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Research

EVALUTION OF GERIATRIC INFECTIONS IN PAST SIX YEARS

Abstract

Introduction: Infections are one of the most important reasons for hospitalization, morbidity, and mortality among geriatric patients.

Materials and Method: The present study, retrospectively evaluated demographic characteristics, underlying diseases, and distribution of infections in patients aged 65 years who were hospitalized for treatment between January – 1, 2010 and December – 31, 2015, at the infectious diseases and clinical microbiology department of Ankara Numune Training and Research Hospital.

Results: Overall, 853 geriatric patients were included in this study, with 435 (51%) woman and 418 (49%) men, the mean age was 76.8 ± 7.3 years, and 86.2% of patients had at least one comorbid chronic disease. Hypertension, cardiovascular diseases and diabetes mellitus were most common comorbidities, and most common reasons for hospitalization included pneumonia (37.9%), urinary tract infection (22.9%) and cellulitis (7.7%). Moreover, beta-lactam antibiotics (88.2%), quinolones (21.1%) and macrolides (19.6%) were most frequent antibiotics used for treatment. The average length of hospital stay was 6.8 ± 5.1 days. Overall, 17 (2%) patients died during the study, 62 (7.3%) were transferred to other clinics, 53 patients (6.2%) were transferred to intensive care units, 51 (6%) were discharged with their current medical status, 670 (78.5%) were discharged with full recovery. Nursing home stay and being transferred from intensive care units were independent risk factors for mortality (p = 0.001).

Conclusion: The number of geriatric patients and their mean age are increasing as life expectancy increases. Advanced age and underlying diseases are predisposing factors for infections, and consequently, infections are one of the most common causes of hospitalization in elderly patients.

Key words: Geriatrics; Aged; Infection

Araştırma

GERİATRİK ENFEKSİYONLARIN 6 YILLIK DEĞERLENDİRMESİ

Öz

Giriş: Enfeksiyonlar geriatrik populasyonda hastaneye yatış, morbidite ve mortalitenin en önemli nedenlerinden biridir.

Gereç ve Yöntem: Çalışmamızda Ankara Numune Eğitim ve Araştırma Hastanesi enfeksiyon hastalıkları ve klinik mikrobiyoloji kliniğinde 01,01,2010 -31,12,2015 tarihleri arasında yatarak tedavi gören 65 yaş ve üzeri hastaların demografik özellikleri, altta yatan hastalıkları, enfeksiyonların dağılımı ve sıklığı retrospektif olarak değerlendirilmiştir.

Bulgular: Çalışmaya 853 geriatrik hasta dahil edildi. Hastaların 435'i (%51) kadın, 418'i (%49) erkekti. Yaş ortalaması 76,8 ± 7,3 idi. Hastaların %86,2'sinde eşlik eden kronik hastalık vardı. En sık eşlik eden kronik hastalıklar hipertansiyon, kardiyovasküler hastalıklar ve diabetus mellitus, en sık yatış sebebi ise sırasıyla pnömoni (% 37,9), üriner sistem enfeksiyonu (% 22,9) ve selülit (% 7,7) idi. Tedavide en sık kullanılan antibiyotikler beta laktamlar (%88,2), kinolonlar (%21,1) ve makrolidlerdi (%19,6). Yatış süresi ortalama 6,8±5,1 gündü. Sonuçlar değerlendirildiğinde hastaların 17 (%2)'si ölmüş, 62 (%7,3)'si başka kliniğe nakil verilmiş, 53 (%6,2)'ü yoğun bakıma nakil verilmiş,51 (%6)'i haliyle taburcu edilmiş, ve 670'i de (%78,5) şifa ile taburcu edilmiştir. Huzurevinde yaşama ve yoğun bakımdan nakil mortalite açısından bağımsız risk faktörü olarak saptandı (p=0,001).

Sonuç: Beklenen ortalama yaşam süresinin artmasına bağlı olarak geriatrik hasta popülasyonu ve yaş ortalamaları da giderek artmaktadır. İleri yaş ve altta yatan hastalıkların enfeksiyonlara zemin hazırlamasına bağlı olarak enfeksiyonlar hastane yatışına neden olan hastalıkların başında gelmektedir.

Anahtar kelimeler: Geriatri, ileri yaş, enfeksiyon

INTRODUCTION

The World Health Organization recognizes elderliness as age ≥ 65 years. Humans are living longer all over the world, particularly in developed countries, birth rates are decreasing, and geriatric population proportionally increases. The number of geriatric patients applying for medical services also increases in parallel to better life expectancy (1). Infections are among the most frequent causes of hospitalization and mortality in elderly patients, and it also has a marked impact on morbidity by exacerbating underlying diseases and deteriorating organ functions (2,3).

The present study evaluated the demographics, concomitant chronic diseases, and distributions of infections, treatments, courses and outcomes of geriatric patients were hospitalized at the infectious diseases and clinical microbiology department.

MATERIALS AND METHODS

Overall data of 853 geriatric patients who were hospitalized at infectious diseases and clinical microbiology department of Ankara Numune Training and Research Hospital, were retrospectively evaluated. Patients' demographic characteristics (age, sex), hospitalization dates and types, underlying diseases, nursing home history, diagnosis, and diseases courses over time, treatments of infections, as well as treatment courses and outcomes were analyzed. Changes over time were compared both overall throughout the 6-year period, and for periods of 2010-2012 and 2013-2015.

Hospitalization types were grouped as emergency department, outpatient clinics, transfer from another clinic, transfer from another hospital, and transfer from an intensive care unit; underlying diseases were grouped as hypertension (HT), diabetes mellitus (DM), cardiovascular disease (CVD), chronic obstructive pulmonary disease (COPD), malignancy, cerebrovascular disease (CVD), and chronic kidney failure (CKF); and disease outcomes were grouped as death, discharge with current status, discharge with full recovery, transfer to another clinic, and transfer to an intensive care unit.

Pneumonia and urinary tract infections (UTIs) were grouped as community-acquired, and iatrogenic.

Antibiotics used for treatment were grouped as beta-lactams (penicillin, cephalosporin, carbapenem, and beta-lactam/lactamase inhibitors), aminoglycosides (AGs), tetracycline, glycylcycline, macrolides, glycopeptides, lipopeptides, oxazolidinediones, quinolones, polymyxines, metranidasole, TMP-SXT, and rifampicin.

Statistical analyzes of mean values and frequencies were performed using SPSS 21 for Windows.

RESULTS

Of the 2133 patients hospitalized at our clinic between January 1, 2010, and December 31, 2015, 853 (40%) were aged ≥ 65 years. Of these elder patients, 51% (n=435) were women and 49% (n = 418) were men. Mean age of the women and men were 77.8 ± 7.4 years and 75.8 ± 7.1 years, respectively ($p < 0.001$). Frequency of hospitalization was highest in the year 2014 (24.2%,). 38.7% (n=330) during 2010-2012 and 61.3% (n = 523) during 2013-2015.

Concomitant chronic disease was present in 735 (86,2%) of the 853 patients, and most frequent diseases were HT, CVD, and DM. Moreover, the frequency of concomitant diseases among hospitalized patients was highest in last 3 years (82.7% vs. 88.3%; $p = 0.02$ - Table 1).

Table 1. Distribution of Concomitant Chronic Diseases

Chronic Diseases	2010-2012 N (%)	2013-2015 N (%)	p
Hypertension	200 (60.6)	307 (58.7)	0.5
CVD	96 (29.1)	208 (39.8)	0.001
Diabetes Mellitus	93 (28.2)	161 (30.8)	0.4
COPD	40 (12.1)	108 (20.7)	0.001
Cerebrovascular attack	60 (18.2)	82 (15.7)	0.3
Alzheimer	50 (15.2)	68 (13)	0.3
Malignity	35 (10.6)	72 (13.8)	0.1
Chronic kidney failure	13 (3.9)	65 (12.4)	0.08
Total	273 (82.7)	462 (88.3)	0.02

CVD: cardiovascular disease; COPD: chronic obstructive pulmonary disease
Furthermore, 6.1% of all patients were living in nursing homes.

The mean days of hospitalization was 6.8 ± 5.1 days. Men were hospitalized longer than women ($p = 0.007$). Types of hospitalizations were 58.3% from emergency department, 21.8% from outpatient clinic, 11.6% from transfer from intensive care unit, 6.2% from transfer from other clinic, and 2.1% from transfer from other hospital. The mean age of patients transferred from intensive care units was greater compared with all other subgroups, and the mean ages of patients from emergency department was greater than that of patients transferred from outpatient clinic or another hospital ($p < 0.001$). The comorbid disease rate among patients transferred from intensive care unit was 92.9%, which was significantly higher compared with other hospitalization types ($p = 0.03$).

The most frequent diagnoses at hospitalization were as pneumonia (37.9%), UTI (22.9%), skin and soft-tissue infection (7.7%), and fever etiology (6.1%) (Table 2).

Table 2. Distribution of infections at hospitalization

Diagnosis	N	%
Pneumonia	323	37,9
Urinary tract infection	195	22,9
Skin and soft_tissue infection	66	7,7
Fever etiology	52	6,1
Acute gastroenteritis	28	3,3
Urosepsis	22	2,6
Crimean_Congo hemorrhagic fever	17	2
Other	150	17,5
Total	853	100

On evaluation of pneumonias were evaluated, 77.1% (n = 249) were community-acquired pneumonia (CAP), and 22.9% (n = 74) were iatrogenic pneumonia (IP). The mean age of CAP and IP patients was 77.7±7.3 and 79.2±7.5 years (p = 0.1). CAP patients had longer hospitalizations (p = 0.02). Furthermore, CAP was more frequent in women, and IP was more frequent in men and patients with concomitant disease (p = 0.001). Treatment period was longer for IP patients than for CAP patients (p < 0.001).

Most frequently identified agent in UTI was Eschericia coli (60.4%), and 43.4% of it was extended-spectrum beta-lactamase (ESBL) positive (Table 3).

ESBL_ positive E. coli was more frequent in iatrogenic than in community-acquired infections (p = 0.001), but it was not significantly different from ESBL_ positive Klebsiella spp. and vancomycin_ resistant enterococcus (p = 0.9 and p = 0.7, respectively).

Table 3. Distribution of microorganisms in UTI

Agent	%	ESBL positive (%)	Quinolone Resistant (%)	TMP-SXT resistant (%)
E.coli	60.4	43.4	41.4	47.4
Klebsiella spp.	15.8	56.6	42.3	57.6
Enterococcus spp.*	10.3			
Pseudomonas spp.	6			
Candida spp.	5.6			
Enterobacter spp.	2.6			

*Vancomycin_ resistant enterococcus: 25.2%

The mean duration of hospitalization for UTI was longer for men than for women (p = 0.001). Of these cases, 59% had community-acquired and 41% had iatrogenic UTI. Community-acquired UTI was more frequent in women, whereas iatrogenic UTI was more frequent in men (p = 0.04). Treatment duration was longer for iatrogenic UTI than for community_ acquired UTI (p < 0.001). On evaluation of diagnoses of 48 patients pre-diagnosed with fever of unknown etiology (FUE), 50.2% were related to infections (Table 4), 21% were to non-infectious causes, whereas 28.8% (n = 14) could not be diagnosed.

Table 4. Distribution of infections in patients with FUE

Diagnosis	N	%
Urinary tract infection	8	16.7
Pneumonia	4	8.3
Skin and soft_ tissue infections	3	6.3
Tuberculosis	3	6.3
Brucellosis	1	2.1
Salmonellosis	1	2.1
Leptospirosis	1	2.1
Discovertebral infection	1	2.1
Intraabdominal infection	2	4.2
Total	24	50.2

On evaluation of disease trends over years, rates of urosepsis, brucellosis, and Crimean_ Congo hemorrhagic fever were found decreased, tularemia cases were no longer observed, whereas FUE rates had increased (Table 5).

Table 5. Disease trends over years

Disease	n (%) (2010_ 2012)	n (%) (2013_ 2015)	P
Pneumonia	128 (38.8)	195 (37.3)	0.6
Urinary tract infection	61 (18.5)	133 (25.4)	0.01
Skin and soft-tissue infection	27 (8.2)	39 (7.5)	0.7
Urosepsis	13 (3.9)	9 (1.7)	0.04
Acute gastroenteritis	10 (3)	18 (3.4)	0.7
Crimean-Congo hemorrhagic fever	10 (3)	7 (1.3)	0.08
Tularemia	7 (2.1)	0 (0)	0.001
Fever of unknown etiology	4 (1.2)	16 (3.1)	0.9
Brucellosis	4 (1.2)	1 (0.2)	0.07

Antibiotics were administered in 91.2% (n = 778) of patients; most frequently used antibiotics were beta lactams (88.2%), quinolones (21.1%), and macrolides (19.6%). Combination antibiotic were administered in 40.8% of patients, and most frequently used combinations were beta lactam + macrolide (44.8%) and beta lactam + quinolone (27.9%) (Table 6).

Tigecycline usage was significantly increased during the last 3 years (p = 0.02).

Table 6. Distribution of antibiotic combinations used for treatment

Combinations	%
Beta-lactam + macrolide	44.8
Beta-lactam + quinolone	27.9
Beta-lactam + glycopeptide	5.3
Beta-lactam + linezolide	5.1
Beta-lactam + daptomycin	3.9
Other	13
Total	100

The mean treatment duration was 6.9 days for hospitalization, 8.4 days for after discharge, and 13.1 days in total. Outcomes of patients were as follows: full recovery, 78.5%; discharge with current status, 6%; transfer to other clinic, 7.3%, transfer to intensive care unit, 6.2%; and exitus, 2%. On evaluating the relationship between mean age and disease outcomes patients transferred to intensive care units were older than patients those transferred to another clinic, discharged with full recovery, and discharged with current status (p = 0.03).

Of patients who died, 23.5% (n = 4) had a history of living at a nursing home. The mortality rate of patients who lived at nursing homes was higher than other patients (p = 0.016). A significant association was observed between mortality and hospitalization type, and the mortality rate of patients transferred from intensive care units was higher than all other patients (p = 0.03). Multivariate analyzes revealed that living at nursing home and being transferred

from intensive care are units were independent risk factors for mortality (p = 0.001).

DISCUSSION

Infections are among the top 10 causes of hospitalization and the top 5 causes of mortality in individuals aged > 65 years (4).

Overall, 40% of patients hospitalized at our clinic were aged > 65 years this rate has been reported as 28.6%, 13.5%, and 33.1% in different studies from our country (5,6,7). The mean patient age in this study was 76.8 ± 7.3 years whereas that reported in similar previous studies was 67 and 76.4 ± 6.9 years (7,8). The mean age and proportions of hospitalized geriatric patients among all hospitalized individuals have been increasing in parallel to aging of the population in our country.

Concomitant chronic diseases are precipitating factors for infections (9). The concomitant disease rate was 86.2% (HT 40.6%, CVD 35.6%, and DM 29.8%) in our study ; similar previous studies have reported rates as 30.8% (HT 19.4%, COPD 17.2%, and DM 16.1%), and 89% (HT 54.5%, DM 29.5%, and CVD 28%) (2,3). Çağatay et al. (10) evaluated 185 geriatric patients and reported that infections were more prevalent among patients with concomitant diseases, and the most frequent infection was pneumonia. Similarly, in our study, pneumonia was more frequent among patients with concomitant chronic diseases (p = 0.001).

Consistent with available literature data most frequent diseases that caused hospitalization in geriatric patients in our study were pneumonia and UTI (5,6,7,8). Moreover disease trends over time revealed that urosepsis, brucellosis, and CCHF cases have decreased in the last three years, tularemia is no longer detected, whereas incidence of FUE has increased.

Most frequent infections that caused FUE among geriatric patients were complicated UTI, tuberculosis, endocarditis, and abscess. The rate of undiagnosed patients was 9% (11). In a study that followed up 185 cases with fever, 72.9% of cases had fever due to infections, such as pneumonia (22.1%), UTI (14%), skin and soft- tissue infections (14%), CNS infections (5.4%), tuberculosis (4.2%), brucellosis (3.2%), and non-infectious diseases (17.3%) including rheumatologic diseases (4.3%), hematological malignancies, (5.4%) solid tumors (3.7%), and vasculitis (3.7%), and 9.7% of patients could not be diagnosed (12). In another study with 301 geriatric patients from our country, patients with FUE (n = 16) had collagen tissue disease (n = 8), brucellosis (n = 2), salmonellosis (n = 1), malignancy (n = 1), and infective endocarditis (n = 1), while 3 patients could not be diagnosed (8). In our study, we found that most frequent infections that caused fever were UTI (16.7%), pneumonia (8.3%), and cellulitis (6.3%), which was in accordance with available literature data. In geriatric individuals, cellular immunity and specific cytokines (IL-2) decrease, and vulnerability to infections due to intracellular pathogens increase ; and our results also revealed that tuberculosis (6.3%), brucellosis (2.1%), and salmonellosis (2.1%) were the predominant causes of geriatric FUE. The proportion of undiagnosed patients (28.8%) was in line with available literature.

In this study, 77.1% of pneumonia cases were CAP, 22.9% were IP ; CAP was more frequent among women, and IP was more frequent among men (p = 0.01). The rate of concomitant chronic disease was higher in IP cases than in CAP cases (95.9% vs. 89.6%, p = 0.09). Grenier et al. (13) evaluated 3295 pneumonia cases and determined CAP in 83%, and IP in 17% of cases; moreover, the mean ages of IP patients was higher (p < 0.001), and both types of pneumonia were more frequently seen in men than in women (p = 0.2). Several studies have revealed that IP is more severe than CAP, and has higher mortality rates, with longer hospitalization periods (14,15). In our study as well, hospitalization was longer for IP than for CAP (p = 0.02).

In elderly men, residual urine volume increases owing to prostate hypertrophy and causes complicated UTI. Resistant gram_ negative bacilli are more frequently identified in complicated UTI than in uncomplicated UTI. Frequently observed agents in uncomplicated UTI are E. coli (75% - 95%), Proteus

mirabilis, Klebsiella pneumoniae, and Staphylococcus saprophyticus (16), whereas Pseudomonas spp., Serratia spp., Providencia spp., enterococcus, staphylococcus, and fungi are observed more often in complicated UTI (17). Similar to complicated UTI, most frequent agents in iatrogenic UTI are generally resistant gram_ negative bacilli (18). In our study, ESBL_ positive E. coli was more frequent in iatrogenic infections than in community_ acquired infections ($p = 0.001$), but no significant differences were noted for ESBL_ positive Klebsiella spp. and vancomycin_ resistant enterococcus ($p = 0.9$, and 0.7, respectively). Agents causing complicated UTI are generally resistant microorganisms, which are resistant to oral antibiotics, and consequently, such patients require hospitalization for antibiotic treatment (19). Most male patients in our study had history of surgery or catheterization because of benign prostate hypertrophy (BPH) ; iatrogenic UTI was more frequently reported in these patients, and the hospitalization duration was longer for these patients than for women ($p = 0.04$, $p < 0.001$).

In this study, the most frequent agent identified in UTI was E. coli (50.8%). A meta-analysis from our country that evaluated antibiotic resistances in E. coli strains isolated from urine cultures reported a piperacillin tazobactam resistance rate of 17.53%, a ceftriaxone resistance rate of 19.22%, an imipenem resistance rate of 2.85%, and a ciprofloxacin resistance rate of 30.98% (20). In the present study, 43.4% of E. coli strains were ESBL_ positive, the quinolone resistance rate was 41.4%, and the TMP-SXT resistance rate was 47.4%. Considering the high resistance rate and adverse effects on central nervous system of quinolone, particularly in geriatric patients, quinolone use for UTI in this study was low (3.1%).

History of nursing home stay in geriatric population is important for healthcare_ related infections. Previous studies have revealed that infectious agents in nursing home patients were generally resistant strains. In addition, mortality among patients living at nursing homes is high owing to the presence of accompanying diseases. Chong et al. (21) revealed that living at nursing homes was an independent risk factor for mortality. Similarly, in our study, living at nursing home was an independent risk factor for mortality ($p = 0.004$).

Typically, geriatric patients, need intensive care owing to exacerbations of underlying diseases or multi-organ system issues. Approximately half of intensive care patients are elderly individuals (22). In our study the mean age (79.6 ± 7.2 years) and accompanying diseases of patients transferred from intensive care units were significantly higher compared with all other patients ($p < 0.001$, $p = 0.03$). Another important point was the mortality rates in these patients ; we found that being transferred from intensive care was an independent risk factor for mortality ($p = 0.03$). Vosylius et al. (23) reported that mortality and morbidity in patients hospitalized in intensive care units were higher, and the mortality rate in patients aged ≥ 75 years was twice that in patients aged < 65 years. Rosenthal et al. (24) evaluated over 150,000 patients, and found that age was independently associated with in-hospital mortality regardless of disease severity and other prognostic factors. Another study including patients hospitalized in intensive care units reported that only age was not sufficient to predict outcomes, and primary diagnosis, presence of accompanying chronic disease, and disease severity were critical as well (25). The higher mortality rates observed in our study can perhaps be explained by both the higher mean patient age as well as the higher rates of concomitant chronic diseases in patients transferred from intensive care units.

In conclusion, on considering our and other studies on geriatric infections, we foresee that geriatric patients will be more prevalent in the coming years, and will mostly be followed- up at hospitals. Medical education before and after graduation should involve training in geriatric medicine to ensure the follow-up of geriatric patients using an appropriate approach. Necessary actions must be taken to introduce the approach to geriatric patients into the specialty training. It was determined that most geriatric patients are admitted to hospital through the emergency department, and it would be appropriate to prioritize emergency physicians in geriatric medicine training considering the fact that elderly patients have higher

demand for acute care services. Concomitant chronic diseases further complicate geriatric cases, and thus, patient management becomes more challenging.

Adequate knowledge regarding management of chronic diseases (particularly HT, CVD, and DM) in such patients will ease follow-up of geriatric patients. Healthcare planning and research must target healthy aging as well as addressing the health problems of geriatric patients. Infections in elderly patients follow atypical courses, with occasionally fever being the only symptom ; such patients also depict changes in mental status, making it hard for them to remain focused, which makes the diagnostic process difficult. Although such patients do not present typical symptoms during assessments, looking for signs and symptoms of common infections will help diagnosis and treatment. In our study, the most frequent infections that caused fever were UTI (16.7%) and pneumonia (8.3%). Diagnostic examinations of geriatric patients hospitalized with the diagnosis of FUE should primarily involve examinations targeting pneumonia and UTI.

According to our results, age, presence of comorbidities, and mortality among patients transferred from intensive care units were high, and thus, this group of special patients should be more closely monitored. Taken together, it will be useful for healthcare facilities to calculate the proportion of their elderly patient population, and establish low-cost palliative care units for management of elderly patients with critical diseases. In our study, the mortality is higher among patients transferred from the intensive care units or nursing homes. So expeditious diagnosis by the clinicians and early institution of treatment are of vital importance in these patients.

Epidemiology, agents and resistance status in geriatric infections are changing day by day, and following these changes will provide an insight to approach to these patients, and we have evaluated our patients also with this aspect.

The limitations of the present study include its retrospective design and being a single-site study. Prospective and multi-site studies would enable acquisition of more accurate information.

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