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EFFECT OF OLD AGE ON PNEUMONIA

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Abstract

Introduction: Pneumonia is one of the leading causes of mortality and morbidity in older persons. In this study, the effect of age on various parameters was investigated within a sample of pneumonia patients followed by a pulmonology clinic.

Materials and Method: In this study, the age, gender, comorbidities, white blood cell counts, albumin values and sputum culture results of the patients were recorded. These patients were divided into two groups (aged 65 years or older and under 65 years), and the recorded values were statistically compared between these groups.

Results: Most of the patients were older persons, and the ratio of male patients was higher than that of female patients. Most patients had one or more comorbidities. A causative pathogen of pneumonia was detected in most of the patients for whom sputum cultures could be taken. When the two age groups were compared in terms of laboratory results, significant between-group differences were found only for albumin values and C-reactive protein/albumin ratios.

Conclusions: In this study, the average age of the patients diagnosed with pneumonia was high, most of them were male, and most of them had one or more comorbidities. These findings indicate that preventive health services and control of additional diseases in older patient likely play important roles in preventing bad outcomes and reducing health costs associated with pneumonia. In addition, the findings of this study indicate that albumin and C-reactive protein/albumin ratio values can be used to evaluate the course of pneumonia or the inflammatory response pneumonia causes.

Keywords: Pneumonia; Aged; Sputum.

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INTRODUCTION

Pneumonia is a common disease with serious mortality and morbidity rates that has important implications for society and public health (1). Data from the World Health Organization show that 7% of all deaths each year are due to pneumonia (2). Aging is a normal process defined as the irreversible loss of an individual's mental and physiological capacities. In both Turkey and reports published by the World Health Organization, it is stated that the onset of old age occurs at 65 years. More specifically, the World Health Organization defines age 65 years or older as old and defines age 85 years or older as very old (3). Prior studies have shown that the incidence of pneumonia increases with age (4).

Old age is a special period that should be evaluated from a perspective that considers the unique psychological, physiological, and socioeconomic changes that occur during this period, as well as the excess of accompanying chronic and acute diseases with atypical signs and symptoms. Pneumonia is one of the leading causes of morbidity and mortality in old age (4). Furthermore, the population of older persons is increasing rapidly, and diseases are detected more quickly and more frequently in old age. Most older persons have more than one health problem, and accordingly, they use the hospital provided at frequently. In general, geriatric patients stay in the hospital longer and experience increased mortality rates and treatment costs. For these reasons, it is necessary to further investigate the problems experienced by older persons (5).

In the present study, pneumonia patients followed by a pulmonology clinic were grouped into those aged 65 years or older and those under 65. Then, the laboratory values, sputum culture results, and comorbidities of these groups were compared.

MATERIALS AND METHOD

This study received the necessary permissions and ethics approval. In present study, covid 19 negative and community-acquired pneumonia patients without covid pneumonia who were hospitalised in the Chest Diseases Clinic of a district State Hospital were included. The ages, genders, comorbidities, C-reactive protein (CRP) values, white blood cell (WBC) counts, albumin levels, and sputum culture results of these patients were recorded. Then, the patients were divided into two groups (aged 65 years or older and under 65 years), and the recorded data were compared.

Statistical Analysis

A statistical analysis of the recorded data was completed using IBM SPSS 25.0. A Kolmogorov–Smirnov test was used for normality testing of the parameters. Descriptive statistics for continuous variables suitable for normal distribution are given as mean and standard deviation, for not normal distribution median and Q1- Q3. Then, an independent samples test was used for parameters suitable for normal distribution, and a Mann–Whitney U test was used for parameters that did not exhibit normal distribution. $P < 0.05$ was accepted as a statistically significant difference between groups. Cohen's d was used in the effect size calculation of parametric tests ($0.2 \leq d < 0.5$ for small effects, $0.5 \leq d < 0.8$ for medium effects and $d > 0.8$ for large effects) and Cliff's Delta was used in the effect size calculation of non parametric tests ($|\delta| < 0.147 \rightarrow$ Small effect, $0.147 \leq |\delta| < 0.33 \rightarrow$ Medium effect, $0.33 \leq |\delta| < 0.474 \rightarrow$ Large effect, $|\delta| \geq 0.474 \rightarrow$ Very large effect). Frequency (%) was given for the categorical data, and statistical analysis of the groups in terms of gender was measured by Chi-square test.

RESULTS

The present study, 54 patients, 29 of whom were 65 years age or older and 25 of whom were under 65 years age, were included. It was observed that the ratio of male patients was higher than the ratio of female patients in both groups. When the groups were evaluated in terms of gender, no significant

difference was observed. In the grouping according to age, there was a statistically significant difference between the groups in terms of mean age and this difference was close to large effect size (Table 1).

A causative pathogen of pneumonia was detected in the sputum cultures of 14 patients 65 years or older and 12 patients under 65 years age (Table 2). When the sputum culture results of the patients were compared, it was shown that the most common reproducing factor in both groups was *Klebsiella* spp.

When the two groups were compared, it was observed that albumin values were statistically significantly lower in patients aged 65 years or older than in patients aged under 65 years and the difference was close to a large effect size (Table 3). When the CRP values and CRP/albumin ratios of the groups were compared, it was showed that the CRP

Table 1. Age and gender distribution of groups

	65 years or older (n=29)	**Under 65 years old** (n=25)	
Age (Years)	73.69 ± 7.19	49.44 ± 11.43	p<0.001 d=2.539
Gender			
Male	22(76%)	17(68%)	Φ=0.088
Female	7(24%)	8(32%)	p=0.735

Table 2. Pathogen distribution of patient sputum cultures

Pathogens	**65 years or older** (n=29)	**Under 65 years old** (n=25)
Klebsiella spp.	5	10
Acinetobacter spp.	2	-
Enterobacter spp.	2	-
Escherichiacoli	2	-
Serratia spp.	1	-
Pseudomonas spp.	1	1
Streptococcus pneumonia	1	1
Oropharyngeal flora elements	10	11
No sputum culture	5	2

Table 3. Laboratory data of groups

Parameters	**65 years or older** (n=29)	**Under 65 years old** (n=25)	**p-value**	**effect size**
CRP (mg/L)	47(10.1-106.5)	10.1(3-71)	0.067	0.291
ALBUMIN (g/L)	29.97 ±3.54	33.51 ±5.48	0.009	0.767
CRP/ALBUMIN	1.46(0.35-3.73)	0.23(0.1-2.27)	0.044	0.320
WBC (10^3/uL)	12.58±4.57	10.74±3.9	0.122	0.433

values and CRP/albumin ratios of patients 65 years and over were higher than those of patients under 65 years. There was a difference close to statistical significance and the difference was medium effect size (Table 3).

DISCUSSION

Aging is a physiological process that progresses with nearly the same phenotypic changes across all intraspecies individuals, in which adaptation to internal and external conditions decreases over time. Today, in parallel with recent medical developments, the average life expectancy has increased due to improved social conditions and quality of life. While the ratio of older persons in the world population was 1% in the 1900s, it is predicted to reach 20% by 2050 (6). Prior studies have shown that the incidence of pneumonia increases with age (3). In the present study the average age of pneumonia patients was found to be high, and the number of patients aged 65 years or older was higher than the number of patients under 65.

Prior studies have shown that pneumonia is more common in men than in women (7). In one study, Angela et al. showed that female sex steroids protect the immune system in cases of trauma and sepsis and that cellular immunity is more developed in women than in men (8). In the present study, the number of male pneumonia patients was higher than that of female pneumonia patients in both age groups.

Furthermore, comorbidities accompanying pneumonia were significantly increased among the older age group compared to the younger age group. Cardiovascular diseases, chronic respiratory diseases, and cerebrovascular diseases are particularly prevalent diseases among pneumonia patients (9). In a study by Erdede et al., chronic respiratory system disease was found to be the most common comorbid condition, occurring at a rate of 37% among pneumonia patients (10). Meanwhile, Köksal et al. reported chronic obstructive pulmonary disease (COPD) in 42.7%, hypertension in 29.8%, and heart failure in 9.6% of 218 pneumonia patients (11). In the present study, comorbidities were found to be more common in patients aged 65 years or older than in patients under 65 years, and the most common comorbidity in both age groups was COPD, in line with the findings of prior studies.

The factors that facilitate the development of pneumonia in older persons and patients with comorbidities include the amount of pathogenic microorganisms to which the patient is exposed, the virulence of these pathogens, and the deterioration of defense mechanisms. Oropharyngeal secretion aspiration, pathogen inhalation, and blood circulation (septic embolism) facilitate the transport of microorganisms to the lungs (12). *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moroxella (Branhamella) catarrhalis*, and other atypical microorganisms are often responsible for pneumonia. However, the agents of pneumonia in older persons (those aged 65 years or older) differ from those of the normal population (13). Erdem et al. In a study of mortality markers in patients with community-acquired pneumonia in need of intensive care—which included 413 patients in 19 intensive care units across 12 centers—the most frequently isolated factors were Gram-negative bacteria, *Staphylococcus aureus*, and *Streptococcus pneumoniae*, in order of frequency (14). In a study of 92 geriatric patients with community-acquired pneumonia, Küçükardalı et al. reported that a bacteriological diagnosis was reached in 31% of these patients and that the causative agents were S*treptococcus pneumoniae*, *Escherichia coli*, *Enterobacter* spp., *Klebsiella pneumoniae*, and *Staphylococcus aureus*, in order of frequency (13). Detection of the causative pathogen is important for both guiding treatment and reducing the cost of treatment. In addition, the presence of the agent helps prevent antibiotic resistance and reduce mortality. In the present study, 7 of 54 patients could

not produce sputum cultures, 21 patients were found to have oropharyngeal flora elements, and *Klebsiella* spp. was found to be the most common causative agent in both age groups. Potential reasons for which *Klebsiella* spp. was the most common reproducing pathogen—in contrast with the findings of many similar studies—include the older age range of the present patient population, the prevalence of comorbidities within this population, and the fact that different geographical conditions may correspond to different frequencies and types of etiological agents.

It is difficult to distinguish pneumonia from other respiratory tract infections by history and physical examination alone (15). The patient's complete blood count, liver and kidney function tests, and serum electrolytes are important in the decision of whether to hospitalize, treatment selection, and determining prognosis. It is known that WBC count is an indicator of disease severity (16). Meanwhile, CRP is an acute phase reactant synthesized by the liver in response to interleukin-6 (17). In a prior study conducted in our country, the severity of pneumonia was found to be associated with elevated CRP and WBC values (18). Melbye et al. reported that WBC and especially CRP have high diagnostic value (19). With respect to age, Vazquez et al. found no significant difference in CRP values between patients aged younger than 65 years and those aged 65 years or older (20). Meanwhile, Bircan et al. found no difference between these same age groups in terms of mean CRP, WBC, or erythrocyte sedimentation rate values (21). Although high WBC levels were found in most of the patients in both groups in our study, no significant difference was found between the groups, in accordance with the findings of the two studies mentioned above. CRP values were close to significantly higher in patients aged 65 years and over than in patients under 65 years, but the effect of this difference was medium.

Albumin is a negative acute phase reactant in case of acute inflammation. Hypoalbuminemia is more common in older patients due to malnutrition and causes a worse course of the disease (22). In one prior study, hypoalbuminemia was found to be an important determinant of mortality in patients with community-acquired pneumonia-related sepsis and septic shock (23). In the present study, albumin values were significantly lower in patients aged 65 years or older than in those under 65. Prior studies have shown that CRP level, albumin level, or the CRP/albumin ratio can be a useful prognostic factor for inflammatory or nutritional status, and the CRP/albumin ratio can be a particularly strong indicator of inflammatory response (24). Kim et al. evaluated patients with sepsis and septic shock and suggested that the CRP/albumin ratio could be used to predict three-month mortality (23). Conversely, in a study of community-acquired pneumonia patients by Hoşgün et al., the CRP/albumin ratio was not found to have significant prognostic value for mortality (25). In present study, the CRP/albumin ratio showed a significant difference between the two age groups of pneumonia patients, but the effect of this difference was medium.

Since present study was conducted during the peak period of the Covid 19 pandemic, patients with Covid 19 positive pneumonia were excluded from the patient sample. The limitations of the study include the exclusion of patients with high probability of community-acquired pneumonia because they could not be differentiated as covid pneumonia or community-acquired pneumonia because they were covid positive, the fact that the study centre was a district state hospital and the short duration of the study.

CONCLUSION

Similar to previous studies, the present study showed the average age of patients diagnosed with pneumonia to be high. The number of patients aged 65 years or older was higher than that of patients under 65 years, the majority of patients were male, and most patients had one or more comorbidities.

Furthermore, the majority of the patients with comorbidities were aged 65 years or older. For this reason, preventive health services, vaccination, and the control of additional diseases in older patients are important in terms of both preventing bad outcomes and reducing health costs associated with pneumonia.

Most of the patients in the present study had elevated CRP and WBC levels, but there were no significant differences in these values between the age groups. However, albumin values were significantly lower and CRP/albumin ratio values were significantly higher in patients aged 65 years or older than in patients under 65 years. Therefore, multicenter and large sample size studies of older pneumonia patients are needed to assess the use of albumin and the CRP/albumin ratio for evaluation of the disease course or the associated inflammatory response.

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