15 (11.3%) patients were postoperative, 13 (9.8%) patients were hospitalized due to respiratory failure, and 6 (4.6%) patients were diagnosed with an acute CVA.

Laboratory results at admission showed that procalcitonin (p<0.001) and albumin (p<0.001) levels were lower in AP patients and these patients also tended to be more anemic (p<0.001). (Table 1). Furthermore, use of antibiotics in the last 90 days was common in CAP patients (p=0.027) and 64 (48.1%) patients in the AP group had a history of previous hospitalization for AP.

In the cultural analysis of sputum or deep tracheal aspiration materials 11 (8.2%) patients had positivity in the AP group, and the most common bacterial types were *Peptostreptococcus* 6 (54.5%), *Fusobacterium* 3 (27.2%), and *Prevotella* 2 (18.1%), while the cultural positivity was 41.5% (54 patients) in CAP and *Streptococcus pneumonia* 23 (42.5%), *Moraxella catarrhalis* 14 (25.9%), and *Klebsiella pneumonia* 7 (12.9%) were the most common isolated strains.

In the nutrition route evaluation, only 2 (1.5%) patients in the CAP group were fed modified oralnutrition apart from normal oral nutrition, whereas in the AP group, 64 (48.1%) patients were fed modified oral, 26 (19.5%) patients were fed a nasogastric tube (N/G), and 3 (2.3%) patients were fed percutaneous endoscopic gastrostomy (PEG) (Table 1). PEG placement before discharge was needed in 67 (51.9%) patients with AP. The presence of caregiver and number of caregivers differed between groups, as shown in Table 1.

The need for ICU admission during hospitalization (p<0.001) and ICU LoS (p=0.019) were significantly different between groups (Table 1).

Evaluating the outcomes of the groups, hospital LoS (p<0.001), mortality (p<0.001) and readmission (p<0.001) were common in the AP group. The readmission mortality rate in the AP group was 57.1%; however, no mortality was observed after readmission in the CAP group.

In the univariate analysis, several risk factors affecting hospital LoS stay were identified, including older age, male gender, the presence of dementia/Parkinson's disease, high CCI, sedative drug use, polypharmacy, poor performance score, presence of pressure sore, fever, hypoxemia/cyanosis, ICU LoS, higher admission CRP, admission procalcitonin levels, presence of anemia, admission albumin level, presence of antibiotic use in the past 90 days, hospital admission in the past 90 days, nasogastric feeding route, caregivers, number of caregivers more than 1, history of previous AP, ICU admission during the current hospitalization, secondary infections, and hospital mortality (see in the Appendix). However, following multivariate analysis, only ICU LoS [odds ratio (OR): 1.12] [95% confidence interval (CI):0.66-1.59], presence of hospital mortality (OR: 10.7) (95% CI: 7.75-13.69) (p<0.001), need for caregivers (OR: 6.9) (95% CI: 3.89-10.09) (p=0.014), ICU admission during the current hospitalization (OR: 6.76) (95% CI: 4.22-9.31) (p=0.006) and hospital admission in the past 90 days (OR: 6.07) (95% CI: 2.05-10.09) (p=0.02) were identified as independent risk factors for increased hospital LoS (Table 2).

When evaluating the risk factors for readmission after discharge in the univariate analysis, several risk factors were detected, including older age, the presence of dementia/Parkinson's disease, high CCI, polypharmacy, sedative drug use, poor performance score, presence of pressure sore, fever, higher admission CRP, admission procalcitonin levels, presence of anemia, admission albumin level, presence of antibiotic use in the past 90 days, hospital admission in the past 90 days, nasogastric feeding route, caregivers, number of caregivers more than 1, history of previous AP, ICU admission during the current hospitalization, secondary infections, and PEG placement before discharge (see in the Appendix). However, following multivariate analysis, only having a high CCI (OR: 0.77) (95% CI: 1.07-4.39) (p=0.032), presence of fever upon admission (OR: 4) (95% CI: 1.65-11.68) (p=0.008), and ICU admission during the current hospitalization (OR: 2.21) (95% CI: 1.26-66.23) (p=0.028) were found to be independent risk factors for readmission following discharge (Table 3).

For predicting in-hospital mortality, the univariate analysis identified several risk factors, including older age, lower body mass index (BMI), presence of dementia/Parkinson's disease, high CCI, polypharmacy, sedative drug use, poor performance score, presence of pressure sore, fever, higher admission CRP, admission procalcitonin levels, presence of anemia, admission albumin level, presence of antibiotic use in the past 90 days, hospital admission in the past 90 days, caregivers, number of caregivers more than one, history of previous AP, increased hospital LoS, ICU admission during the current hospitalization, secondary infections, and place of secondary infections (see in the Appendix). However, following multivariate analysis, only having a lower BMI (OR: 1.46) (95% CI: 0.45-0.89) (p=0.01), the presence of more than one caregiver (OR: 2.56) (95% CI: 0.01-0.94) (p=0.045), and increased hospital LoS (OR: 1.65) (95% CI: 1.18-3.10) (p=0.028) were found to be independent risk factors for in-hospital mortality (Table 4).

**Table 1. Characteristics and outcomes of patients**

| | Total n=263 | Aspiration pneumonia n=133 (50.6) | Community-acquired pneumonia n=130 (49.4) | p |
|---|---|---|---|---|
| Age* | 75 (64-87) | 86 (79-91) | 66 (58-71) | **<0.001** |
| Male | 167 (63.5) | 71 (53.4) | 96 (73.8) | **<0.001** |
| Body mass index* | 26 (22-29) | 24 (21-28) | 27 (23-31) | **0.02** |
| Current or ex-smoker | 163 (62) | 70 (52.6) | 93 (71.5) | **0.02** |
| Cigarette pack/year* | 25 (15-35) | 21 (15-35) | 25 (16-34) | 0.334 |
| History of | | | | |
| Dementia/Parkinson's disease | 90 (34.2) | 84 (63.2) | 6 (4.6) | **<0.001** |
| Cerebrovascular accident | 59 (22.4) | 56 (42.1) | 3 (2.3) | **<0.001** |
| Motor neuron diseases | 14 (5.3) | 14 (10.5) | 0 | **<0.001** |
| Polypharmacy | 63 (23.9) | 56 (42.1) | 8 (6.15) | **<0.001** |
| Sedative drug use | 27 (10.2) | 26 (19.5) | 1 (0.7) | **<0.001** |
| Antipsychotic use | 32 (12.2) | 19 (14.3) | 13 (10) | 0.347 |
| OSAS | 34 (13.9) | 15 (11.3) | 19 (14.6) | 0.420 |
| Chronic respiratory disease | 138 (52.7) | 77 (58.3) | 61 (46.1) | 0.06 |
| GERD | 91 (34.6) | 35 (26.3) | 56 (43.1) | **0.004** |
| Charlson Comorbidity Index | 3 (1-4) | 4 (3-6) | 1 (0-2) | **<0.001** |
| ECOG performance status scale | 2 (1-4) | 4 (3-4) | 1 (1-1) | **<0.001** |
| Presence of | | | | |
| Pressure sore | 32 (12.2) | 32 (24.2) | 0 | **<0.001** |
| Fever | 135 (51.3) | 45 (33.8) | 90 (69.2) | **<0.001** |
| Cough | 238 (90.5) | 122 (91.7) | 116 (89.2) | 0.490 |
| Sputum | 97 (36.9) | 32 (24.1) | 65 (50) | **<0.001** |
| Dyspnea | 143 (54.4) | 72 (54.1) | 71 (54.1) | 0.938 |
| Hypoxemia/cyanosis | 218 (82.9) | 102 (76.2) | 116 (89.2) | 0.007 |
| Points of origin | | | | |
| Home | 186 (70.7) | 56 (42.1) | 130 (100) | **<0.001** |
| Nursing home | 30 (11.4) | 30 (22.6) | 0 | |
| Other hospital | 13 (4.9) | 13 (9.8) | 0 | |
| ICU | 34 (12.9) | 34 (25.6) | 0 | |
| Laboratory results at admission | | | | |
| CRP* | 103 (82-165) | 103 (82-142) | 104 (79-189) | 0.672 |
| Procalsitonin* | 1 (0.53-2.1) | 0.6 (0.4-1.2) | 1.5 (0.78-3.1) | **<0.001** |
| Albumin* | 3.3 (3.1-3.6) | 3.1 (2.9-3.3) | 3.5 (3.2-3.6) | **<0.001** |
| Anemia | 114 (43.3) | 82 (61.7) | 32 (24.6) | **<0.001** |
| Sputum culture positivity | 65 (24.7) | 11 (8.2%) | 54 (41.5%) | **<0.001** |
| Antibiotic use within the last 90 days | 92 (35) | 38 (28.6) | 54 (41.5) | **0.027** |
| Hospitalization within 90 days | 33 (12.5) | 14 (10.5) | 19 (14.6) | 0.317 |
| History of aspiration pneumonia | 64 (24.4) | 64 (48.4) | 0 | **<0.001** |
| Nutrition route | | | | |
| Normal oral | 168 (63.9) | 40 (30.1) | 128 (98.5) | **<0.001** |
| Modified oral | 66 (25.1) | 64 (48.1) | 2 (1.5) | |
| N/G | 26 (9.9) | 26 (19.5) | 0 | |
| PEG | 3 (1.1) | 3 (2.3) | 0 | |
| The presence of a caregiver | 120 (45.6) | 109 (82) | 11 (8.5) | **<0.001** |
| Presence of more than 1 caregiver | 44 (16.7) | 42 (31.6) | 2 (1.5) | **<0.001** |
| Secondary infection during admission | 95 (36.1) | 73 (54.9) | 22 (16.9) | **<0.001** |
| PEG placement before discharge | 67 (25.9) | 67 (51.9) | 0 | **<0.001** |
| ICU admission during hospitalization | 53 (20.2) | 39 (29.3) | 14 (10.8) | **<0.001** |
| ICU length of stay* | 5 (3-6) | 5 (4-7) | 4 (4-7) | **0.019** |
| Outcomes | | | | |
| Hospital length of stay* | 10 (7-15) | 13 (10-18) | 7 (5-10) | **<0.001** |
| Mortality | 25 (9.5) | 21 (15.8) | 4 (3.1) | **<0.001** |
| Readmission | 23 (9.5) | 21 (18.8) | 2 (1.5) | **<0.001** |
| Readmission mortality | 12 (52.2) | 12 (57.1) | 0 | 0.217 |

*Data are presented as median (interquartile range), and categorical variables are presented as n (%).
OSAS: Obstructive sleep apnea syndrome, GERD: Gastroesophageal reflux disease, ECOG: Eastern Cooperative Oncology Group, ICU: Intensive care unit, N/G: Nasogastric tube, PEG: Percutaneous endoscopic gastrostomy, CRP: C-reactive protein

**Table 2. Factors associated with hospital length of stay following multivariate analysis**

| | OR | 95% CI | p |
|---|---|---|---|
| ICU length of stay | 1.12 | 0.66 - 1.59 | <0.001 |
| Hospital mortality | 10.7 | 7.75 - 13.69 | <0.001 |
| Having caregivers | 6.9 | 3.89 - 10.09 | 0.014 |
| ICU admission during the current hospitalization | 6.76 | 4.22 - 9.31 | 0.006 |
| Hospital admission within 90 days | 6.07 | 2.05 - 10.09 | 0.02 |

OR: Odds ratio, CI: Confidence interval, ICU: Intensive care unit

**Table 3. Factors associated with readmission following multivariate analysis**

| | OR | 95% CI | p |
|---|---|---|---|
| Higher Charlson Comorbidity Index | 0.77 | 1.07 - 4.39 | 0.032 |
| Fever at admission | 4 | 1.65 - 11.68 | 0.008 |
| ICU admission during the current hospitalization | 2.21 | 1.26 - 66.23 | 0.028 |

OR: Odds ratio, CI: Confidence interval, ICU: Intensive care unit

**Table 4. Factors associated with mortality following multivariate analysis**

| | OR | 95% CI | p |
|---|---|---|---|
| Lower BMI | 1.46 | 0.45 - 0.89 | 0.01 |
| Having more than one caregiver | 2.56 | 0.01 - 0.94 | 0.045 |
| Hospital length of stay | 1.65 | 1.18 - 3.10 | 0.028 |

OR: Odds ratio, CI: Confidence interval, BMI: Body mass index

## Discussion

In this study, data from 263 patients hospitalized with a diagnosis of AP and CAP were analyzed. Compared with CAP, patients diagnosed with AP had more dementia/Parkinson's disease, CVA history, hypoalbuminemia and anemia, and worse CCI and ECOG scores, while the frequency of fever and sputum production were higher and hypoxemia was more common in patients diagnosed with CAP. Hospitalization, mortality, and readmission were significantly higher in the AP group. In patients diagnosed with AP, factors contributing to increased LoS included the presence of a caregiver, the need for ICU during hospitalization, the length of ICU stay, and hospital admission within the last 90 days; risk factors for readmission included a high CCI, the presence of fever on admission, and the need for ICU during hospitalization. Regarding risk factors determining mortality in AP patients, it was found that a longer hospital stay, lower BMI, and the presence of more than one caregiver were independent factors.

In literature studies on AP, it has been consistently reported that the study populations are typically aged 70 and above (12). It has been underscored that the risk of developing AP increases with age, particularly beyond 70, and cases occurring in this age group often involve malignancies, neuromuscular diseases, or chronic respiratory conditions. In our study, age was significantly different between the AP and CAP patients. The ages range between 52-96 years in patients diagnosed with AP, and we observed 12 (9%) patients below the age of 70 in this group. It was noted that a majority of these patients developed AP either following a surgery or during intensive care hospitalization due to respiratory failure.

AP holds significant prominence among CAP (13), and dysphagia is believed to contribute to this condition in up to 60% of the elderly population (14). Studies have indicated that cases with a history of recurrent pneumonia are often attributed to aspiration, and "recurrent pneumonia" has been proposed as a typical indicator of AP (3,15,16). Similarly, another study noted a higher prevalence of nutritional modification or nasogastric feeding before hospitalization in patients admitted with AP. Our study also revealed that 64 (48%) patients underwent home nutrition modification, 26 (19.5%) were fed with N/G and 3 (2.3%) had PEG in the AP group, whereas only 2 (1.5%) patients in the CAP group had modified their diet for nutrition. Implementing home nutrition modification implies that a significant proportion of patients exhibited clinical manifestations potentially linked to aspiration, regardless of prior hospitalization for AP. In our study, all patients in the AP group underwent swallowing evaluations during hospitalization. PEG was recommended for 71 (52.2%) patients, and PEG was performed in 66 (49.6%) patients. Notably, two (40%) patients declined the procedure, and one (1.5%) patient, discharged with PEG was readmitted within 30 days.

In a comprehensive review of the literature, van der Maarel-Wierink et al. (17) conducted a detailed study identifying 13 conditions that may pose risk factors for AP, including age, male gender, chronic lung disease, dysphagia, diabetes mellitus, dementia, angiotensin i-converting enzyme deletion, poor oral hygiene, malnutrition, Parkinson's disease diagnosis, antipsychotic use, PPI use, and angiotensin-converting enzyme inhibitor use. Suzuki et al. (18) discovered that low BMI and albumin levels, indicative of malnutrition, increased the risk of aspiration. Similarly, in our study, advanced age, low BMI, presence of dementia/Parkinson diagnosis, and lower albumin levels were common in the AP group, whereas GERD and male sex were common in the CAP group, and no significant difference was observed between the groups in terms of chronic lung disease, which was reported as a risk factor for aspiration. While our study exclusively focused on cases with AP without specifying individual risk factors, we evaluated the impact of these risky conditions on the LoS, readmission, and mortality. Unlike van der Maarel-Wierink et al. (17) study, age, male gender, chronic lung disease, and dementia were not found to affect LoS and mortality in our study. However, mortality was observed to be higher in patients with low BMI.

In this study, we examined the factors influencing LoS in patients diagnosed with AP. We found that the presence of a caregiver, ICU need during hospitalization, and hospital admission within the last 90 days were significant factors affecting LoS. Additionally, for readmission, a high CCI and the presence of fever on admission were identified as significant factors. Consistent with our findings, a study evaluating LoS in patients diagnosed with pneumonia suggested that AP was associated with a longer hospital stay than other types of pneumonia. In the subgroup analysis, male sex and multilobar infiltration on chest X-ray at admission were associated with increased LoS. Notably, in our study, the effect of sex on LoS was not significant, and a specific radiological evaluation was not conducted.

In a study by Noguchi et al. (19), the evaluation of 6-month mortality and recurrent AP within 30 days after discharge focused on patients with AP. This study assessed CVA, disorientation, bed addiction, dementia, sleeping drug use, and GERD as risk factors for aspiration. This study demonstrated that dementia, sleeping drug use, and poor performance status increased the risk of both aspiration and mortality. In this study, we also demonstrated that dementia, CVA, higher ECOG status, higher CCI points, polypharmacy, and sedative drug usage was common in the AP group, similar to Noguchi et al. (19) However, in terms of risk factors for mortality, we found that a longer hospital stay, lower BMI, and the presence of more than one caregiver were independent factors. Although the mortality relationship between long hospital stays and low BMI was predictable, interestingly, having more than one caregiver was also found to be significant in terms of mortality in this study. The possible reasons for this are that the number of caregivers may increase as the workload of a single caregiver may be high in patients with high care needs or dependencies. For social and cultural reasons in our country, caregivers are usually primary or secondary relatives of patients rather than professionals. It is believed that irregularities during patient and caregiver follow-up with insufficient knowledge and competence may be related to this situation. The results suggest that the longer hospital stay of patients with caregivers is related to the possible high fragility of these patients.

We also focused on evaluating risk factors for AP requiring readmission and in multivariate analyses we identified high CCI, presence of fever at admission, and ICU need during hospitalization as significant risk factors. In a meta-analysis conducted by Komiya et al. (20) the study evaluated the frequency of AP and related mortality in hospitalized cases with CAP. According to their findings, cases with AP exhibited higher mortality compared to pneumonia without aspiration, which is consistent with our results. Risk factors for mortality in elderly patients with pneumonia were previously studied, and heart failure, high ECOG score, high pneumonia severity index score, shock, Gram-negative bacterial pneumonia, respiratory failure, and renal failure were identified as possible risk factors (21). In a recent study by Shin et al. (22) which focused on risk factors for mortality in isolated AP cases, increasing age and the development of the need for mechanical ventilation during hospitalization were identified as independent risk factors for mortality. Moreover, prolonged hospital stay was highlighted as a factor contributing to increased mortality in patients aged 65 and over.

Similar to the study by Shin et al. (22) our study focused on isolated AP cases, and risk factors for mortality were identified. In our study, factors such as BMI, having more than one caregiver, and a prolonged hospital stay were associated with increased mortality. These findings suggest that our study represents a patient group with a high likelihood of frailty.

### Study Limitations

Because of its retrospective nature, this study has some limitations. Some patients were excluded due to data loss. As part of the diagnosis of AP relies on patient or caregiver testimony, we did not perform fluoroscopy. Blood results were obtained at the initial hospital admission, potentially creating disparities between the dates of aspiration and hospital admissions. Detailed information on the hospitalization of patients requiring ICU admission was not available. Additionally, specific radiological evaluations were not included in the study.

## Conclusion

In summary, the findings of this study indicate that AP and CAP have different characteristics. In cases of AP, factors such as the need for care, recent hospitalization within the last 3 months, requirement of ICU during hospitalization, and prolonged ICU LoS contribute to an extended duration of hospitalization. Additionally, readmission is associated with higher mortality in this group, cases with fever at admission, high CCI, and ICU need during hospitalization are at risk for readmission. Independent indicators of mortality in AP include high need for care, low BMI, and extended hospitalization.

### Ethics

**Ethics Committee Approval:** This study was approved by the Marmara University Faculty of Medicine Clinical Research Ethics Committee (approval number: 09.2023.1380, date: 03.11.2023).

**Informed Consent:** The informed consent form was read and signed by the participants to -inform them about the study purpose and methodology.

### Footnotes

**Financial Disclosure:** The author declared that this study received no financial support.

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