Original Article
Eurasian Journal of Critical Care

Mortality Risk Factors at Time on ED Admission in Elderly Patients with Infectious Diseases

Seval Demir Aydın[1], Yasar Bayindir[2], Neslihan Yucel[3]
[1]Elazig Fethi Sekin City Health Application and Research Center, Elazig, Turkey.
[2]Department of Infectious Diseases and Clinical Microbiology, Inönü University Turgut Ozal Health Centre, Malatya, Turkey.
[3]Department of Emergency Medicine, Inönü University Turgut Ozal Health Centre, Malatya, Turkey

Abstract

Background: As elderly individuals often exhibit heightened vulnerability to infections due to factors such as compromised immune systems, chronic illnesses, and age-related physiological changes, understanding the characteristics and risk factors associated with infectious diseases in this population is crucial. The aim of the present study was to evaluate the characteristics of elderly patients with infectious disease in ED admission and to identify risk factors that influence in-hospital mortality.

Material and Method: In this study, we enrolled 448 adult patients diagnosed with infectious diseases such as pneumonia, urinary tract infection, gastroenteritis, meningitis, and cellulitis. The participants were directly admitted to our Emergency Department (ED) from their homes or their relatives' residences between November 1, 2014, and May 31, 2015. We investigated patient's vital signs, disease signs, source of infection, length of staying at hospital, length of staying at emergency service, mortality related scores, laboratory data, treatment and prognosis.

Results and Conclusion: The rate of emergency care admissions with an infectious etiology was found as 17%. Average age of patients was 76±8 with 180 (40%) of them being female and 268 (60%) of them being male. Mortality rate was found as 23%. Cox regression analysis concluded that for 65 years or older patients, risk factors that effected mortality were; septic shock, cardiac disease and presence of malignancy, absence of COPD/Asthma, higher pCO2 and lower HCO3 at the time of admission to the emergency service. Calculating MEDS score and APACHE 2 score at admission to the emergency department and intensive care unit can facilitate early intervention, improving recovery prospects. Further research and clinical strategies may benefit from these identified predictors to improve the management and outcomes of elderly patients with infectious diseases in the ED.

Keywords: Mortality, Infectious Diseases, Elderly patients

Introduction

The elderly population is proportionally increasing worldwide due to the increasing life expectancy and decreasing birth rate (1) . In line with this increase, the rate of admission of elderly patients to emergency departments (EDs) for a number of diseases such as infectious disease, cardiovascular disease, cerebovascular event, and other their chronic illness is also gradually increasing (2,3). Infectious diseases are the most frequent cause of hospitalization in this population. Elder persons generally are more vulnerable to infections than younger adults because of numerous reasons such as altered host resistance, chronic illnesses and comorbid conditions, age-related lower physiologic reserve and physiological changes, living in a nursing home or in the community, polypharmacy, medical devices surgical wounds, immunsuppressive medications, and malnutrition (4). Also, managing infections in the elderly is challenging and complicated for a number of reasons. Elderly patients frequently present with non-spesific symptomes such as functional impairment, changes in cognition, delirium, anorexia, or generalised weakness that makes infectious disease more difficult to identify (5, 6). The aim of the present study was to evaluate the characteristics of elderly patients with infectious disease in ED admission and to identify risk factors that influence in-hospital mortality.

Material and Method

The investigation was conducted in the ED of xxxxx University hospital. The University's Institutional Review Board approved the study design and participants and/or their relatives provided written consent. The participants were 448 adult patients with infectious disease such as pneumonia, urinary tract infection, gastroenteritis, menengitis, and sellutis etc. who had been directly admitted to our ED from their or relatives's house between November 1, 2014 and May 31, 2015. Inclusion criteria were ≥65

Corresponding Author: Seval Demir Aydın **e-mail:** aydinsevaldemir@gmail.com
Received: 28.08.2024 • **Accepted:** 02.09.2024
DOI: 10.55994/ejcc.153996

Cite this article as: Demir Aydın S, Bayındır Y, Yucel N. Mortality Risk Factors at Time on ED Admission in Elderly Patients with Infectious Diseases. Eurasian Journal of Critical Care. 2024;6(2): 75-80

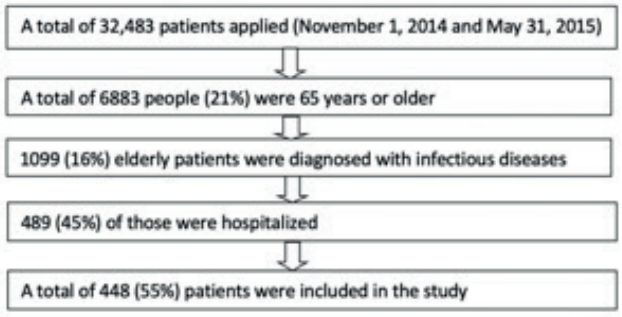

Figure 1: Patient flow chart

years of age, hospitalization, and lived in relative's or their house. Patients were excluded if they were diagnosed except infectious disease, or if they were transferred to our hospital while they were hospitalized in another hospital, or if they died or discharged during ED management. All patients were followed up until hospital discharge or in-hospital death (Figure 1). Standart study forms were prepared for recording to data of the patients during ED admission. When the patient was admmitted to the ED, each patients were monitored and the pulse rate, arterial blood pressure, fever, respiratory rate and oxygen saturations were recorded on the study form. Patients were examined and Glasgow Coma Scales (GCS) was determined (7). While intravenous line was placed, the blood samples were drawn to measure hemoglobin, hematocrit, platelet count, activated partial thromboplastin time (aPTT), international normalized ratio (INR), glucose, lactate, renal function indicators, liver enzymes, arterial blood gases, C-rective protein, procalcitonin, and electrolytes. Also, blood (a minimum of two samples), urine, and other relevant culture specimens were ordered in the ED according to infectious source before antibiotics were administered. The documentation for each patient included detailed information on demographics (age, sex, underlying diaease), presence and source of infection, duration of emegency department, hospital stay, ICU stay, time of initiation of antibiotics, duration of symptoms, main complaints, vital signs and laboratory findings on admission, and outcome. Diagnosis of infection disease was made according to main complaints, physical examination, laboratory findings, and imaging studies. Infections were classified according to origin, provided with the following listings: respiratory system infection (RSI), urinary system infection (USI), gastrointestinal system infection (GSI), hepatobiliary system infection (HBI), intraabdominal infection, soft tissue infection (STI), central nervous system infections (CNSI), and other infections. If any occurrences of organ failure were detected during ED evaluation in the patient with or without sepsis/septic shock, it was recorded to this patient's study form. In each case with or without sepsis/septic shock, MEDS was determined during ED admission (8). Antibiotics in ED were initiated based on consultation with the attending infectious disease specialist.

Statistical analysis

Findings were analyzed with patients categorized in survivor and non-survivor groups. The software package PAWS (Predictive Analytics SoftWare) for Windows version 18.0 (SPSS, Inc., Chicago, IL, USA) was used for statistical analysis. Descriptive statistics were reported, including frequency, mean, standard deviation, median, and interquertile range. Categorical data were analyzed using the chi-square or Fisher's exact test. Continuous data were analyzed using the unpaired *t* test or Mann-Whitney *U* test, depending on whether the data were normally distributed. Multivariate cox-regression analysis was used to assess the independent effect of elderly patient with enfectious disease on occurrence of death. Assumptions of model adaptation and periodic risky were assessed using residual (Schoenfeld and Martingale) analyzes. A p value of ≤ 0.05 was considered statistically significant. Estimated odds ratios (ORs) and their corresponding 95% confidence intervals (CIs) were reported.

Results

During the study period, of total 448 (55%) patients were included to the present study. Table 1 presents patient characteristics, other case details, and results of univariate analysis. The patients were 268 (60%) males and 180 (40%) females of the median age 75 years (range, 65 to 111 years). During the study period, 102 (22%) of the patients died in hospital. While 32 (31%) of those died within 3 days of hospitalization and remaining deaths occurred within 28 or more days of hospitalization. Total 403 (90%) patient had one or more co-existing illness. The non-surviving group had significantly higher median values for MEDS score and lower median values for GCS than surviving goup ($p<0.001$ for both). Median time of antibiotic initiation was significantly lower in the non-survivors than in the survivors ($p=0.001$). The non-surviving group had a shorter mean duration of ED admission and a longer mean duration of ICU stay than surviving group ($p=0.001$ for both). Table 2 presents main complaints of all patients during ED admission. The most common complaints were shortnes of breath in (177 patients, 40%). The results for source of infections, sepsis, septic shock, and organ failure during ED evaluation are shown in Table 3. The most common diagnosis of all patients was respiratory system infections ($n=229$, 51%), urinary tract infections ($n=171$, 38%), hepatobiliary system infections ($n=48$, 11%), and skin/soft tissue infections ($n=21$, 5%). Table 4 summarizes the group results for vital signs and laboratory findings. Table 5 showed the bacterial culture results for the survivors, non-survivors, and all patients together during ED admission. Of 448 patients total, 141 (32%) had one or more positive cultures for blood, urinary, lower respiratory tract, cerebrospinal fluid or skin/soft tissue samples, and the rates of overall culture positivity in surviving and non-surviving groups were not

Table 1: Characteristics of patients diagnosed with infectious disease admitted to ED and the results of univariate analysis

	Survivors (n=346, 77%)	Non-survivors (n=102, 23%)	All patients (n=448)	p
Age (mean±SD)	76±7	77±9	76±8	0.951
65-75 years (no.[%])	164 (48%)	48 (47%)	212 (47%)	0.531
76-85 years (no.[%])	139 (40%)	36 (35%)	175 (39%)	0.221
>85 years (no.[%])	43 (12%)	18 (18%)	61 (14%)	0.119
Sex (no.[%])				0.184
Female	130 (38%)	44 (43%)	174 (39%)	
Male	216 (62%)	58 (57%)	274 (61%)	
Co-existing illness (no.[%])	307 (89%)	96 (94%)	403 (90%)	0.075
Hypertension	138 (40%)	35 (34%)	173 (39%)	0.184
Cardiovascular disease	129 (37%)	33 (32%)	162 (36%)	0.214
Diabetes Mellitus	91 (26%)	26 (26%)	117 (26%)	0.490
Oncologic or hematologic malignancy	80 (23%)	31 (30%)	111 (25%)	0.088
COPD/ Asthma/ interstitial pulmonary disease	79 (23%)	12 (12%)	91 (20%)	**0.009**
Neurologic disorders	63 (18%)	19 (19%)	82 (18%)	0.593
Chronic renal failure	34 (10%)	19 (19%)	53 (12%)	**0.015**
Chronic liver failure	10 (3%)	5 (5%)	15 (3%)	0.240
Others	6 (2%)	3 (3%)	9 (2%)	0.592
MEDS score				0.001
Median	9	14.5	10	
Interquartile range	3 to 23	5 to 25	3 to 25	
GCS				0.001
Median	15	14.5	15	
Interquartile range	4 to 15	5 to 15	3 to 15	
Health care associated infections	90 (26%)	46 (45%)	136 (30%)	**0.001**
Community acquired infections	256 (74%)	56 (55%)	311 (70%)	**0.001**
Duration of symptoms (days)	4±6	4±4	4±5	0.069
Time of antibiotic initiation (h)				0.001
Median	4	2	4	
Interquartile range	1 to 12	1 to 14	1 to14	
ICU admission	107 (31%)	89 (%87)	196 (44%)	**0.001**
Duration of the ED stay (min)	251±125	216±130	243±127	**0.004**
Duration of ICU stay (days)	7±6	12±15	9±11	**0.001**
Duration of hospital stay (days)	12±10	14±16	12±11	0.092

Table 2: Main complaints

	Survivors (n=346)	Non-survivors (n=102)	All patients (n=448)	*p*
Shortness of breath	127 (37%)	50 (49%)	177 (40%)	**0.017**
Generalized weakness	101 (29%)	56 (55%)	157 (35%)	**0.001**
Fever	120 (35%)	28 (27%)	148 (33%)	0.106
Anorexia	93 (27%)	50 (49%)	143 (32%)	0.001
Cough, sputum and hemoptysis	100 (30%)	27 (27%)	127 (28%)	0.288
Nausea and vomiting	80 (23%)	20 (20%)	100 (22%)	0.273
Deterioration in general health status	47 (14%)	50 (49%)	97 (22%)	**0.001**
Abdominal pain	76 (22 %)	16 (16%)	92 (21%)	0.106
Dysuria, hematuria, oliguria or anuria	66 (19%)	14 (14%)	80 (18%)	0.136
Altered level of consciousness	38 (11%)	33 (31%)	71 (16%)	**0.001**
Delirium	45 (13%)	24 (24%)	69 (15%)	**0.009**
Chill	55 (16%)	11 (11%)	66 (15%)	0.130
Chest pain	40 (12%)	6 (6%)	46 (10%)	0.065
Diarrhea	20 (6%)	5 (5%)	25 (6%)	0.479
Flank pain	13 (4%)	2 (2%)	15 (3%)	0.298
Others*	34 (10%)	5 (5%)	39 (9%)	0.083

*Pain (headache, neck pain, back pain, knee pain, whole body pain, etc), vertigo or dizziness, fall, jaundice, itchy, pruritus, rigor, pain, edema or induration, rash, redness, swelling, petechiae or ecchymosis or necrosis; erythema, myalgia, arthralgia, skin ulcer, etc.

statistically different (p>0.05). The cox regression results for the mortality risk factors identified and their influences on death are listed in Table 6.

Discussion

In the elderly population, infections frequently coincide with an array of other health issues, leading to a consistent rise in hospitalization and emergency department admissions due to infectious diseases. This study, consistent with previous research, revealed that 16% of elderly patients admitted to the emergency department were diagnosed with infectious diseases, with nearly half of them requiring hospitalization (9,10). The escalating rates of infectious diseases among the elderly are not only a concern locally but also on a global scale. Swift and accurate diagnosis is paramount to initiate timely treatment and prevent the escalation of infections, especially in a setting where elderly patients may present with atypical symptoms or masked manifestations of illnesses (10,11). Pneumonia emerged as the predominant

Table 3: Source of infections, sepsis, septic shock, and organ failure for all patients during ED admission

Diagnosis	Survivors (n=346)	Non-survivors (n=102)	All patients (n=448)	P
Respiratory system infection (pneumonia)	163 (47%)	66 (65%)	229 (51%)	**0.001**
Urinary tract infection	136 (39%)	35 (34%)	171 (38%)	0.214
Hepatobiliary system infection*	42 (12%)	6 (6%)	48 (11%)	**0.048**
Skin and soft tissue***	16 (5%)	5 (5%)	21 (5%)	0.542
Gastrointestinal system infection**	12 (3%)	4 (4%)	16 (4%)	0.513
Intraabdominal infection****	8 (2%)	6 (6%)	14 (3%)	0.073
Central nervous system infections	3 (1%)	1 (1%)	4 (1%)	0.646
Others*****	15 (4%)	6 (6%)	21 (5%)	0.337
Patients with sepsis and septic shock during ED management				
Sepsis	67 (19%)	49 (48%)	116 (26%)	**0.001**
Septic shock	10 (3%)	25 (25%)	35 (8%)	**0.001**
Organ failure in patients with/without sepsis and septic shock during ED admission				
Organ failure (no.[%])				
Renal failure	81 (23%)	41 (40%)	122 (25%)	0.001
Respiratory failure	38 (11%)	70 (67%)	108 (24%)	**0.001**
Hematologic	46 (13%)	30 (29%)	76 (17%)	**0.001**
Neurologic	32 (9%)	38 (37%)	70 (16%)	**0.001**
Metabolic	22 (6%)	36 (35%)	58 (13%)	0.001
Liver failure	30 (9%)	16 (16%)	46 (10%)	0.035
Cardiovascular failure	13 (4%)	30 (29%)	43 (10%)	**0.001**
Two or more organ failure	64 (18%)	69 (68%)	133 (30%)	**0.001**
No organ failure	176 (51%)	14 (14%)	190 (42%)	0.001

* Cholangitis/cholecystitis/pancreatitis, **Gastroenteritis, diverticulitis, ***Cellulitis, diabetic foot infection, pressure ulcers, necrotizan faciitis, ; ****Intraabdominal abscess, liver abscess, pancreatic abscess, renal abscess, peritonitis etc.; ****Influenza, persistent central venous catheter-related infection, septic arthritis, unknown source, brucellosis, infective endocarditis.

Table 4: Patients' vital signs and laboratory findings during ED admission.

	Survivors (n=346)	**Non-survivors** (n=102)	**All patients** (n=448)	*p**
Vital signs				
Body temperature (°C)	37.1±1	36.9±0.8	37.1±1	**0.023**
<36 °C	12 (3%)	9 (9%)	21 (5%)	**0.029**
36-37.1 °C	191 (55%)	57 (56%)	248 (55%)	0.498
37.2-37.8 °C	49 (14%)	24 (24%)	73 (16%)	**0.020**
≥37.9°C	92 (27%)	12 (12%)	104 (23%)	**0.001**
Mean arterial pressure (mmHg)	93±17	87±25	92±19	0.061
Heart rate (beat/min)	86±22	91±25	87±22	0.034
Respiratory rate (breaths/min)	22±5	26±8	23±6	**0.001**
Laboratory findings				
White blood cell count (10^3 cells/mm3)	14±14	20±28	15±17	**0.024**
Hemoglobin (g/dL)	12.1±2.3	11.3±2.6	12±2.4	0.005
Platelet count (10^3 cells/mm3)	244±142	214±142	240±126	**0.038**
Activated partial thromboplastin time (sec)	33±19	38±31	34±25	**0.031**
International normalized ratio	1.3±0.6	1.4±0.8	1.3±0.6	**0.003**
Serum glucose level (mg/dL)	156±83	163±96	155±90	0.430
Blood urea nitrogen (mg/dL)	32±24	54±36	37±28	**0.001**
Serum creatinine level (mg/dL)	1.5±1.3	2.2±2	1.6±1.5	**0.001**
Serum alanine aminotransferase (IU)	72±207	106±263	78±211	0.532
Serum aspartate aminotransferase (IU)	58±147	74±187	60±150	0.676
Bilirubin (mg/dL)	1.2±1.4	1.6±2.4	1.4±1.8	0.147
C-reactive protein (mg/dL)	10±8	13±11	10±9	**0.002**
Procalcitonin (ng/mL)	2±5	6±13	2.8±8	**0.001**
Lactate (mg/dL)	16±12	27±26	18±17	**0.001**
pH	7.41±0.08	7.35±0.1	7.40±0.1	**0.001**
pCO_2 (mmHg)	34±11	34±12	35±11	0.431
pO_2 (mmHg)	67±12	64±11	67±12	**0.009**
HCO_3 (mEq)	23±5	20±6	22±5	**0.001**
O_2 saturation (%)	92±7	89±7	91±7	**0.001**

*p values for comparisons between the surviving and non-surviving groups.

Table 5: Culture results for all patients which was took during ED evaluation

	Survivors (n=345)	**Non-survivors** (n=103)	**All patients** (n=448)	***p****
Lower respiratory tract culture	**17 (5%)**	**11 (11%)**	**28 (6%)**	0.120
Pseudomonas aeruginosa	10 (3%)	3 (3%)	13 (3%)	
Klebsiella pneumonia	5 (2%)	4 (4%)	9 (2%)	
Staphylococcus aureus	1 (0.3%)	1 (1%)	2 (0.4%)	
MRSA	1 (0.3%)	1 (1%)	2 (0.4%)	
E. coli	0 (0%)	2 (2%)	2 (0.4%)	
Urinay culture	**70 (20%)**	**23 (22%)**	**93 (21%)**	0.374
E. coli	47 (14%)	7 (7%)	54 (12%)	
K. pneumonia	11 (%3)	7 (6%)	18 (4%)	
Candida albicans	1 (0.3%)	3 (3%)	4 (1%)	
P. aeruginosa	4 (1%)	2 (2%)	6 (1%)	
E. coli (ESBL +)	4 (1%)	2 (2%)	6 (1%)	
Proteus mirabilis	2 (0.6%)	2 (2%)	4 (1%)	
Enterobacter species	1 (0.3%)	0 (0%)	1 (0.2%)	
Blood culture	**29 (8%)**	**6 (5%)**	**34 (8%)**	0.398
E. coli	18 (5%)	2 (1%)	20 (4%)	
E. coli (ESBL +)	2 (0.6%)	1 (1%)	3 (0.6%)	
K. pneumonia	3 (1%)	1 (1%)	4 (1%)	
MRSA	1 (0.3%)	1 (1%)	2 (0.4%)	
P. aeruginosa	1 (0.3%)	0 (0%)	1 (0.2%)	
S. aureus	2 (0.6%)	1 (1%)	3 (0.6%)	
S. pneumonia	1 (0.3%)	0 (0%)	1 (0.2%)	
Salmonella spp.	1 (0.3%)	0 (0%)	1 (0.2%)	
Skin/soft tissue	**5 (1%)**	**5 (5%)**	**10 (2%)**	0.055
MRSA	0 (%0)	1 (1%)	1 (0.2%)	
P. aeruginosa	3 (1%)	2 (2%)	5 (1%)	
S. aureus	1 (0.3%)	1 (1%)	2 (0.4%)	
S. pyogenes	1 (0.3%)	1 (1%)	2 (0.4%)	
Cerebrospinal fluid culture	**2 (0.6%)**	**1 (1%)**	**3 (0.6%)**	0.544
N. menengiditis	1 (0.3%)	0 (0%)	1 (0.2%)	
S. pneumonia	1 (0.3%)	1 (1%)	2 (0.4%)	

MRSA: Methicillin-resistant Staphylococcus Aureus; ESBL: Extended-spectrum beta-lactamase

infectious disease in our study, followed by urinary tract infections (USI) and hospital-based infections (HBI), aligning with trends observed in long-term care facilities and home health settings (12). Our analysis uncovered an association between mortality and healthcare-associated infections, particularly pneumonia. Diagnosing infectious diseases in the elderly poses a challenge for emergency physicians due to atypical signs, limited patient articulation of concerns, and diminished comprehension levels, compounded by the exacerbation of underlying conditions.

Table 6: Results of multivariate cox-regression analysis

	p	HR	95% CI
Lactate (mg/dL)	0.001	1.03	1.01-1.04
Blood urea nitrogen (mg/dL)	0.001	1.02	1.01-1.03
Serum creatinine level (mg/dL)	0.001	1.47	1.18-1.84
Deterioration in general health status	0.012	1.79	1.13-2.83
Sepsis	0.044	1.65	1.01-2.67
Septic shock	<0.001	3.48	1.65-7.31
Respiratory failure	<0.001	4.10	2.26-7.45
Renal failure	0.005	2.59	1.34-5.03
Cardiovascular failure	<0.001	3.29	2.19-6.74
Multiple organ failure	0.005	2.22	1.27-3.89
MEDS score	0.001	1.11	1.05-1.17

CI: Confidence Interval; HR: Hazard Ratio

Subtle changes resulting from infections in the elderly, coupled with non-specific symptoms, further complicate the diagnostic process. Common symptoms identified in this study included shortness of breath, generalized weakness, fever, and anorexia. Notably, fever, a vital sign in infectious disease diagnosis, may be absent in up to one-third of infected elderly patients. Studies suggest redefining fever criteria for frail older adults to capture subtle temperature changes as a potential indicator of infection (13). Despite fever complaints being prevalent on admission, a significant proportion of patients, especially in the survivor group, did not exhibit fever in the emergency department, potentially delaying diagnosis and treatment. Multiple chronic diseases, multidrug therapy, and a history of hospitalization and antibiotic use emerged as critical factors complicating infections in the elderly (14,15). The aging process, coupled with chronic diseases, heightens susceptibility to infections, making them a leading cause of hospitalization and mortality in the elderly (16,17). Emergency services utilization is higher among the elderly, and they are prone to adverse outcomes post-emergency visits. Infections rank among the top causes of death and hospitalization in individuals aged 65 and older (18). Given the unique characteristics of the geriatric patient population, emergency physicians must tailor their approach, recognizing non-specific symptoms, severe disease presentations, and the presence of resistant microorganisms.

Conclusion

Upon initial presentation to the emergency department, factors such as inadequate control of pCO2, low HCO3 levels, septic shock symptoms, and comorbidities (heart

disease, malignancy, COPD/Asthma) were identified as risk factors contributing to mortality. Timely intervention following the onset of sepsis and septic shock, along with organ immunity, significantly influences hospitalization duration and mortality. Calculating MEDS score and APACHE 2 score at admission to the emergency department and intensive care unit can facilitate early intervention, improving recovery prospects. Further research and clinical strategies may benefit from these identified predictors to improve the management and outcomes of elderly patients with infectious diseases in the ED.

References

1. Mathers CD, Stevens GA, Boerma T, White RA. Tobias MI. Causes of international increases in older age life expectancy. Lancet 2015;385:540-548
2. Scannapieco FA, Cantos A. Oral inflammation and infection, and chronic medical diseases: implications for the elderly. Periodontol 2000. 2016;72(1):153–175.
3. Fabbri LM, Luppi F, Beghe B, Rabe KF. Update in chronic obstructive pulmonary disease 2005. Am J Respir Crit Care Med 2006;173:1056–1065.
4. Heppner HJ, Cornel S, Peter W, Bahrmann P, Singler K. Infections in the elderly. Crit Care Clin 2013;29:757–74
5. Bunawan NC, Rizka A. "Diagnostic and Prognostic Value of Procalcitonin for Bacterial Infection in the Elderly." International Journal of Medical Reviews and Case Reports 2021;5(8):14
6. Landi F, Calvani R, Tosato M, Martone AM. Ortolani E, Savera G, Sisto A. Marzetti E. Anorexia of aging: Risk factors, consequences, and potential treatments. Nutrients 2016;8:69
7. Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale. Lancet 1974;2:81-84
8. Shapiro NI, Wolfe RE, Moore RB, Smith E, Burdick E, Bates DW. Mortality in Emergency Department Sepsis (MEDS) score: a prospectively derived and validated clinical prediction rule. Crit Care Med. 2003;31(3):670–5.
9. Ittisanyakorn M, Ruchichanantakul S, Vanichkulbodee A, et al.. Prevalence and factors associated with one-year mortality of infectious diseases among elderly emergency department patients in a middle-income country. BMC Infect Dis. 2019;19:662
10. Goto T, Yoshida K, Tsugawa Y, Camargo CA, Jr, Hasegawa K. 2016. Infectious disease-related emergency department visits of elderly adults in the United States, 2011-2012. J Am Geriatr Soc 64:31–36
11. Holman RC, Curns AT, Singleton RF, et al. Infectious disease hospitalizations among older American Indian and Alaska Native adults. Public Health Rep. 2006;121(6):674–683
12. da Silva NCZ, da Rocha JA, do Valle FM, Silva ASDN, Ehrlich S, Martins IS. The impact of ageing on the incidence and mortality rate of bloodstream infection: A hospital-based case-cohort study in a tertiary public hospital of Brazil. Trop Med Int Health. 2021;26(10):1276–84.
13. Schoevaerdts D, Sibille F-X, Gavazzi G. Infections in the older population: what do we know? Aging Clin Exp Res. 2021;33(3):689–701.
14. Singhal S, Kumar P, Singh S, Saha S, Dey AB. Clinical features and outcomes of COVID-19 in older adults: a systematic review and meta-analysis. BMC Geriatr. 2021;21(1):321
15. Mukherjee K, Burruss SK, Brooks SE, May AK. Managing infectious disease in the critically ill elderly patient. Current Geriatrics Reports. 2019;8:180-193
16. McLeod JC, Stokes T, Phillips SM. Resistance exercise training as a primary countermeasure to age-related chronic disease. Front. Physiol. 2019;10:645
17. Gavazzi G, Krause KH, Ageing and infection. The Lancet Infect Dis 2002; 2(11):659-66.
18. High KP. Infection as a cause of age-related morbidity and mortality. Ageing Research Reviews 2004;3(1):1-14.