

Effects of community-acquired infections on fever, leukocyte count and the length of stay in elderly

A cross-sectional study of 240 cases

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ABSTRACT

Objective: To evaluate the relationships between community acquired infections in elderly cases (≥ 65 ages) not living in a nursing home and factors such as, fever and white blood cell (WBC) counts; age, gender and the presence of underlying chronic diseases as compared to the length of stay.

Methods: We conducted this study in Dokuz Eylul University Hospital in Turkey as a defining cross-sectional research covering a 5-year period between January 1999 and December 2003. The data of 240 elderly cases were investigated, forms, which includes gender, existence of chronic diseases, fever, WBC counts, diagnosis, applied treatment and prognosis were prepared, and results were presented.

Results: The most frequently encountered infections were urinary system infections (35.4%), acute gastroenteritis (17.9%), pneumonia (15.9%) and soft tissue infections (13.3%). We observed that WBC counts were significantly

elevated, parallel with high fever ($p=0.021$). In elderly cases we determined the existence of underlying disease and that living in the community lengthens the hospital staying periods ($p=0.001$). It was determined that elderly patients with an elevated WBC are 2.02 times more likely to have a temperature of 38.3°C or higher compared with patients with a normal temperature ($p<0.05$).

Conclusion: There was a strong association between leucocytosis and high fever in elderly cases. However, the absence of fever and leucocytosis in 78 (32.5%) of our cases, makes it hard for us to decide whether there was an infection or not. The most frequently encountered infections in elderly cases living in the community were similar to those living in nursing homes. These cases must be followed in the geriatric wards of hospital or geriatric hospitals whenever possible.

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The population at 65 years of age and over, defined as "old age or elderly," is increasing all over the world. While it was only 1% of world population in 1900s, it is estimated that this age group will increase

to 20% in 2050.¹ According to the Turkey census results in 1990, while 4.3% of the population was over 65 and 0.8% over 80 years, these proportions were 5.7% for over 65 years and 0.7% for over 80

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years in 2000.² In Turkey, old people usually live with their relatives in the same house. Although there are nursing homes, which elderly cases are cared, their number is inadequate. In hospitals, there are no geriatrics departments where acute diseases of elderly cases are followed. Therefore, the most concerned departments in the hospitals follow them. Since elderly patients have several chronic diseases dealing with various specialties at the same time, it is a reality that infectious diseases and clinical microbiology specialists will also have a role in the diagnosis and treatment of cases aged 65 years and over.³ In this study, the relationship between community acquired infections of elderly cases that were not living in a nursing or old people's home and factors such as, fever and white blood cell (WBC) count, the effects of age, gender and presence of underlying chronic diseases compared to length of stay were evaluated.

Methods. This study was carried out in a tertiary care teaching hospital, which is one of the 2 university hospitals in Izmir, western region of Turkey with 850 beds. In university hospitals in Izmir, there are no departments of geriatrics where acute diseases of elderly cases have been followed yet. This also apply to government hospitals or university hospitals where elderly cases are followed by the most concerned departments such as infectious diseases or internal medicine wards.

This study was conducted as a cross-sectional survey of medical records over a 5-year period, between January 1, 1999 and December 31, 2003. Elderly cases hospitalized in the Infectious Diseases and Clinical Microbiology ward, Dokuz Eylul University Hospital, Turkey with the pre-diagnosis of infectious diseases were included in the study. Exclusion criteria were usage of antibiotics and hospitalization in the previous 30 days of admission, living in a nursing home or old people's home. None of the cases included in the study have hospital-acquired infections, and all patients hospitalized with pre diagnosis of infectious diseases. Forms including gender, existence of chronic diseases, fever, WBC counts, diagnosis, applied treatment and prognosis were prepared and determined results were presented.

The data of each case was evaluated using the Statistical Package for Social Sciences version 10. Chi-square test, t-test, Chi-square for trend and variance analysis in independent groups in statistical analysis were also used.

Results. Initially, we investigated the length of stay of whole cases (n=835) hospitalized in our

inpatient clinic as to age. Of these cases that were not in a nursing home for the elders, 33.1% (276/835) was determined in ≥ 65 years of age term. The proportions of elderly patients to hospitalized patients (276/835) were calculated for each year as follows: 22.3 % in 1999, 35% in 2000, 33.5 % in 2001, 40.3 % in 2002, and 30.5 % in 2003. There were statistically significant differences among the number of elderly cases according to the years (Chi-square: 11.626, $p=0.02$). However, it was not possible to find the data of all cases. The data of 87% (240/276) cases were investigated for other information mentioned in this study except length of stay.

Only 240 cases, considered as old age, were followed in this study: 25 (10.4%) in 1999, 43 (17.9%) in 2000, 42 (17.5%) in 2001, 79 (32.9%) in 2002 and 51 (21.3%) in 2003. Of the cases, 125 (52.1%) were females and 115 (47.9%) were males. Mean age was 74.7 ± 6.5 (65-92); 74.7 ± 6.6 (65-92) in females, 74.8 ± 6.4 in males. There were no statistically significant differences among the mean age of the cases according to gender ($t=-0.146$, $p=0.884$). Of the cases, 57 (23.8%) was determined ≥ 80 years of age. While 13 (5.4%) of the cases were transferred to the other wards as they have a noninfectious diseases, 227 (94.6%) cases were followed as they have an infectious diseases. The most frequently encountered infections were 85 (35.4%) urinary system infections, 43 (17.9%) acute gastroenteritis, 38 (15.9%) pneumonia, 32 (13.3%) soft tissue infections, 15 (6.3%) meningitis, 14 (5.8%) hepatitis, brucellosis, endocarditis, viral upper respiratory tract infections. While antibiotic treatment initiated with one drug in 122 (50.8%) and with combination of more than one drugs in 58 (24.1%) of the cases included in the study, antibiotic treatment was not applied in 60 (25.0%) cases. The most commonly used antibiotics were ciprofloxacin in 96 (40.0%), ampicillin-sulbactam in 39 (16.3%), and ceftriaxone in 37 (15.4%). The most frequently used antibiotic combinations were ampicillin-sulbactam + ciprofloxacin and ceftriaxone + ciprofloxacin. At the end of the treatment, while 170 (70.8%) cases recovered, 3 (1.3%) cases died. Since 18 (7.5%) of the cases wanted to leave the hospital voluntarily before the treatment was completed, they were discharged with consecutive treatment, and 49 (20.4%) were transferred to other departments of our hospital. Of the patients transferred to other hospital wards, 43 (87.8%) had underlying chronic diseases or noninfectious causes and 6 (12.2%) needed intensive care observation for their existing infections.

Upon examination for the underlying chronic diseases of 216 (90%) of the patients, there were one (128 cases) or 2 (88 cases) chronic diseases whereas

we found no underlying disease in 24 (10%) patients. While the average length of stay of these 24 cases having no chronic disease was 8.29 ± 7.96 days, this period compared to those patients having chronic diseases was 13.23 ± 11.94 . It was determined that the cases having chronic diseases stayed in the hospital for longer time and this difference between the 2 groups were statistically significant ($t=-2.719$ $p=0.01$). Additional diseases determined were as follows: hypertension in 94 (39.1%), diabetes mellitus in 69 (28%), coronary artery diseases in 32 (13.1%) and cerebrovascular diseases in 25 (10.4%).

In the admission, fever was found below 37.2°C in 114 (47.5), $37.3 - 38.2^{\circ}\text{C}$ in 61 (25.4%), $38.3-39.5^{\circ}\text{C}$ in 65 (27.1%) of the patients. The WBC counts were determined between 4000 and 10000 per cubic mm in 99 (41.3%), over 10000 per cubic mm in 141 (58.7%) of the cases. The relationship between fever and WBC counts was illustrated in **Table 1**. It was observed that, WBC counts were significantly elevated, parallel with high fever (Chi-square for trend: 5.317, $p=0.021$). It was determined that elderly patients with an elevated WBC were 2.02 times more likely to have a temperature of 38.3°C or higher compared with patients with a normal temperature ($p<0.05$). Leukocytosis and fever were not determined in 78 (32.5%) of all our patients. Of these cases, 13 (16.6%) were diagnosed as having soft tissue infection, 12 (15.3%) acute gastroenteritis, 11 (14.1%) urinary infection, 3 (3.8%) pneumonia and 2 (2.5%) had meningitis.

The lengths of stay of the elderly cases were evaluated together with of the all cases hospitalized during the study period in our clinic. Mean hospitalization time of the total 835 cases was 9.7 ± 8.2 days (1-61 days). Then the patients were divided into 4 groups (18-49/ 50-64/ 65-79 and 80+ years) and length of stay was evaluated with One-way ANOVA test. Mean lengths of stay of the cases according to their age were 8.35 ± 7.38 days in 18-49 ($n=369$);

9.52 ± 6 , 71 days in 50-64 ($n=190$); 9.80 ± 7.69 days in 65-79 ($n=182$); 15.55 ± 12.12 days in 80 and over ($n=94$) age groups. It was determined that the older the age was, the more mean length of stay, and this increase was statistically very significant ($F=20.417$, $p=0.0001$). At the end of Bonferroni analysis carried out to determine the origin of this difference, it was found that differences among the age groups acquired from 80-and-over age group; and this age group stayed in the hospital significantly longer than the others ($p=0.0001$). When the length of stay was evaluated on the 80-and-over years old cases according to the gender, mean length of stay is 16.7 ± 15.6 days in men, 17.7 ± 12.3 in women. According to gender, statistically significant difference among the length of stay of the cases was not found ($t=0.281$, $p=0.780$).

Discussion. Approximately 20% the world population will be over 65 years old in the year 2050. In our country, the population of 65 years old as to the data of 2000 was 5.7% and most of them live with their families (children, relatives), although fewer of them stay in nursing homes.² The nursing homes' capacity is very inadequate for elderly patients and they are not used widely. Additionally, it is not an accepted behavior for a family to put the elderly person into a nursing home. As some people are reluctant to behave that way, they have a person to look after the old one at home. In Turkey, there are 6500 elderly people living in 63 nursing homes belonging to the government under the Ministry of State while 9842 elderly people living in other 118 nursing homes belonging to other ministries, municipalities, associations and foundations. Izmir, where the study was held, is the third biggest city of the country and has 4 official old people's homes serving 1730 elders and 10 private homes belonging to other associations and foundation serving 155 elders.³ In this study, parallel to the increase in the population, we determined that the proportion of elderly patients

Table 1 - Distribution of white blood cell counts of the cases as to fever level.

Fever ($^{\circ}\text{C}$)	White blood cells (μL)						(95% CI)
	$\geq 10,000$		4,000-10,000		Total		
	n	(%)	n	(%)	n	(%)	
36 - 37.2	58	(50.9)	56	(49.1)	114	(100)	1
37.3 - 38.2	39	(63.9)	22	(36.1)	61	(100)	1.71 (0.86-3.41)
Over 38.3	44	(67.7)	21	(32.3)	65	(100)	2.02 (1.02-4.02)
Total	141	(58.7)	99	(41.3)	240	(100)	
Chi-square for trend: 5.317, $p=0.021$							

staying in our clinic, probably due to infectious diseases was increased from 22.3 to 30.5% between the years of 1999-2003, and there was a significant difference among the proportions of hospitalization of elderly patients according to the years. With this increase, it is considered that elderly population and their health problems will also become an important problem in our country in the near future.

Infections are one of the 5 leading causes of death and are among the top 10 causes for hospitalization of persons age 65 and older.⁴ Older persons residing in nursing homes as well as other types of long-term care facilities are at increased risk for infections due to clustered living conditions.⁵ Moreover, in these cases, decrease in the all system functions of the body resulting from advanced age factors (anatomic, physiologic and immunologic, and others) and existence of underlying chronic diseases increase in this tendency.^{5,6} We expect that infections in old people living with their families were different from those in nursing home residents. Consequently, we studied the community acquired infections in individuals over 65 years and living with their families and we observed that the following infections were frequent: urinary system infections (35.4%), acute gastroenteritis (17.9%) pneumonia (15.9%) and soft tissue infections (13.3%), similar to those that reported from nursing homes in the literature.^{1,4,6,7}

In elderly cases, it is observed that the frequency of chronic diseases such as diabetes mellitus, hypertension, coronary artery diseases and cerebrovascular accident has been increased. Norman et al⁴ evaluated the existence of chronic disease as one of the major factors causing the formation of atypical clinical presentation. Length of stay in the hospital between the patients with or without an underlying chronic disease was compared in order to investigate if additional chronic diseases have a negative influence on the duration of hospital stay by causing an atypical presentation or disturbing the host immune response, in those patients. In our study group, we determined at least one chronic disease in 90% of the hospital staying cases; and that existence of the underlying disease lengthened the hospital staying periods ($p=0.001$). Using as criteria of the seriousness of the underlying chronic disease in the prognostic scoring systems developed for infectious diseases such as meningitis, endocarditis and pneumonia, our study shows that existence of the chronic disease in elderly patients is effective in the prognosis of infectious disease.⁸

Fever and WBC counts in elderly as well as in younger patients, are the most important signs of infectious diseases. However, increase in WBC count

determined in 60% of the elderly cases is specific although it is not a sensitive sign for infection.⁹ Bentley et al¹⁰ reported that determining the increase in WBC count made them consider that there is a high probability of bacterial infection. In addition, in our study we observed the existence of a statistically significant relationship between fever and WBC counts. In our opinion, determining leukocytosis existence in the cases with or without high fever can make the diagnosis simpler. However, we did not determine fever in 114 (47.5%), leukocytosis in 99 (41.3%) of all our patients and neither leukocytosis nor fever was found in 78 (32.5%) patients and this situation made the evaluation hard for whether there was infection or not. It is also reported in the literature that fever could not be determined even in the progress of serious infections such as pneumonia, tuberculosis, infective endocarditis, and having no fever could be a cause for the increase of mortality by delaying the diagnosis and treatment.^{6,7,11-13} In the study presented here, fever and leukocytosis were not determined in 13 of soft tissue infection, 12 of acute gastroenteritis, 11 of urinary infection, 3 of pneumonia and 2 of meningitis cases. For this reason, while existence of fever is examined, basal body temperature and diurnal rhythm also need to be known. As 1.1°C (2F) increase of basal body temperature or over 38.3°C is evaluated as fever.^{7,8,11} Since the cases in our study live in the community and chronic diseases are in the remission, vital functions were not being followed before admitting to the hospital. For this reason, we were not able to get information concerning basal body temperatures and diurnal rhythms, and may be we could not determine some cases which could be accepted as fever. Following the daily fever changes in the cases living in the community is difficult. These values can be followed easily and standardized in old people nursing homes. In a study carried out with the cases followed in old people nursing home, it is reported that following basal body temperature and diurnal fever changes will be helpful for early defining of infections.¹³ One of the limitations of this study was the small quantity in the number of patients in the specific diagnosis groups such as pneumonia or meningitis and these groups were not be able to sub-divided such as atypical or typical pneumonia and septic or aseptic meningitis. For this reason the relationship between fever and leukocytosis could not be determined in different diagnosis groups and subgroups.

It is known that length of stay and cost increased in situations which nosocomial infection developed in all cases that were staying in the hospital.¹⁴ In nursing homes for elders, frequent circulations between the

nursing home and the hospital increases the length of stay, morbidity and mortality.⁶ In our opinion, elders living with their relatives, the type of infections which might develop is community acquired, and it is expected that it will not lengthen the hospital staying time. However, in this study, it is determined that hospital staying time became longer among elderly group during treatment of community acquired infections which needed hospital staying. When hospital staying periods were evaluated according to the age groups, it is determined that the older the age became, the longer the mean length of stay, and this increase was statistically significant ($p=0.0001$).

According to gender, although there was no meaningful difference among the hospital staying time of the cases over 80, it was determined that women cases stayed in the hospital longer ($t=0.281$, $p=0.78$). Goebeler et al¹⁵ and his friends reported that hospital staying time is 46 days in women and 19 days in men because of dementia, coronary artery disease and stroke in the series of 2077 cases of 90 years old and over. Since the cases followed in this study were observed with acute infectious clinical presentation, it was considered that hospitals staying time in the cases over 80 years old were not affected as to the gender.

In conclusion, geriatric wards for patients that need to be followed in hospital in this age group are not yet present in Turkey, observing the cases carried out in the departments considered the most related. In this study, the most frequently seen infections among the elderly cases living in the community are determined as urinary system infection, acute gastroenteritis, pneumonia and soft tissue infection. During physical examination, either with or without fever, it is determined that increases in the leukocyte values of cases were specific and hospitals staying times were effected meaningfully with age and chronic disease existence. In elderly cases, either they live in the community or in the nursing homes, there is a decrease in their body system functions due to advanced age (anatomic, physiologic, immunologic, and others) and the existence of chronic diseases affects their living qualities. For this reason, "advanced age and infections" must be considered as a special health issue and physicians experienced in the subject must follow the cases. Further, investigations based on the specific clinical data, types of pathogenic microorganisms such as extracellular and intracellular

pathogens, their virulence factors and applications of antibiotics are necessary.

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