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İpek ÖZMEN[1]
Elif YILDIRIM[1]
Hamza OGUN[2]
Halil İbrahim YAKAR[3]
Tülay TÖRÜN[1]
Haluk ÇALIŞIR[4]

Correspondance

İpek ÖZMEN
Süreyyapaşa Chest Diseases and Chest Surgery Training and Research Hospital, Chest Diseases Clinic, İSTANBUL

Phone: 0216 421 42 00
e-mail: ipekozmen2011@gmail.com

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[1] Süreyyapaşa Chest Diseases and Chest Surgery Training and Research Hospital, Chest Diseases Clinic, İSTANBUL
[2] Turhal State Hospital, Chest Diseases Clinic, TOKAT
[3] İstanbul Medeniyet University, Faculty of Medicine, Department of Chest Diseases, İSTANBUL
[4] Acıbadem University Atakent Hospital, Department of Chest Diseases, İSTANBUL

RESEARCH

IS THE COURSE OF PNEUMONIA THE SAME IN ELDERLY AND OLDER PATIENTS?

ABSTRACT

Introduction: Pneumonia is a major mortality and morbidity reason among elderly. Age limit is commonly accepted as 65 years, but actually age definition varies by country.

Objective: In the present study we aimed to evaluate the course of pneumonia in patients age 75 and older as "75-84 years" and "85 and older" patients.

Materials and Method: This is a retrospective cohort study in a chest disease clinic between January 2009 and May 2013. Pneumonia patients aged 75 and older followed in chest disease ward were included in the study. The patients were evaluated in two groups: "75-84 years" and "85 and older". Demographics, CURB65 score, hospital and short term mortality (mortality within 30 days after discharge) were recorded.

Results: A total number of 116 pneumonia patients, 54% male were enrolled. The mean age was 83±5 years. There were 76 patients in "75-84 years" group and 40 in "85 and older" group. The incidence of congestive heart failure/coronary artery disease was significantly higher in "85 and older" patients (P = 0.002). Penicillins and cephalosporins were the most commonly used antibiotics. In both age groups in-hospital and short-term mortalities were similar. The length of hospital stay was similar in both age groups, but "75-84 years" patients were more likely to transfer to intensive care unit than "85 and older" patients (11% vs. 3%, p = 0.13)

Conclusion: The course of pneumonia, LOS, and in-hospital and short-term mortality are analogous among "75-84 years" and "85 and older" patients. Close clinical follow-up, good compliance to guidelines and a good management to comorbidities is required. As multidisciplinary approach and close follow-up is vital for elderly patients, a focus on hospital workforce conditions while planning and organizing is essential.

Key Words: Pneumonia; Aged; Frail Elderly; Aging.

ARAŞTIRMA

YAŞLI VE İLERİ YAŞLI PNÖMONİ HASTALARININ SEYRİ AYNI MIDIR?

ÖZ

Giriş: Dünya nüfusu giderek yaşlanmaktadır. Pnömoni yaşlı nüfus için önemli bir mortalite ve morbidite nedenidir. Yapılan çalışmalarda "yaşlılık" tanımı için 65 yaş ve üzeri kabul edilmektedir. Diğer taraftan "yaşlılık" tanımı ülkeden ülkeye farklılık gösterebilir. Bu çalışmada "75-84 yaş" ve "85 yaş ve üzeri" hasta gruplarında pnömoni seyrinde fark olup olmadığının araştırılması amaçlanmıştır.

Gereç ve Yöntem: Üçüncü basamak göğüs hastalıkları hastanesinde bir göğüs hastalığı kliniğinde Ocak 2009- Mayıs 2013 tarihleri arasında kliniğe yatırılarak tedavi edilen 75 yaş ve üzeri pnömoni hastaları retrospektif olarak incelenmiştir. Hastalar; "75-84 yaş" ve "85 yaş ve üzeri" olarak iki grupta değerlendirilmiştir. Hastaların demografik özellikleri, CURB 65 skoru, hastane ve kısa dönem mortalite (taburculuktan sonraki ilk 30 gün) özellikleri hastane verilerinden kaydedilmiştir.

Bulgular: Çalışmaya yaş ortalaması 83±5 olan toplam 116 hasta alındı. Yetmiş altı hasta "75-84 yaş" grubunda ve 40 hasta "85 yaş ve üzeri" gruptadır. Konjestif kalp yetmezliği/koroner arter hastalığı "85 yaş ve üzeri" hasta grubunda anlamlı olarak yüksek saptandı (P = 0.002). Genel hastane mortalitesi %8, kısa dönem mortalite %11 olarak saptandı. Hastane ve kısa dönem mortalite her iki yaş grubunda da benzer saptandı. Hastane yatış süresi her iki grupta benzerdi, yoğun bakıma nakil "75-84 yaş" gruptaki hastalarda daha fazla idi (%11 vs %3, p=0.13). Her iki yaş grubunda da %18-20 penisilin ve sefalosporin tedavisine makrolit eşlik etmekteydi.

Sonuç: Pnömoni seyri, hastane yatış süresi, hastane ve erken mortalite sonuçları "75-84 yaş" ve "85 yaş ve üzeri" hastalarda benzerdir. İleri yaşlı olan bu hastalarda eşlik eden hastalıkların iyi yönetimi, multidisipliner yaklaşım ve yakın izlem hayati önem taşımaktadır bu nedenle hastane işgücü koşullarına odaklanmak, planlama ve organizasyon gerekmektedir.

Anahtar Sözcükler: Pnömoni; Yaşlı; Kırılgan Yaşlılık; Yaşlanma.

Introduction

The world population is aging; in the elderly population, pneumonia is an important cause of morbidity and mortality (1). Physiological changes that occur in the respiratory physiology and diminishment of the immune system with age are known to create appropriate environment for pneumonia. Increased risk of pneumonia and hospitalisation in the elderly is associated with increased mortality (2,3).

The age limit for the definition of old age is commonly accepted as 65 years, and many studies on pneumonia used this age limit. However, the age definition varies by country. There are studies comparing older and younger patients with pneumonia (2,3). As a result of prolonged human life, elderly population ratio is increasing worldwide and in our country, and a change in the patient profile in hospitals is also expected. However, the course of pneumonia in 75 years and older has not been determined. The purpose of this study was to evaluate the course of pneumonia in 75 years and older patient populations.

Materials and Method

This is a retrospective cohort study in a chest disease clinic in a tertiary hospital for chest diseases between January 2009 and May 2013. The study was approved by the local ethics committee of the hospital in accordance with the Declaration of Helsinki. Because of the retrospective nature of the study design, informed consent was not obtained.

Patients

Patients with community-acquired pneumonia (CAP) aged 75 years and older followed-up in the chest disease ward were included in the study. Patients who required hospitalisation according to the Turkish Thoracic Society consensus on the diagnosis and treatment of CAP were included (4). Figure 1 shows the flowchart of the study.

The patients were evaluated in two groups: "75–84 years" and "85 and older".

Pneumonia Criteria

Pneumonia was defined as acute onset of symptoms suggestive of lower respiratory tract infection and radiographical evidence of a new infiltrate (4,5). Severity of pneumonia was rated by CURB-65 scoring system (6). The CURB-65 uses the following variables: confusion of new onset, blood urea nitrogen greater than 19 mg/dL, respiratory rate of 30 breaths/min or greater, systolic blood pressure less than 90 mmHg/diastolic blood pressure 60 mmHg or less and age 65 years or older (6).

Laboratory Measurements

Complete blood count was determined using a Coulter LH 780 Hematology Analyzer (Beckman Coulter, USA). C-reactive protein (CRP) was assessed using the nephelometry method BN II System (Siemens, Germany). The normal range of CRP is 0–5 mg/L.

Data Recording

Data of pneumonia cases aged 75 years and older followed-up in the chest disease ward were recorded from the hospital data. Demographics; comorbidities, including chronic obstructive pulmonary disease (COPD), diabetes mellitus, coronary artery disease and neurological diseases (Alzheimer's disease, cerebrovascular attack), and use of long-term oxygen therapy (LTOT) were also recorded as were laboratory, radiology and antibiotic therapy data. Arterial blood gas values at the time of admission to the ward, CURB-65 score, length of hospital stay (LOS) and in-hospital and short-term mortality (mortality within 30 days after discharge from hospital) were also recorded.

Treatment

Empirical antibiotic treatment was initiated following a clinical diagnosis of pneumonia immediately after admission according to national guidelines. Patients were re-evaluated for antibiotic treatment if there was no response to empirical treatment within 72 h (fever >38°C, new onset of pulmonary infiltrates or an increase in oxygen demand) (4,5).

Outcomes

The primary outcome was short-term mortality (mortality within 30 days after discharge), and the secondary outcome was in-hospital mortality.

Statistical Analysis

The Mann–Whitney *U* test and Student's *t* test were used for analysis of continuous variables with non-parametric and parametric values, respectively. The chi square test was applied for categorical variables of survivors and non-survivors. The median and interquartile range was employed for non-parametric continuous variables, and mean ± standard deviation was used for parametric continuous variables. Count and per-

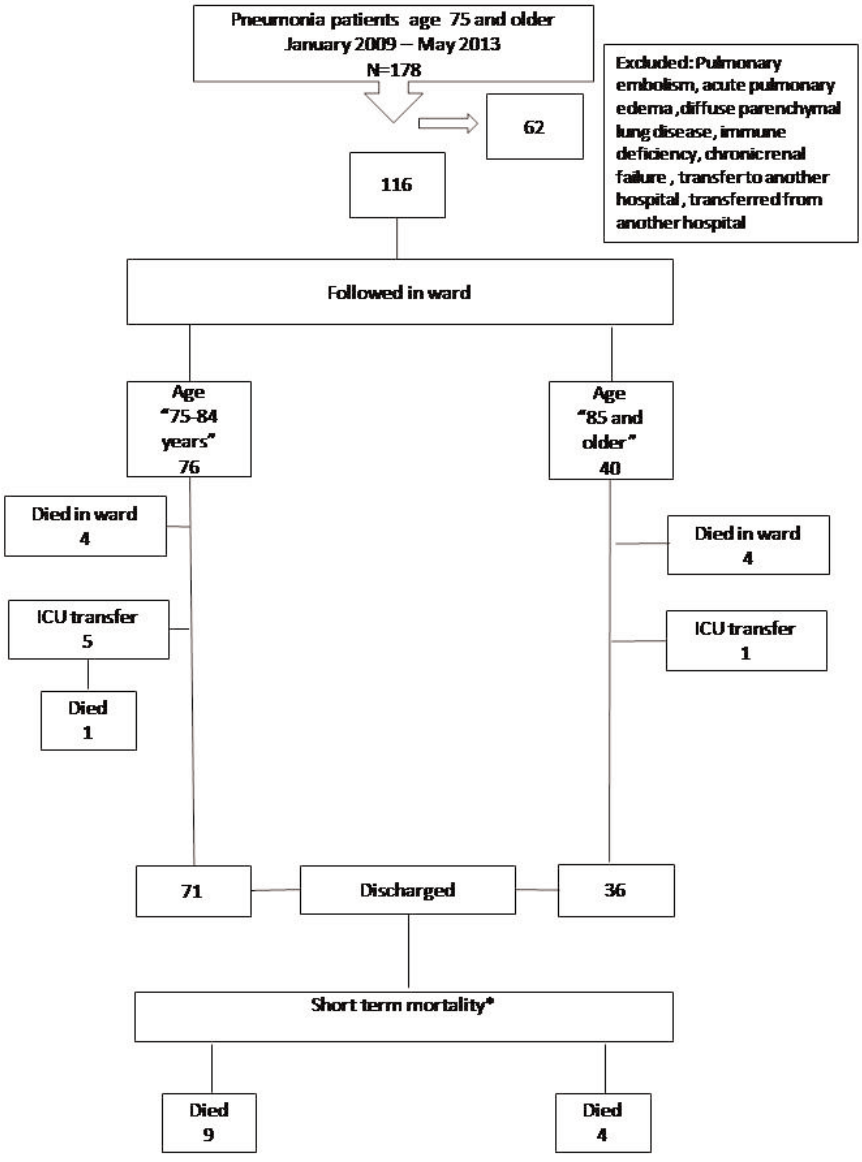

Figure 1— Flowchart of the study.

centage were used when applicable. A p value <0.05 was accepted as statistically significant.

RESULTS

In this study, a total of 116 patients with pneumonia aged 75 years and older were enrolled. The mean age was 83 years (range, 75–99 years). There were 76 patients in "75–84 years" group and 40 in "85 and older" group.

Patient demographics and comorbidities according to age group are summarized in Table 1. COPD/asthma, hypertension and neurological diseases were the most common comorbidities. Twelve (10%) patients were receiving LTOT at home. Table 2 summarizes the laboratory and radiological comparisons of both age groups with pneumonia. The number of patients living in nursing house was higher among "85 and older" group (n = 3, 8%) than "75–84 years" group (n=2, 3%) (p=0.22). The incidence of congestive heart failure/coronary

Table 1— Baseline Characteristics and Comorbidities of the Pneumonia Patients

Number of patients	116
Gender, male n (%)	63 (54.0)
Age, year*	83±5
Smoke history, n (%)	59 (51.0)
Smoking packyear*	35±20
Current smokers, n (%)	14 (12.0)
Living in nursing house n (%)	5 (4.0)
Comorbidities, n (%)	
COPD/Asthma	60 (52.0)
Hypertension	48 (41.0)
Neurological diseases	36 (31.0)
Cerebrovascular accident	16 (14.0)
Alzheimer disease	11 (10.0)
Parkinson's disease	4 (3.0)
DM	19 (16.0)
Congestive hearth failure/Coronary artery diseases	18 (16.0)
Long term oxygen theraphy, n (%)	12 (10.0)

*mean±SD, COPD: Chronic obstructive pulmonary diseases, DM: Diabetes mellitus

artery disease was significantly higher in "85 and older" group (p=0.002). Serum albumin levels significantly lower in "85 and older" group than "75–84 years" group (p=0.016). CURB-65 pneumonia severity score was significantly higher in "85 and older" group (p=0.027). Pneumonia severity of both age groups is shown in Table 3. The majority of patients had CURB-65 scores of 2 and 3, but there was no significant difference in pneumonia severity between two age groups.

Table 4 summarizes laboratory values of elderly and older patients with pneumonia. Hypoalbuminaemia (albumin<2.5 g/dl) and anaemia (haemoglobin <9 g/dl) were more common in "85 and older" patients but not significantly higher. Hypoxic respiratory failure and hypercapnic and hypoxaemic respiratory failure were more frequent in "75–84 years" group.

Radiological characteristics of both age groups were similar. Pneumonia was bilateral in 25% of "75–84 years" and 28% of "85 and older" group. Aspiration history was higher in "85 and older" (n=10, 25%) than "75–84 years" group (n=9, 12%) (p=0.07) but not significantly higher. Tracheal aspiration and fibreoptic bronchoscopy were performed in seven patients with dense secretions, inadequate cough and/or atelectasis on chest x-ray (Figure 2).

In both age groups, penicillins and cephalosporins were the most commonly used antibiotics; macrolides accompanied penicillins and cephalosporins in nearly 18%–20% of each age group. Antibiotic treatment was upgraded in 9 (12%) patients in "75–84 years" and 6 (15%) patients in "85 and older" group (p=0.63).

In-hospital and short-term mortality of patients is shown in Table 5. The overall in-hospital mortality was 8% (n=9) and short-term mortality (mortality within 30 days after discharge) was 11% (n=13). In-hospital and short-term mortalities were similar in both age groups (7% vs. 10% and 12% vs. 10%, respectively). The LOS was not significantly different between age groups. Transfer to intensive care unit were more frequent in "75–84 years" group (11% vs. 3%, p=0.13), but not statistically significant.

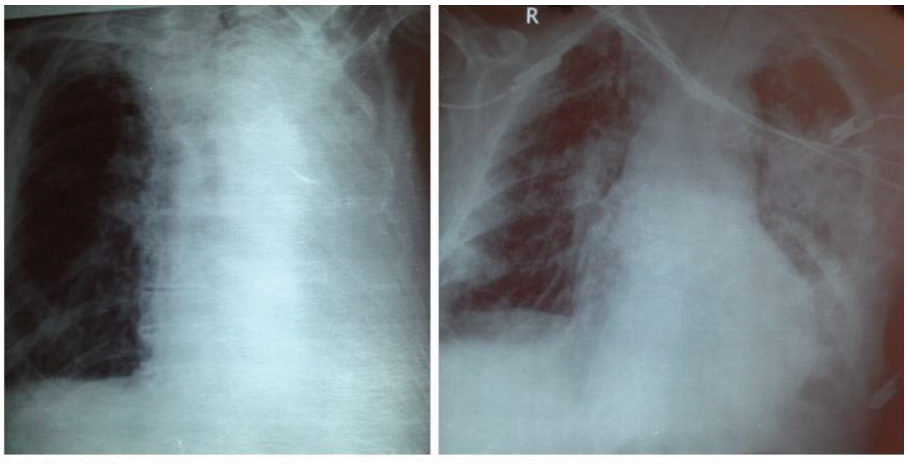

Figure 2— Chest x-ray of pneumonia patient with atelectasis

Table 2— Comparison of the Baseline Characteristics According to Age Groups of Patients with Pneumonia.

	"75–84 years" N=76	"85 and older" N=40	p
Gender, male n (%)	45 (59.0)	18 (45.0)	0.14
Smoking history, n (%)	43 (57.0)	16 (42.0)	0.52
Current smoker, n (%)	9 (23.0)	5 (31.0)	0.53
Long term oxygen theraphy, n (%)	9 (12.0)	3 (8.0)	0.46
Comorbidities n (%)			
COPD/Asthma	43 (57.0)	17 (43.0)	0.15
Hypertension	34 (45.0)	3 (8.0)	0.31
Congestive hearth failure/Coronary artery diseases	6 (8.0)	12 (30.0)	0.002
Diabetes mellitus	15 (20.0)	4 (10.0)	0.18
Neurological diseases	19 (25.0)	17 (43.0)	0.14
Alzheimer disease	6 (8.0)	10 (25.0)	0.012
Cerebrovascular accident	9 (12.0)	2 (5.0)	0.22
Parkinson's disease	2 (3.0)	2 (5.0)	0.52
Total blood count			
Leukocytecount, 109L*	11.7±5.9	12.4±6.9	0.61
Hemoglobin, g/dl*	12±3	12±2	0.33
Hematocrit, %*	37±7	37±6	0.89
Platalet count, 109L*	275±100	285±141	0.71
Biochemistry			
Glucose, mg/dl**	116 (95-157)	123 (84-172)	0.66
BUN mg/dl**	23 (16-33)	25 (20-41)	0.15
Serum creatinine, mg/dl**	0.89 (0.73-1.25)	0.97 (0.73-1.61)	0.36
Serum albumine, g/dl**	3 (2.7-3.4)	2.5 (2.2-3.3)	0.016
AST U/L**	18 (14-28)	23 (15-32)	0.13
ALT U/L**	14 (10-25)	15 (10-20)	0.93
Arterial blood gases analysis on admission			
pH**	7.44 (7.37-7.47)	7.42 (7.35-7.47)	0.64
$PaCO_2$, mmHg*	39±11	41±10	0.72
PaO_2, mmHg*	62±10	65±17	0.37
SaO_2,%**	92 (89-92)	92 (90-95)	0.35
Pneumonia severity			
CURB-65 score**	2 (1-2)	2 (2-3)	0.027
Inflammatory marker			
CRP, mg/dl*	58 (22-140)	84 (54-162)	0.11
Length of hospitalstay, day**	8 (6-10)	8 (6-11)	0.61
Radiological findings, n (%)			
Bilateralinfiltration	19 (25.0)	11 (28.0)	0.77
Atelectasis	2 (3.0)	3 (8.0)	0.22
Pleuraleffusion	16 (21.0)	11 (28.0)	0.43

*Mean ±sd: standart deviation,**IQR: Inter quartile range

BUN:Blood urea nitrogen, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase

CRP was avaible in 97 patients, arterial blood gass was avaible in 60 patients

Table 3— Pneumonia Severity of the Patients with Pneumonia According to Age Groups.

CURB 65 Score	"75–84 years" N=76 n (%)	"85 and older" N=40 n(%)	p
2	55 (72.0)	25 (63.0)	0.28
3	5 (7.0)	7 (18.0)	0.07
4	1 (1.0)	3 (8.0)	0.08
5	1 (1.0)	1 (3.0)	0.64

Table 4— Laboratory Values and Respiratory Failure Data of the Patients With Pneumonia.

	"75–84 years" N=76	"85 and older" N=40	p
Hypoalbuminemia, n(%) (Alb < 2.5g/dl)	29 (38.0)	19(47.0)	0.33
Anemia, n(%) (Hb < 9 g)	9 (12.0)	15 (13.0)	0.91
Hypoxemic respiratory failure*, n(%)	9 (12.0)	3 (8.0)	0.46
Hypercapnic and hypoxemic respiratory failure**, n(%)	27 (36.0)	13 (33.0)	0.74

*Hypoxic respiratory failure: Partial arterial oxygen pressure in inspired fractionated oxygen (PaO_2/FiO_2) was < 300 and partial arterial carbon dioxide pressure ($PaCO_2$) was < 45 mmHg.

**Hypercapnic and hypoxemic respiratory failure: $PaCO_2$ > 45 mmHg and PaO_2/FiO_2 < 300.

Table 5— Hospital and Short Term Mortality of the Pneumonia Patients.

	"75–84 years" N=76	"85 and older" N=40	p
Length of hospital stay (day)*	8 (6-10)	8 (6-11)	0.61
Transfer to ICU, n(%)	8 (11.0)	1 (3.0)	0.13
Hospital mortality, n(%)	5 (7.0)	4 (10.0)	0.51
Short term mortality, n(%)	9 (12.0)	4 (10.0)	0.76

*Mortality within 30 days after discharge.

Discussion

In this study, we showed that the course of pneumonia, LOS, and in-hospital and short-term mortality among "75–84 years" and "85 and older" patients are similar.

According to the United Nations definition, a country's population is 'aged' when the percentage of the elderly population in the country is between 8% and 10%, whereas 'very elderly' means that this percentage is greater than 10% (7). According to the population projections, elderly population ratio in Turkey will rise from 7.7% to 10.2% by 2023 (7). The number of hospitalised patients and the number of elderly patients admitted to chest disease clinics are expected to increase because of growing of the elderly population in number.

Age is reported to be an independent risk factor for pneumonia (8). The physiological changes in the body that occur with old age produce an easy environment for pneumonia. In a population-based study in England, individuals aged 85–89 years had seven times more CAP episodes than individuals aged 65–69 years (9). Besides that, there are studies supporting that age does not represent an increased risk for mortality (10,11). Respiratory muscle weakening and reduction in lung elasticity result in decreased functional residual capacity, which causes air trapping and reduction in mucociliary clearance and disrupts the ability of coughing to clear the bronchial system. This situation creates the most common risk environment for oropharyngeal aspiration causing pneumonia (2,3).

In this study, the overall mortality (8%) was less than the overall in-hospital mortality that has previously been reported (12,13). There is no significant difference in in-hospital and short-term mortality between "75–84 years" and "85 and older" patients, but the lower overall mortality can be attributed to strict daily clinical evaluation, adherence to guidelines and a good approach to comorbidities.

Here, antibiotic therapy was initiated empirically in concordance with national guidelines for CAP [4]. In both age groups, penicillins and cephalosporins were the most commonly used antibiotics, accompanied by macrolides in 18%–20% of patients. We did not compare the cost effectiveness of the antibiotic regimens, but both penicillins and cephalosporins are low-cost medicines. The adherence to guidelines in elderly CAP patients treated in the ward is also reported to be cost effective (14).

Here, aspiration history in "85 and older" patients was more common than in "75–84 years" patients, these patients had Alzheimer's disease, cerebrovascular attack and Parkinson's disease causing aspiration during feeding. Inadequate cough and dense secretion, even causing atelectasis, required fiberoptic bronchoscopy in seven patients. The Japanese Study Group for Aspiration Pulmonary Disease reported the incidence of aspiration pneumonia to be 80% among hospitalized

patients aged 70 years and older (15). Because of decreased mucociliary activity and silent aspirations during feeding, clinicians should always be alert for aspiration pneumonia and lung atelectasis. Dehydration and drug overdose are important risk factors for aspiration pneumonia in elderly patients (16,17,18). Aspiration is also a factor for readmission and recurrent pneumonia (19). To prevent aspiration, educating both health care workers and patients' family is essential. In addition, improving oral care might help to reduce oropharyngeal pathogens (3).

Elderly patients with pneumonia are more likely to be hospitalised as they have more comorbidities than younger patients (16,20). Congestive heart failure that is risk factor for pneumonia was significantly higher in "85 and older" patients. Pneumonia in these patients cause impairment in cardiac function, electrolyte imbalance, feeding problems, immobility and often references to hospital. Additional conditions imposed by ageing, such as hypoalbuminaemia and anaemia, may require supportive therapy. Here, anaemia and hypoalbuminaemia were higher in "85 and older" patients. We can attribute this to additional diseases and malnutrition linked to comorbidities in older patients, which create a risk factor for pneumonia. On the other hand, albumin plays a role as a negative acute phase reactant.

In this study, we evaluated the severity of pneumonia patients with CURB-65 scoring system, score 3 and over illustrates the course of a severe illness. Here, most of the patients had score of 2 and 3 indicating moderate and severe pneumonia, however CURB-65 doesn't cover comorbid diseases that has an important place in the course of the disease.

Here, like previously reported data, admission to the ICU was 11% in "75–84 years" patients and 3% in "85 and older" patients (12). This can be explained by existing comorbiditites, severity of pneumonia, advanced age and selection of patients for ICU (21).

There are studies emphasizing that age alone is not a factor for severity of pneumonia (22). Myint et al. (23) noted the difficulty of defining the severity of pneumonia in an elderly population and mentioned the need for new age-related weight markers for a scoring system for the severity of pneumonia in elderly patients.

In the present study, pleural effusion was present, and pneumonia was bilateral in one-quarter of the patients. El Solh et al. described slow radiographic resolution in patients with comorbidity, multilobar involvement and enteric Gram-negative bacilli pneumonias (24).

Due to additional disease, older patients are expected to have longer LOS, although in this study both age groups had similar LOS besides comorbidities. Hypoalbuminemia, anaemia and respiratory failure are not rare in both age groups and require appropriate time for replacement, which is as important as antibiotic therapy affecting LOS. The mean LOS was lower than reported in previous studies (25).

There are some limitations of the present study. Because this is a retrospective study, all the required data may not be available. Identification of specific bacteriologic aetiology data is missing in the study; only a few patients' data were available, the study was carried out in a single centre there can be limited generalization of the data. The small sample size also limits the ability to detect small but potentially significant associations. The strength of this study lies in the data related to patients with pneumonia aged 75 years and older; most studies use a lower age limit of 65 years.

In conclusion, the course of pneumonia, LOS, ICU need, in-hospital and short-term mortality in "75–84 years" and "85 and older" patients are alike. This vital disease in this population can be well managed if close clinical follow-up, good compliance to guidelines, early detection and a good approach to comorbidities. The older age profile of patients, who require a multidisciplinary approach and close follow-up, should be taken into consideration while planning and organising workforce conditions.

References

1. Fine MJ, Smith MA, Carson CA, et al. Prognosis and outcomes of patients with community-acquired pneumonia: a meta-analysis. Jama 1996;275 (2):134-1. (PMID:8531309)
2. Marik PE, Kaplan D. Aspiration pneumonia and dysphagia in the elderly. CHEST 2003;124 (1):328-36. (PMID:12853541)
3. Fung HB, Monteagudo-Chu MO. Community acquired pneumonia in the elderly. Am J Geriatr Pharmacother 2010;8:47-62. (PMID:20226392).
4. Ozlu T, Bulbul Y, Alataş F, et al. Turkish Thoracic Society concensus paper on the diagnosis and treatment of community acquired pneumonia. Turk Thor J 2009;10 (S9):3-16. Accessed:01.02.2015. (In Turkish).
5. Woodhead M, Blasi F, Ewig S, et al. Guidelines for the management of adult lower respiratory tract infections?Full version. Clin Microbiol Infect 2011;17 (s6):E1-59. (PMID:21951385).
6. Lim WS, Van der Eerden MM, Laing R, et al. Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. Thorax 2003;58 (5):377-82. (PMID:12728155).
7. Press Releases of Turkish Statistical Institude; Elderly Statistics, 2013. [Internet] Available from: http://www.tuik.gov.tr/PreHaberBultenleri.doid=16057 ID: 16057 Accessed: 01.02.2015. (in Turkish).
8. Loeb M, McGeer A, McArthur M, Walter S, Simor AE. Risk factors for pneumonia and other lower respiratory tract infec-

tions in elderly residents of long-term care facilities. Arch Intern Med 1999;159 (17):2058-64. (PMID:10510992).
9. Millett ER, Quint JK, Smeeth L, Daniel RM, Thomas SL. Incidence of community-acquired lower respiratory tract infections and pneumonia among older adults in the United Kingdom: a population-based study. PloS one 2013;8 (9):e75131. (PMID:24040394).
10. Lim WS, Macfarlane JT. Defining prognostic factors in the elderly with community acquired pneumonia: a case controlled study of patients aged ? 75 yrs. Eur Respir J 2001;17(2):200-5. (PMID:11334120).
11. Rello J, Rodriguez R, Jubert P, Alvarez B. Severe community-acquired pneumonia in the elderly: epidemiology and prognosis. Clin Infect Dis 1996;23(4):723-8. (PMID:8909834).
12. Ruiz LA, Zalacain R, Capelastegui A, et al. Bacteremic pneumococcal pneumonia in elderly and very elderly patients host-and pathogen-related factors, process of care, and outcome. J Gerontol A Biol Sci Med Sci 2014;69(8):1018-24. (PMID:24470128).
13. Kaplan V, Angus DC, Grıffın MF, Clermont G, Scott Watson R, Lınde-Zwırble WT. Hospitalized community-acquired pneumonia in the elderly: age-and sex-related patterns of care and outcome in the United States. Am J Respir Crit Care Med 2002;165(6):766-72. (PMID:11897642).
14. Egger ME, Myers JA, Arnold FW, Pass LA, Ramirez JA, Brock GN. Cost effectiveness of adherence to IDSA/ATS guidelines in elderly patients hospitalized for Community-Aquired Pneumonia. BMC medical informatics and decision making 2016;16(1):1. (PMID:26976388).
15. Teramoto S, Fukuchi Y, Sasaki H, etal. High incidence of aspiration pneumonia in community?and hospital?acquired pneumonia in hospitalized patients: a multicenter, prospective study in Japan. J Am Geriatr Soc 2008;56(3):577-9. (PMID:18315680).
16. Leroy O, Vandenbussche C, Coffinier C, et al. Community-acquired aspiration pneumonia in intensive care units: epidemiological and prognosis data. Am J Respir Crit Care Med 1997;156 (6):1922-9. (PMID:9412576).
17. Manabe T, Teramoto S, Tamiya N, Okochi J, Hizawa N. Risk Factors for Aspiration Pneumonia in Older Adults. PloS one 2015;10(10):e0140060. (PMID:26444916).
18. Ticinesi A, Nouvenne A, Folesani G, et al. An investigation of multimorbidity measures as risk factors for pneumonia in elderly frail patients admitted to hospital. Eur J Intern Med 2016;28:102-6. (PMID:26686926).
19. Taylor JK, Fleming GB, Singanayagam A, Hill AT, Chalmers JD. Risk factors for aspiration in community-acquired pneumonia: analysis of a hospitalized UK cohort. Am J Med 2013;126 (11):995-1001. (PMID:24054176).
20. Millett ER, De Stavola BL, Quint JK, Smeeth L, Thomas SL. Risk factors for hospital admission in the 28 days following a community-acquired pneumonia diagnosis in older adults, and their contribution to increasing hospitalisation rates over time: a cohort study. BMJ 2015;5(12):e008737. (PMID:26631055).
21. Boumendil A, Angus DC, Guitonneau AL, et al. Variability of intensive care admission decisions for the very elderly. PLoS One. 2012;7(4):e34387. (PMID:22509296).
22. Bont J, Hak E, Hoes AW, Macfarlane JT, Verheij TJ. Predicting death in elderly patients with community-acquired pneumonia: a prospective validation study reevaluating the CRB-65 severity assessment tool. Arch Intern Med 2008;168 (13):1465-8. (PMID:18625928).
23. Myint PK,Kamath AV, Vowler SL, Maisey DN, Harrison BD. Severity assessment criteria recommended by the British Thoracic Society (BTS) for community-acquired pneumonia (CAP) and older patients. Should SOAR (systolic blood pressure, oxygenation, age and respiratory rate) criteria be used in older people? A compilation study of two prospective cohorts. Age Ageing 2006;35(3):286-91. (PMID:16638769).
24. El Solh AA, Aquilina AT, Gunen H, Ramadan F. Radiographic Resolution of CommunityAcquired Bacterial Pneumonia in the Elderly. J Am Geriatr Soc 2004;52(2):224-9. (PMID:14728631).
25. Riquelme R, Torres A, El-Ebiary M, et al. Community-acquired pneumonia in the elderly: clinical and nutritional aspects. AmJ Respir Crit Care Med 1997;156(6):1908-14. (PMID:14728631).