Mortality Prognostic Factors in Elderly Inpatients with Community Acquired Pneumonia at Dr. Cipto Mangunkusumo National Central General Hospital Jakarta: a Survival Analysis

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ABSTRACT

Background: Community acquired pneumonia (CAP) in the elderly is still a major problem due to its high morbidity and mortality. There is considerable variability in the result of various studies on prognostic factors. The prognostic factors in Indonesia have not been identified.

Methods: We performed a prospective cohort study on 147 elderly patients hospitalized with CAP in the internal medicine ward of Cipto Mangunkusumo National Central General Hospital, Jakarta from September 2002 to March 2003. We calculated the survival rate during hospitalization. We used Cox proportional-hazard regression analysis to examine factors associated with mortality in the first 48 hours of hospitalization.

Results: There were 34 deaths (23.1) associated with CAP in 1471 person-days. The survival rate at day 5, 10 and 15 were 88.9%, 77.2 and 67.2% respectively. Severe pneumonia, an serum albumin of d"3.5 g/dL, reduced consciousness, temperature > 37.0°C, and a hemoglobin level of d" 9.0 g/dL demonstrated a tendency towards increased mortality rate. Other factors such as age, sex, immobilization, swollen disorders, co-morbidities, leukocyte count, and serum creatinine level demonstrated no significant relationship with mortality.

Conclusion: Severe pneumonia, low serum albumin, decreased consciousness, high temperature and low hemoglobin level in the first 48 hours hospitalization were found to be worse prognostic factors. Early identification and modification of these factors are recommended.

INTRODUCTION

Community-acquired pneumonia is still a chief cause of morbidity and mortality both in developed as well as developing nations, such as Indonesia.[1,2,3] In Indonesia, pneumonia-associated mortality and morbidity is expected to soar among the elderly, due to an increase in elderly population, smoking, and co-morbidity. Lower respiratory tract infection is the third cause of mortality and morbidity according to a 1995 survey.[3] Data from the geriatric ward of the Department of Internal Medicine of Cipto Mangunkusumo General Hospital demonstrates pneumonia as the most commonly diagnosed illness, with a continuously increasing incidence and mortality rates.[4]

Community-acquired pneumonia in the elderly has a different characteristic compared to that in other adult populations.[5] Community-acquired pneumonia has a higher morbidity and mortality rate among this population. According to our literature review, retrospective and prospective case-control studies on the prognosis of pneumonia both on the general population as well as among the elderly have demonstrated different results.[6,7,8,9,10,11,12,13,14,15,16] In Indonesia, prospective studies on the prognosis of elderly patients

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with community-acquired pneumonia (death) has never been performed.

We conducted this study to determine a correlation between prognostic factors and death and life expectancy as well as determining the survival rate of elderly patients who are hospitalized with community-acquired pneumonia.

METHOD

The Patients

This study was designed as a prospective cohort study. The study was conducted at the internal medicine ward of Cipto Mangunkusumo General Hospital, Jakarta, from September 2002 to March 2003, involving 147 patients. Patients who were included in the study were 60 years or older, with pneumonia as the chief diagnosis established within the first 24 hours of admission. Patients were excluded from the study if they were admitted for other causes 2 weeks prior to recent admission, if the patient left the hospital without being released, is known to suffer from malignancy before or after care, is undergoing treatment for lung tuberculosis, or clearly has lung tuberculosis or during care was found to have lung tuberculosis. Patients who were not treated by an internal medicine specialist and those who had been living in long-term nursing facilities such as nursing homes prior to admission were also excluded from the study.

The diagnosis of pneumonia was established in the presence of a recent infiltrate or progressive infiltrate changes on chest x-ray with at least 1 major symptom or 2 minor symptoms. Major symptoms include cough, with sputum or fever (temperature of 37.8 degrees Celsius or more). Minor symptoms include difficulty breathing, chest pain, or lung consolidation on physical examination (rales found during auscultation and muted percussion) as well as leukocytosis (>12,000/mL).

Prognostic Factors

This research studied the correlation between sex, age, temperature, reduced consciousness, severe pneumonia, immobilization, trouble swallowing, co-morbidity, albumin level, leukocyte count, and creatinine level with mortality due to community-acquired pneumonia.

Temperature is established using a thermometer placed on the axilla, mentioned in degrees Celsius. Degree of consciousness is measured using the Glasgow coma scale. Consciousness is considered to be reduced if the score is less than 15. Trouble swallowing is noted if the patient is unable to swallow solid as well as liquid food up to 7 days prior to the diagnosis of pneumonia is established, characterized by history of choking, difficulty breathing, and/or the insertion of a nasogastric tube. Immobilization is established if the patient is in total bed rest (completely unable to sit unsupported) for at least 3 days prior to or during hospital admission. Co-morbidity is established if there is one or more of the following conditions: heart failure, chronic renal failure, cirrhosis, stroke, chronic obstructive lung disease, asthma, dementia, or diabetes mellitus. Severe pneumonia is established if there is one or more of the following conditions: respiratory rate of over 30 times/minute, PaO2/FiO2 ratio of less than 250, systolic blood pressure of less than 90 mmHg, diastolic blood pressure of less than 60 mmHg, and the involvement of 3 or more lobes in chest x-ray.

Data Collection

The author visited the patients and collected data as soon as possible within 48 hours of admission and recorded the data on a special form. All data on prognostic factors were obtained by direct anamnesis of the patient and/or family, by checking previous medical records, by performing physical examination, by observing treatment as well as by performing laboratory tests and other auxiliary procedures. Patients were observed from the time of admission up to their release or death. Death was established to have been caused by pneumonia or a direct comparison of pneumonia if prior to death there was hypoxemia, respiratory failure, adult respiratory distress syndrome, and/or shock or pneumonia-associated septic shock.

Statistical Analysis

Data sorting and analysis was performed using Stata version 7.0. Bivariant analysis was performed using the log rank method. All variables resulting from the bivariant analysis that has a p value of less than 0.25 and fulfills the diagnostic confounder and interaction test (proportional hazard assumption test) was included in the multi-variant analysis model. Life table and graphic analysis were presented using the Kaplan-Meier method. Multi-variant analysis was performed using Cox proportional hazard regression. A p value of less than 0.05 was considered to be statistically significant.

STUDY RESULTS

Sample Characteristics

During the length of the study, 168 patients with community-acquired pneumonia were detected. Twenty patients did not fulfill the inclusive criteria (8 patients terminated treatment without permission, 4 suffered from malignancy, 2 were diagnosed with lung tuberculosis, 3 were diagnosed with another infectious disease, and 4 died for reasons other than pneumonia. In the end, 147 patients were included in the study. The study subjects consisted of 68 males (46.26%) and 79 females (53.74%), with a median age of 71 years and an interquartile range of 65 to 75 years, and a median hospital stay of 9 days, with an interquartile range of 6 to 13 days. In this study, there were in total 34 deaths (23.1%), and a survival of 1471 man-days. Severe pneumonia was found in 86 patients (58.50%), with a mortality rate of up to 33.7% (29/86).

Patient characteristics, which included demographical characteristics and clinical and laboratory findings are presented in Tables 1 and 2. The number of patients for the variables of albumin, globulin, and PaO2/FiO2 ratio were 139, 137, and 122 patients respectively. Among all patients, 122 (83%) had one or more co-morbidity, with consecutive counts as follows: diabetes mellitus in 46 (31.3%), chronic obstructive pulmonary disease in 45 (30.6%), heart failure in 40 (27.2%), stroke in 33 (22.5%), bronchial asthma in 17 (11.6%), dementia in 12 (8.2%), renal failure in 11 (7.5%), and liver cirrhosis in 8 (5.5%).

Table 1. Demographical Characteristics of The Patients.

Variable	Frequency (%)	median	minimal	maximum
Ward type				
Private	33 (22.45)			
Non private	114 (77.55)			
Duration of care (days)		9	1	35
Age (years)		71	60	92
Sex				
Male	68 (46.26)			
Female	79 (53.74)			

Bivariant Analysis

The results of bivariant analysis using the log rank method can be found in Table 3. The dependent variables are classified according to value as seen in Table 3 according to previous studies.[8,9,10,11,12,13,14]

The mortality rate in this study was 0.023, or 2.3 per 100 man-days. The survival rate/prognostic curve is demonstrated in Figure 1. We could see that the curve steeply falls from the first to the 17th day, and then levels down up to the 35th day. Then survival rate on the 5th, 10th, and 15th day is 88.95%, 77.24%, and 67.23%. On the 17th day, the survival rate drops up to 63.5% and remains until the 35th day.

Table 2. The Patients' Clinical Characteristics.

Variable	Frequency (%)	All patients	Alive	Dead
Vital signs				
Systolic (mmHg)		141± 27.6	145 ± 26.6	129 ± 27.7
Diastolic (mmHg)		81 ± 15.2	83 ±14	77 ± 18.2
Respiratory rate (x/min)		28 ± 6.6	27 ± 6.5	30 ± 6.7
Pulse rate (x/min)		99 ± 16.5	98 ± 5.2	102 ± 20.2
Body temperature (°C)		37.5 ± 1.03	37.3 ±1.01	37.9 ±0.99
Hb (g/dL)		12.09 ± 2.6	12.27 ± 2.3	11.47 ± 3.4
Leukocyte count (/mL)		12688 ± 6389	12370 ± 6037	13747 ± 7443
Platelet count (x10³/mL)		251.6 ± 137.1	258.2 ± 136.7	229.9 ± 136.70
Cito blood sugar (g/dL)		160 ± 95.2	160.8 ± 95.1	160.5 ± 96.8
Albumin (g/dL)		3.51 ± 0.57	3.65 ± 0.52	3.00 ± 0.42
Globulin (g/dL)		2.92 ± 0.67	2.96 ± 0.67	2.79 ± 0.68
PaO_2/FiO_2 ratio		302 ± 106.9	310 ± 100.7	277 ± 120.8
Ureum (mg/dL)		42.9 ± 26.4	40.6 ± 25.2	50.4 ± 29.1
Creatinine (mg/dL)		1.62 ± 2.57	1.62 ± 2.86	1.62 ± 1.25
Reduced consciousness	54 (36.7)		31(21.0)	23(15.7)
Difficulty swallowing	53 (36.0)		27(18.3)	26(17.7)
Immobilization	38 (25.9)		19(12.9)	19(12.9)
With co-morbidity	122 (83.0)		89(60.5)	33(22.5)
Size of infiltrate				
1-2 lobe	110 (74.8)		87(59.2)	23(15.6)
? 3 lobe	37 (25.2)		26(17.7)	11(7.5)
Severe pneumonia	86 (58.5)		57(38.8)	29(19.7)

Numbers with ± demonstrate mean ± SD; numbers with ( ) demonstrate frequency (%) Compared with all patients.

Figure 2 demonstrates that the survival probability for the group with an albumin level of over 3.5 g/dL on the 5th, 10th, and 15th day is 98%, 98%, and 85% respectively, and remains stable up to the 29th day, while in the group with an albumin level of 3.5 g/dL or less, the probability has dropped to 85%, 64%, and 55% for the same 3 evaluation points respectively. On the 17th day, the survival probability for this group has dropped to 49% and remains up to the 35th day.

In Figure 3 we could see that the difference in survival probability for patients with severe pneumonia is evident from the first day of admission. In the group with severe pneumonia, the survival probability on the 5th day have dropped to 82%, while in the group without severe pneumonia the survival probability was still 98%. In the group with severe pneumonia the probability continues to drop to 70%, 54%, and 49% on the 10th, 15th, and 20th day. In the group without severe pneumonia, the probability only drops to 88% on the 10th day and is maintained up to the 25th day.

Table 3. The Results of Log Rank Analysis on 147 Elderly Patients With Community-based Pneumonia.

Variable	Incidence rate	n	Dead	Hazard ratio	p	95% CI
Age						
? 80	0.021	137	29			
> 80	0.060	10	5	2.630	0.046	1.016 - 6.806
Ward type						
Private	0.025	33	7			
Non private	0.023	144	27	0.886	0.776	0.384 - 2.043
Sex						
Female	0.020	78	16			
Male	0.026	69	18	1.300	0.445	0.662 - 2.552
Vital signs						
Systolic (mmHg)						
>90	0.020	141	29			
?90	0.139	6	5	6.398	0.000	2.450 - 6.713
Diastolic (mmHg)						
>60	0.018	129	25			
?60	0.059	18	9	3.237	0.003	1.504 - 6.969
Respiratory rate (x/min)						
?30	0.018	104	19			
>30	0.037	43	15	2.100	0.032	1.066 - 4.140
Pulse rate (x/min)						
60-120	0.022	136	30			
<60 or >120	0.052	11	4	2.430	0.101	0.841 - 7.021
Body temperature (°C)						
? 37.0	0.013	72	10			
> 37.0	0.036	75	24	2.809	0.006	1.340 - 5.888
Difficulty swallowing						
No	0.009	94	8			
Yes	0.047	53	26	5.825	0.000	2.625 - 2.922
Immobilization						
No	0.014	109	15			
Yes	0.041	38	19	3.013	0.002	1.512 - 6.006
Co-morbidity						
Absent	0.004	25	1			
Present	0.027	122	33	6.325	0.085	0.864-46.299
Reduced consciousness						
Fully conscious	0.012	93	11			
Reduced	0.041	54	23	3.749	0.000	1.817 - 7.734
Size of infiltrate						
1-2 lobe	0.021	110	23			
? 3 lobe	0.028	37	11	1.330	0.438	0.648-2.730
Severe pneumonia						
No	0.008	61	5			
Yes	0.034	86	29	4.516	0.002	1.747 - 1.669
Hemoglobin (g/dL)						
> 9.0	0.020	134	27			
? 9.0	0.054	13	7	2.583	0.025	1.124 - 5.937
Variable	Incidence rate	n	Dead	Hazard ratio	p	95% CI
Leukocyte count (/mL)						
>4000 <20000	0.019	126	25			
?4000 ?20000	0.060	21	9	3.053	0.005	1.406 - 6.631
Cito blood sugar (g/dL)						
<200	0.022	117	27			
?200	0.027	30	7	1.180	0.698	0.513 - 2.715
Albumin (g/dL)						
> 3.5	0.004	64	3			
? 3.5	0.037	75	27	8.696	0.000	2.636-28.684
PaO_2/FiO_2 ratio						
?250	0.015	76	13			
<250	0.044	46	19	2.940	0.003	1.450 - 5.966
Ureum (mg/dL)						
<40	0.016	95	15			
?40	0.035	52	19	2.217	0.021	1.126 - 4.366
Creatinine (mg/dL)						
<1.4	0.019	108	21			
?1.4	0.035	39	13	1.831	0.087	0.916 - 3.660

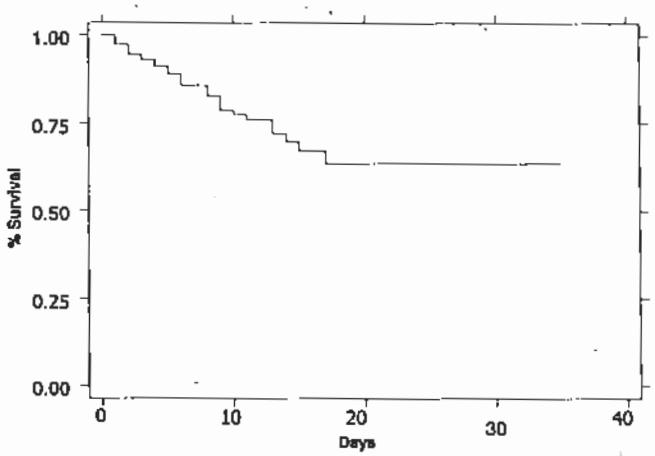

Figure 1. The Kaplan-Mejer Prognostic Curve for Elderly Patients

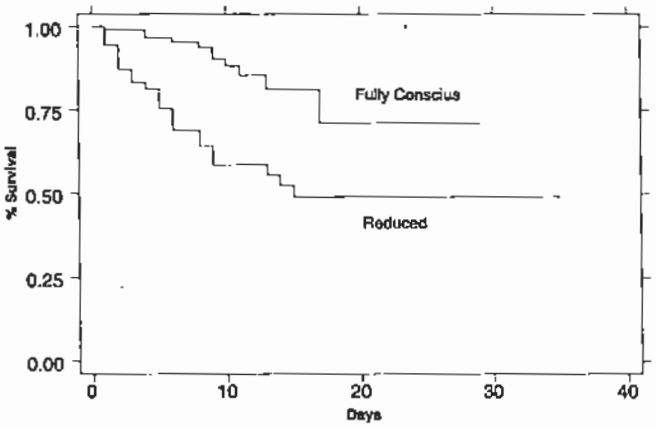

Figure 4. The Kaplan-Meier Prognostic Curve Based on The Category of Consciousness Among Elderly Patients with

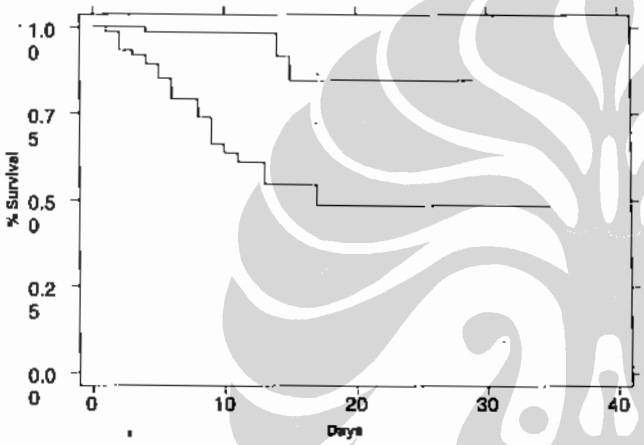

Figure 2. The Kaplan-Meier Prognostic Curve Based on Albumin

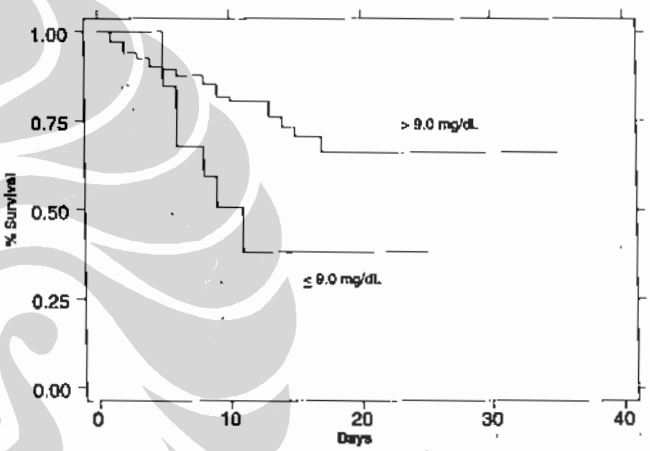

Figure 5. The Kaplan-Meier Prognostic Curve Based on Hemoglobin

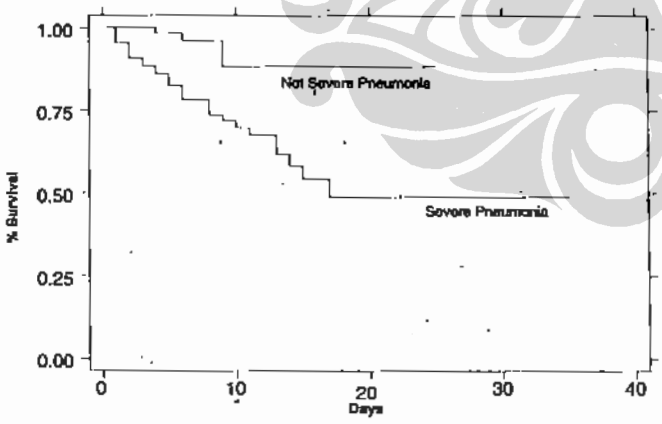

Figure 3. The Kaplan-Meier Prognostic Curve Based on The Category of Severe Pneumonia Among Elderly Patients with

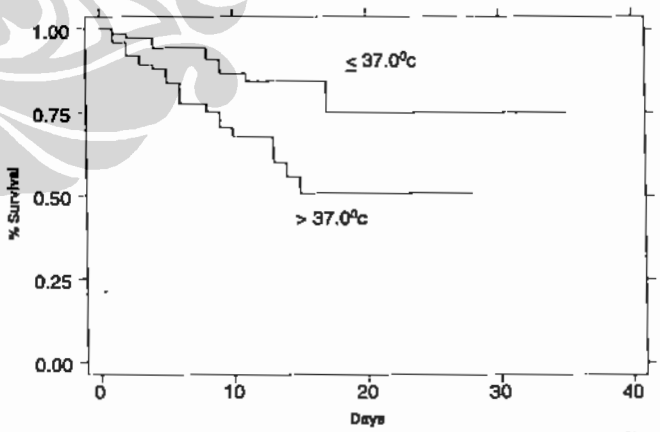

Figure 6. The Kaplan-Meier Prognostic Curve Based on The Category of Body Temperature Among Elderly Patients with

Patients with reduced consciousness have a survival probability up to the 5th, 10th, and 15th day of 75%, 59%, and 50% respectively, and is then maintained up to the 35th day. Compared to patients with patients with reduced consciousness, patients who were fully conscious had a higher survival probability. On the 5th, 10th, 15th, and 20th days, the survival probability for this group is 97%, 88%, 81%, and 71% respectively, to then be maintained until the 29th day (Figure 4).

In Figure 5, we can see that patients with hemoglobin levels of over 9.0 g/dL has a better survival probability compared to the group with hemoglobin levels of 9.0

g/dL or less. The survival probability for the group with hemoglobin levels of 9.0 g/dL and 9.0 g/dL or less on the 5th, 10th, 15th, and 20th day is 89% vs. 85%, 80% vs. 51%, 76% vs. 38%, and 66% vs. 385.

In this study, we also found that patients with an axillary temperature of over 37.0 degrees Celsius had a lower survival probability compared to patients with a temperature of 37 degrees Celsius or less. We can see in Figure 6 that in patients with a body temperature of over 37 degrees Celsius, the survival probability on the 5th day is already reduced from 84% to 67% and 51% on the 10th and 15th days. The group with a temperature of 37.0 degrees Celsius or less has a better prognosis. On the 5th day, their survival probability is still 94%, and then deops to 87% on the 10th day, and 84% on the 15th day.

Table 4. The Results of Cox Proportional-hazard Analysis Mortality Associated Prognostic Factors.

Variable	Hazard Ratio	p	95% Confidence Interval
Severe pneumonia	3.497258	0.012	1.321269 - 9.256867
Albumin ? 3.5 g/dL	7.484235	0.001	2.227025 - 25.15184
Reduced consciousness	2.832123	0.007	1.327026 - 6.044281
Body temperature > 37.0 °C	2.498419	0.026	1.113268 - 5.607004
Hemoglobin level ? 9.0 g/dL	3.967549	0.003	1.595685 - 9.865007

Multivariant Analysis

From all of the dependent variables, multivariant analysis demonstrates that severe pneumonia, serum albumin level of less than 3.5 g/dL, reduced consciousness, body temperature of over 37 degrees Celsius, hemoglobin level of 9.0 g/dL or less are significantly associated with increased mortality in community-acquired pneumonia in the elderly (Table 4). The variables that were included in the multivariant analysis were severe pneumonia, serum albumin level, reduced consciousness, trouble swallowing, temperature, hemoglobin level, and immobilization.

DISCUSSION

The pneumonia-associated mortality rate in this study is 23.1%. This rate is still higher compared to the mortality rate in the study by Zweig et al (15.8%) in rural USA,[10] and other studies by Kaplan et al (10.6%)[17] and Fine et al[9] among the elderly (17.6%). This difference may have been due to a difference in the quality of health in the population and the quality of available healthcare facilities.

The median age of the patients in this study was 71 years, which is younger compared to those in the study by Zweig (mean 80 years),[10] Venkatesan (median age 79 years),[13] and Kaplan (mean 77 years).[17] This difference may have been attributed to the difference in the criteria of what is considered elderly (Venkatesan and Kaplan used a criteria of 65 years or more), the larger proportion of elderly patients in studies abroad, and the difference in the health status of each population.

The median duration of care is 9 days. This is longer compared to the duration of care for similar patients in Kaplan's study (mean 7.6 days). This difference may be due to a difference in sample number and characteristics and differences in the level of healthcare.

The survival rate for inpatients with community-acquired pneumonia in this study was 88.95% on the 5th day, 77.24% on the 10th day, and 67.23% on the 15th day. The survival rate on the 17th day was 63.5% and is stable up to the 35th day. The incidence rate of mortality is 0.023 or 2.3 for 100 man-days. From the cumulative prognostic curve (Figure 6), we could see that the survival rate of patients with community-acquired pneumonia drops in a linear pattern in line with prolonged care, reaching 63.5% on the 17th day and stabilizing up to the 35th day. This shows that pneumonia-attributed mortality occurs during the initial weeks of admission, up to the 17th day. This supports and affirms the findings from the study by Venkatesan et al.[8] Venkatesan found that mortality due to community-acquired pneumonia occurs within 2 weeks.

Age and sex were not found to significant prognostic factors for mortality in this study, unlike the results obtained by Kaplan, Conte, and Fine. Such results support the study on the elderly by Riquelme and Zweig. Riquelme et al[12] found that age of over 75 years is not a determinant for poor prognosis. Zweig[10] also found that age and sex are not associated with mortality in the elderly population. Sample size and characteristics as well as study method may have caused this difference. The number of elderly patients of over 80 years of age was only 10 people in this study. The fact that old age did not turn out to be a significant prognostic factor for death in this study affirms the hypothesis that age is not a specific constraint to perform aggressive treatment (such as ICU admission).[12]

We did not find the presence of co-morbidity to be a factor associated with increased mortality. This study could not be compared with another study by Conte[8] who found malignancy as co-morbidity. The insignificance of the results may have been caused by a difference in

the severity of each co-morbidity and differences in the criteria of co-morbidity with other studies. Statistical means to determine the severity of co-morbidity is not easily performed. The clinical and substantiality of co-morbidity in community-acquired pneumonia is very important, and deserves attention. Establishing the severity of co-morbidity is more of a problem in clinical assessment.

Reduced consciousness was found to be a mortality prognostic factor in this study. This result supports and is in keeping with the results of various other studies both among the elderly, by Starcweski,[14] Zweig,[10] and Conte,[8] as well as studies of the adult population by Fine,[5] BTS,[16] and Luna.[15] Reduced consciousness as a mortality prognostic factor due to pneumonia in the elderly supports the statement in the BTS Guidelines for the Management of Community Acquired Pneumonia in Adults. The results differ from the study by Venkatesan.[8] This difference may have been due to the difference in study and sampling methods. The presence of reduced consciousness is associated with immobilization and difficulty swallowing. Immobilization and trouble swallowing were not found to be statistically significant mortality prognostic factors. Nevertheless, these two variables are mortality prognostic factors that are clinically and substantially important to receive attention. In the second multi-variant analysis, these two variables were found to demonstrate a significant correlation if independently analyzed from the variable of reduced consciousness. The presence of a colinearity with the variable of reduced consciousness could render the variables immobilization and trouble swallowing insignificant.

A leukocyte count of d" 4,000 or e" 20,000/mL turned out to be unassociated with increased mortality. These findings differed from the BTS study,[16] and the study by Zweig.[10] The BTS researchers found the variables leukocyte count <4,000/mL and >20,000/mL to be independently correlated with a higher mortality rate, with a p of <0.001 and <0.01 respectively. Zweig[10] found that patients with a leukocytosis of > 20,000/mL to have a higher mortality rate. Leukopenia or leukocytosis is associated with failure of the body's defense mechanism or conditions of severe infection. The fact that the results of this study are not in keeping with the findings of other studies may be due to differences in sampling.

The presence of severe pneumonia was able to increase the possibility of death up to 3.5 times compared to that without severe pneumonia. Such results supports the results obtained and recommended by ATS, which state that severe pneumonia has a poor prognosis and requires ICU treatment.

We found that a body temperature of over 37.0 degrees Celsius as a mortality prognostic factor. Such findings differ from previous studies by Venkatesan et al,[8] Zweig et al,[10] and Riquelme et al[8], as well as the meta-analysis by Fine et al[9] who found a body temperature of less than 37.0 degrees Celsius to be a strong determinant factor of poor prognosis. This may be due to differences in sampling and data collection. Our study was performed on elderly patients who were admitted to the regular inpatient ward. Their temperature was obtained from the axilla, using a mercury thermometer.

A serum albumin level of 3.5 g/dl or less has the strongest correlation with inflammation in patients with community acquired pneumonia. A more severe inflammatory process causes great reduction in serum albumin. In patients with severe infection, there is a serum albumin reduction of 1.5 to 2.0 g/dL during the first 24 hours. This is due to widespread endothelial damage and protein leakage. Such low albumin level increases the mortality rate to 7.5 times compared to albumin levels of over 3.5 g/dL. This finding is in line with the study by Ortquirst[9] and the BTS study. It is also in keeping with another study by Hedlund,[18] who found that a serum albumin of less than 3.0 g/dL during admission to be attributed to a higher risk of recurrent pneumonia and death during admission. Reduced serum albumin levels may be caused by capillary processes.[19]

A hemoglobin level of 9.0 g/dL or less was found to be a significant mortality prognosis factor. This study is in line with the results of a meta-analysis by Fine et al.[9] This is in line with the ATS guidelines[1] and the Patient Outcomes Research Team (PORT) study on the determinant factors for death or complications in community acquired pneumonia, who found that a hematocryte level of 0.30 or less or a hemoglobin level of less than 9.0 g/dL to be prognostic criteria. The severity of anemia could demonstrate the severity of infection.[21] Anemia also reflects a reduced red blood cell capacity to carry oxygen to the tissues.[22] Such reduced oxygen capacity could cause anemic hypoxia.

The limitations in this study is that the elderly patient samples were inpatients in the regular ward who were referred from the emergency department, while patients with severe illness were most likely not referred to the regular inpatient ward, but either referred to high care or intermediate care wards, or died in the emergency room instead. This means that patients with severe

illness were indirectly excluded from the study. Another limitation is that we did not determine the etiology of pneumonia.

It can be concluded that the mortality rate of community acquired pneumonia in the elderly during hospitalization is increased if at the initial care there is severe pneumonia, a serum albumin level of d"3.5 g/dL, reduced consciousness, a body temperature of > 37.0°C, and a hemoglobin level of d" 9.0 g/dL. Other variables are age of over 80 years, male sex, immobilization, trouble swallowing, leukocyte count of d" 4,000 or e"20,000/ mL and a creatinine level of e" 1.4 mg/dL were not found to be significant mortality prognostic factors. Efforts to reduce morbidity and mortality could include early identification and modification of patients with high prognostic factors. Evaluation and clinical identification of prognostic factors should be performed even though the prognostic factors are not found. In order for the results of this study to be more widely used, similar studies that include the intensive care unit and the emergency unit of several hospitals should be performed. Such study should also try to discover the etiology of pneumonia.

REFERENCES

1. Niederman MS, Mandell LA, Anzueto A, Bass JB, Broughton WA, Campbell GD. Guidelines for the management of adult with community-acquired pneumonia. Am J Respir Crit Care Med 2001;163:1730-54.
2. Fein AM. Pneumonia in the elderly: overview of diagnostic and therapeutic approaches. Clin Infect Dis 1999;28:726-9.
3. Survei Kesehatan Rumah Tangga (SKRT) DepKes RI,1995.
4. Data Subbagian Geriatri Bagian Penyakit Dalam FKUI-RSUPN CM. Jakarta, 2000.
5. Fein AM. Pneumonia in the elderly special diagnostic and therapeutic considerations. Med Clin North Am 1994;78:1015-33.
6. Farr BM, Sloman AJ, Fisch MJ. Predicting death in patients hospitalized for community-acquired pneumonia. Annals of Internal Medicine 1991;115:428-36.
7. Houston MS, Silverstein MD, Suman VJ. Risk factors for 30-day mortality in elderly patients with lower respiratory tract infection. Arch Intern Med 1997;157:2190-5.
8. Conte HA, Chen YT, Mehal W, Scinto J, Quagliarello VJ. A prognostic rule for elderly patients admitted with community-acquired pneumonia. Am J Med 1999;106:20-8.
9. Fine MJ, Smith MA, Carson CA, Mutha SS, Sankey SS, Weissfeld LA, et al. Prognosis and outcomes of patients with community-acquired pneumonia: a meta-analysis. JAMA 1996;275:134-41.
10. Zweig S, Lawhorne L, Post R. Factors predicting mortality in rural elderly hospitalized for pneumonia. J Fam Pract 1990;30:153-9.
11. Ortqvist A, Hedlund J, Grillner L, Jolonen E, Kallings I, Leinonen M, et al. Aetiology, outcome and prognostic factors in community-acquired pneumonia requiring hospitalization. Eur Resp J 1990;3:1105-13.
12. Riquelme R, Torres A, El-Ebiary M, De La Bellacasa JP, Estruch R, Mensa J, et al. Community-acquired pneumonia in the elderly: a multivariate analysis of risk and prognostic factors. Am J Respir Crit Care Med 1996;154:1450-5.
13. Venkatesan P, Gladman J, Macfarlane JT, et al. A hospital study of community acquired pneumonia in the elderly. Thorax 1990;45:254-8.
14. Starczewski AR, Allen SC, Vargas E, Lye M. Clinical prognostic indices of fatality in elderly patients admitted to hospital with acute pneumonia. Age and Aging 1988;17:181-6.
15. Luna CM, Famiglietti A, Absi R, Videla AJ, Nogueira FJ, Fuenzalida AD, et al. Community-acquired pneumonia etiology, epidemiology, and outcome at a teaching hospital in argentina. Chest 2000;118:1344-54.
16. British Thoracic Society and the Public Health Laboratory Service. Community-acquired pneumonia in adult in UK hospital in1982-1983: a survey of etiology, mortality, prognosis factors and outcome. Q J Med 1987;62:195-220.
17. Kaplan V, Angus DC, Griffin MF, Clermont G, Watson RS Linde-Zwirble WT. Hospitalized community-acquired pneumonia in the elderly. Age- and sex- related patterns of care and outcome in the United State. Am J Respir Crit Care Med 2002;165:766-72.
18. Hedlund JU, Ortqvist AB, Kalin ME, Granath F. Factors of importance for the long-term prognosis after hospital treated pneumonia. Thorax 1993;48:785-9.
19. Lynn WA. Sepsis. In: Amstrong D, Cohen J. editors. Infectious diseases. London: Mosby;1999.p.1-14.
20. Fine MJ, Auble TE, Yealy DM, Hanusa BH, Weissfeld LA, Singer DE, et al. A prediction rule to identify low-risk patients with community-acquired pneumonia. N Engl J Med 1997;336:243-50.
21. Adamson JW. Iron deficiency and other hypoproliferative anemias. In: Braunwald E, Fauci AS, Kasper DL, Hauser SL, Longo DL, Jameson JL, editors. Harrison's principles of internal medicine. 15th ed. New York: McGraw-Hill, Medical Publishing Division; 2001.p.660-6.
22. Dinh-Xuan AT, Dhainaut JF. Transport of oxygen and carbon dioxide in the blood. In Dhainaut JF, Thijs LG, Park G, editors. Septic shock. London: WB Saunders Company Limited; 2000.p.417-21.