

**ABSTRACT**

Infections are common cause of morbidity and mortality in older patients despite advances in antibiotic therapy. They account for one third of all deaths in people of 65 years and older. As the population of older adults increase the clinicians are seeing increasing number of cases of infectious diseases in older adults – particularly nosocomial and health-care associated infections. Early detection of infection can be difficult in older adults due to the frequent absence of typical signs and symptoms. The absence of fever does not exclude infection, the absence of respiratory symptoms does not exclude pneumonia and without dysuria there can be UTI. Instead of classic symptoms of infection older adults may present with confusion, delirium, anorexia, falls and general decline in functional status. Estimated 90% of deaths in pneumonia occurs in people 65 years and above. Mortality resulting from influenza primarily occur in elderly and UTI is the most common of bacteraemia in older adults. Tuberculosis and HIV infection is very difficult to treat in older patients because of their low immunity and organ dysfunction. Tropical disease like malaria and diarrhoea become most fatal in this age group. Therefore physicians should be most careful while treating elderly people with infection.

**INTRODUCTION**

Despite advances in antibiotic therapy infectious diseases continue to be a major cause of mortality in older adults. The diagnostic and therapeutic advances of managing infections in older adults create special challenges for physicians, still then early diagnosis and treatment in these patients are essential because of higher incidence of morbidity and mortality. Many signs and symptom of infection that are common in younger adults particularly fever and leucocytosis present less frequently or not at all in older adults<sup>1</sup>. While 60 percent of older adults with serious infections develop leucocytosis, its absence does not rule out infectious process. Because frail old adults found to have poor body temperature response, elevations in body temperature of 1.1°C from their normal base line temperature should be considered a febrile response.

Changes caused by infection in the elderly are subtle and nonspecific complaints may be the only sign of infection. Elderly patients with infection may present with cognitive impairment or a change in mental status, frank delirium occurs in 50% of older adults with infections. Further move anorexia, functional decline, falls, weight loss or

a slight increase in respiratory rate may be only sign indicating infection in older patients.

Demographic picture in developing countries<sup>2</sup> : Demographic aging is now well established and the elderly population (age >65yrs ) will exceed 1 billion persons in 2030. At present the proportion of elderly persons in developed countries are much more than the same population in developing countries but this proportion is changing. This fast changing pace in demographic structure results from phenomenon called demographic transition in which the successive or concomitant reduction in the death and birth rates results in the former boosting population size and the latter increasing the proportion of elderly individuals. At present the increase in elderly population of developing countries is dramatically faster than the increase observed in the industrialised countries. Because aging is associated with higher prevalence of chronic and debilitating disease leading to disability, healthcare needs will be increased among the aging population and will place more pressure on the already constrained healthcare resources of developing countries.

What is the role of infection in the death of elderly individuals? Statistics from the WHO suggest that in Europe and United states is 5% of population > 60 years old will die as a consequences of infection compared with 20% in Africa. In the developing world the infectious diseases of death are respiratory infection, diarrhoeal disease, tuberculosis, malaria and AIDS, which together represent >90% of deaths. The remaining 10% are due to tropical disease and various other infections. In industrialised countries respiratory tract infections, bloodstream infections, urinary tract infections and infections of digestive system represent 90% of infection related deaths, other disease such as tuberculosis, hepatitis B and C, diarrhoeal disease and AIDS represents nearly all remaining 10%. As already stated by Kalache in 1996, many infectious diseases “no longer kill but neither do day die”. This aphorism is also reminds that the impact of infectious diseases should not be only measured by mortality rate, but also morbidity and quality of life, particularly in the aging population. These parameters are much more difficult to access objectively, but understanding them will be increasingly important in the future.

**BACTERIAL PNEUMONIA**

Pneumonia and influenza combined are the 6<sup>th</sup> leading cause of death in United States, and 90% of these deaths

**Table 1: Empirical antibiotic therapy for community acquired pneumonia****Out Patients**

1. previously healthy and no antibiotic in past 3 months.
  - clarithromycin or azithromycin, Doxycycline
2. comorbidities and antibiotic in past 3 months
  - moxifloxacin or levofloxacin or gemifloxacin
  - Amoxicillin clavulunate or ceftriaxone or cefpodoxime plus macrolide.

**In patient, Non ICU**

1. parenteral moxifloxacin or levofloxacin
2. parenteral ceftriaxone, ampicillin, cefotaxime, ertapenem plus macrolide

**In patient ICU**

1. ceftioioxone, ampicillin -sulbactam, cefotaxime + azithromycin or fluroquinolon

**Special Concerns**

- a. Pseudomonas –piperacillin –Tazobactam, cefipime, impenem, meropenem plus Ciprofloxacin or levofloxacin
- b. Betalactam +amioglycoside +azithromycin
- c. Betalactam + aminoglycoside + antipneumococcal fluroquinolone

CA-MRSA: Linozolid or Vancomycin

**Empiric Antibiotic Treatment for health care associated Pneumonia**

Patients without risk factor for MRD pathogens

- Ceftriaxone or Cefotaxime
- Moxifloxacin, ciprofloxacin or levofloxacin
- Ampicillin /sulbactam
- Ertapenem

Patients with risk factors for MRD pathogens

1. A Beta-lactam, Ceftazidime or cefipime or piperacillin /tazobactam or Imipenem or merepenem plus
2. Gram negative coverage, Gentamycin or tobramycin or amikacin, Ciprofloxacin or levofloxacin plus
3. Gram +ve coverage. Linozolid or vancomycin

occur in the adults 65years and older. Changes in the pulmonary reserve, decrease cough reflex, decrease elasticity of alveoli and poor ventilation, all of which lead to diminished cough and airway patency-cause older adults susceptible to pneumonia. Because the diagnosis of pneumonia in older adults is difficult to make since the signs and symptoms can be subtle, the initiation of antibiotics therapy is often delayed, which may

contribute to higher mortality rates. Diagnosis is made by gram- stain and culture and radiological examination of chest. Besides urinary antigen test for Legionella, PCR, IgM serology, CRP and procalcitonin tests are also done for pneumonia. Regardless of the age bacterial causes of pneumonia can only be identified in 20% – 50 % of patients. In the absence of specific bacterial etiology, pharmacotherapy of pneumonia is initially empiric and directed at likely causative pathogens. In older patients viruses, Hemophylus influenzae, gram negative bacilli and Staphylococcus aureus, Moraxilla catarrhalis, Legionella and Mycoplasma are less common but important causes of pneumonia in elderly because the bacterium may not be covered by traditional empiric antibiotic regimens. Gram negative bacteria are responsible for more infection in elderly than younger adults. Therefore in older patients empiric antibiotic therapy should include the coverage for gram +ve and gram -ve and atypical organism. (Table 1 summerises the option for initial antibiotic therapy for pneumonia).

In addition to the choice of antibiotic adequate hydration and oxygenation must also be assured. The duration of treatment for S. pneumonia is 10 days but the gram -ve and a typical organism long duration treatment is required.

**INFLUENZA**

It is a common respiratory infection that has enormous impact world wide and causes significant morbidity and mortality in older adults. Of deaths resulting from influenza, 80%-90% occur in adults 65 years and older. Older adults can benefit most from vaccination, early detection and aggressive therapy. The signs and symptoms of influenza infection in older adults are similar to those occurring in younger patients, again a febrile response may be absent. It is typically associated with headache, fever chills, muscle aches, malaise, cough and sore throat. Older adults may develop persistent weakness for longer period and risk of complications such as pneumonia are high. Diagnosis is done by RT-PCR, RIDTS, C Rapid influenza diagnostic test, virus culture in tissue and antibody titre in paired sera. Four antiviral agents available and approved for prevention and treatment-Amantadine, Rimantadine, Zanamivir and Oseltamivir. They must be taken within 48hrs of onset of symptoms. Janamivir and oseltamivir are not approved for prophylactic use. These type of drugs also require dosage modification in elderly persons with renal impairment.

**TUBERCULOSIS**

The low disease fighting capacity of elderly patients which is partially attributable to deregulation of immune system and greater secretion of macrophage pro-inflammatory cytokines in response to antigenic challenge also leads to greater or longer lasting metabolic changes in this population<sup>3</sup>. Whilst no change was found in T-cell function in very healthy elderly individuals without nutritional deficit, micronutrient deficiency has

370 been shown to lower immunity resulting in susceptibility to infection.

The incidence of tuberculosis is increasing in developing countries. The presentation is atypical with more disseminated disease and more frequent lower lobe involvement in case of pulmonary tuberculosis. Drug induced hepatitis and infection with other drugs may be relevant problems. The difficulty faced by the elderly population in obtaining access to health care may lead to an exclusion from treatment. In Taiwan rates of drug resistance have been found in elderly population that are higher than general population.

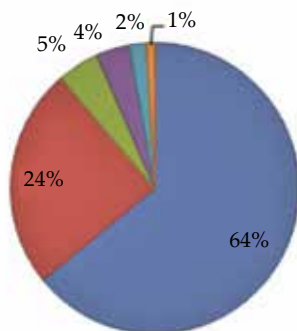
### URINARY TRACT INFECTION IN ELDERLY

UTI is one of the most prevailing causes of infectious diseases among the geriatric population in both genders. Due to their anatomy and reproductive physiology, women are more susceptible. However between females and males the ratio varies from geriatric( 50:1) to younger( 2:1) population. Previous studies showed that UTI is often erroneously diagnosed with around 40% of hospitalised elderly admissions due to nonspecific symptoms. UTI was caused due to urinary urinary incontinence previous history, urogenital surgery and diabetes mellitus<sup>4</sup>. In the study conducted in South India by R. K. Venkatesh et. al<sup>5</sup> (2016), 106 patients had UTI. Diabetes and hypertension were the most common co- morbidities. Urine culture and sensitivity was done and 50 patients had culture positivity (Table 2) and sensitivity pattern as per (Table 3). The clinical outcome of UTI treatment patients is accordingly to Figure 1. This study clearly suggests that E coli is the common organism of UTI in elderly and the prefer use of antibiotics according to the sensitivity pattern improves outcome. In a study conducted in Tamil naidu in three medical colleges the risk factors among subjects with UTI was as per Table 4.<sup>6</sup> Careful attention should be paid to appropriate dosing in the elderly. Renal impairment is common in this age group and often unrecognized. So the calculated GFR should be determined in all patients and the dosage adjustment of various drugs should be done<sup>7</sup>.

### SKIN INFECTION

Herpes zoster: Infection with herpes zoster caused by

■ Improved ■ Stable ■ DAMA ■ DARA ■ Died ■ Worsened



DARA-Discharged against referral advice  
DAMA-Discharged against medical advice

Fig. 1

a reactivation of varicella virus dormant in dorsal root ganglia is also common in older adults. As cellular immunity wanes with advancing age, clinical reactivation of virus can occur. The hall mark herpes zoster is skin lesions that progress from discrete patches of erythema to grouped vesicles in a dermatomal pattern that postulate and crust within 7 to 10 days. Diagnosis of suspicious lesions can be confirmed by giant cells noted on Tzank test preparation of lesion scrapings, DNA –PCR or a positive viral culture of vesicular fluid. Pain is the most common symptom associated with herpes zoster, and it can be debilitating in frail elderly patients. Post herpetic neuralgia develops in 10-70% of the patients and can be difficult to treat. In immune-compromised patients there may be cutaneous dissemination, pneumonitis, meningo- encephalitis, transverse myelitis and other serious complication. Immune- competent patients can be treated with oral acyclovir at a dosage of 800mg five times daily for 7-10 days. However valacyclovir and famcyclovir are superior in terms of pharmacokinetics and pharmacodynamics and should be used preferentially. Famcyclovir is given at a dose of 500mg three times for 7days. Valacyclovir is given at a dose of 1gm three times for 5-7days. In severely immune-compromised patients the treatment should be started with IV acyclovir which prevents the occurrence of visceral complications. The dose is 10mg/kg 8hourly for 7 days. Acute neuritis and post herpetic neuralgia can be treated with gabapentin, pregabalin, amitriptyline hydrochloride, lidocaine (patches) and flufenazine hydrochloride. In one study glucocorticoid therapy administered early in the course of herpes zoster significantly accelerated the quality of life and reduced the analgesic medication<sup>8</sup>.

Methycillin resistant Staphylococcus aureus: MRSA present a major problem for elderly patients especially those in the institutional settings. The most common reservoir of MRSA colonization are nasal mucosa and oropharynx. Skin contamination from persons already colonised in these areas may also be source of MRSA infection. Vancomycin is the drug of choice for MRSA infection. Older adults require dosage adjustment basing on their renal function. Staffs and patients who are MRSA carriers should be isolated and topical mupirocin should be applied to the colonised areas. The following table shows the MRSA therapeutic option.

### MRSA PREVENTION

1. Carefull hand washing
2. Isolation of infected patients.
3. Removal of colonized catheters
4. Eradication of nasal carriage with mupirocin

### ORAL THERAPY FOR MILD INFECTIONS

1. clindamycin
2. TMP-SMX
3. minocyclin
4. Doxycycline

**Table 2: Most prevalent organisms in Urinary tract infections**

Type of microbe	Organism	Number of isolates	Percentage of isolates
Gram Negative bacteria (66%)	E coli	24	48
	Klebsiella pneumonia	5	10
	Pseudomonas aeruginosa	2	4
	Serratiasps	1	2
	Citrobacterkoseri	1	2
	Enterococcus sps	8	16
Gram Positive bacteria (28%)	MRSA	3	6
	Staphylococcus aureus	2	4
	MSSA	1	2
Fungus (6%)	Candida sps	3	6
	Total	50	100

**Table 3: Sensitivity pattern of the antibiotics used in UTI patients**

Antibiotic	Sensitive	(%)	Resistance	(%)
Netilmicin	24	100	0	0
Amikacin	24	100	0	0
Imipenem	22	100	0	0
Cofeperazone-Sulbactam	21	95.5	1	4.5
Piperacillin-Tazobactam	17	77.2	5	22.8
Gentamicin	14	58.3	10	41.7
Cotrimoxazole	6	25	18	75
Norfloxacin	3	15	17	85
Amoxicillin-Clavulanic acid	2	8.3	22	91.7
Ampicillin/Amoxicillin	2	8.3	22	91.7
Cefotaxime/Ceftriaxone	2	8.3	22	91.7
Cefuroxime	2	8.3	22	91.7
Cefpirome, Cefepime	1	4.5	21	95.5
Aztreonam	0	0	22	100
Ticarcillin-Clavulanic acid	0	0	14	100
Cefazolin/Cefodroxil	0	0	4	100
Ciprofloxacin/Levofloxacin	0	0	4	100

**Table 4: Frequency of risk factors among the subjects with UTI**

Risk factor	Culture positive		Culture negative	
	No.	%	No.	%
Diabetes	14	50%	21	29.10%
Catheterisation	12	42.80%	21	29.10%
Renal stones	8	28.50%	7	9.70%
Immuno suppression	5	17.80%	15	20.80%
Incontinence	6	21.40%	14	19.40%
None of the above	3	10.70%	25	34.70%

5. linezolid, tedizolid

3. Tecoplanin

**FOR SERIOUS INFECTION, PARENTAL THERAPY**

1. Vacomycin

4. Ceftaroline

2. Daptomycin

5. Tedizolid

6. Dalbavamcin

**Table 5: Management of infections caused by VRE****Endovascular Infections**

1. Daptomycin +Aminoglycoside
2. Qunupristin –dalfopristin+another active agent
3. Linozolid
4. High dose ampicillin +Aminoglycoside

**Non endovascular bacteremia**

1. High dose daptomycin +another agent +aminoglycoside
2. Quinupristin + Dalfopristin+another active agent
3. Linozolid

**Meningitis**

1. Linozolid+CSF penetrating active agent
2. Q/D +another active agent
3. High dose daftomycin +CSF penetrating active agent

**UTI**

1. Fastomycin
2. Nitrofurantoin
3. Ampicillin or Amoxicillin

**VANCOMYCIN RESISTANT ENTEROCOCCI**

VRE present a major problem in old patients especially when an outbreak occurs in institutional settings. They are the 2<sup>nd</sup> most common organism in nosocomial urinary tract and wound infection and 3<sup>rd</sup> most common cause of nosocomial bacterium in United States. They have become resistant to vancomycin since 1988 leading to high mortality. Because of the high level of antibiotic resistance prevention of outbreaks and spread of VRE is crucial. The following table 5 shows the management of infection caused by VRE.

**AIDS**

The number of elderly patients with HIV infection is increasing throughout the world. In industrialised countries patients aged >50years account for 10-15% of HIV infection. In developing countries the incidence

is low(5-10%). The route of infection is homosexual transmission and nosocomial infection plays a major role. They have a short survival than the younger population. They are also many times deprived of adequate medical care.

**MALARIA**

Malaria is a major cause of morbidity and mortality in elderly population. Higher parasite loads and higher proportion of severe forms have been reported to be associated with malaria among elderly individual without immunity as compared with younger adult population. In various studies in endemic area it was seen that in severe malaria in elderly, fever was absent in 40% of cases, co-infection with other organism was present in 40% with the overall mortality higher.

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