ORIGINAL RESEARCH PAPER

General Medicine

A COMPARATIVE STUDY OF ANTIMICROBIAL SUSCEPTIBILITY OF E. COLI AMONG NONELDERLY VERSUS ELDERLY PATIENTS WITH URINARY TRACT INFECTION IN A TERTIARY CARE HOSPITAL.

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ABSTRACT

Introduction: As there is rise in the elderly population, there is increase in the geriatric illnesses, urinary tract infection is one of the commonly seen among them. There is increasing prevalence of antibiotic resistance in the elderly patients. **Aim:** Study was conducted to look for the difference in antibiotic susceptibility in nonelderly compared to elderly patients. **Material and methods:** We took 100 cases with 50 elderly and 50 nonelderly with E.coli grown in urine samples with features of urinary tract infection. **Results:** There was no significant difference in the antibiotic susceptibility in both the groups except for the cefepime being good choice in nonelderly amongst cephalosporins. Amongst oral antibiotics to choose empirically are Nitrofurantoin, Cotrimoxazole and Amoxycillin in both the groups with no significant differences. **Conclusions:** We can use all the groups of antibiotics empirically especially injectables like Cephalosporins, Piperacillin, Aminoglycosides and Carbapenems as and when indicated in both groups with almost equal results. But we need to take a prospective study with larger number of cases to arrive at a more definitive conclusion.

INTRODUCTION

With the increasing life expectancy and better health care facilities, the number of elderly people is increasing all over the world.

As per 'national policy on older persons-january-1999' and' Maintenance and Welfare of Parents and Senior Citizens Act, 2007, a senior citizen or elderly means any person who is a citizen of India, and who has attained the age of 60 years or above. The comorbid conditions, low immunity, high chances of infections are common in elderly persons as compared to the nonelderly. These lead to increased morbidity, length of stay and mortality if not taken care at the right time with the right medications.

Urinary tract infection (UTI) is a common problem in our day-to-day clinical practice especially in the background of associated conditions like diabetes mellitus, age, female sex, pregnancy, catheterization etc. Out of the various gram-negative bacteria causing UTI, Escherichia coli is the commonest organism (70-95%) encountered -[1].

The time to report a urine culture may take as long as 24-48 hours and the patient may need antibiotic therapy as early as possible depending upon the clinical scenario. Hence, we must start an empirical antibiotic based on our local antibiogram and the protocol. Indiscriminate and unnecessary use of antibiotics have produced multidrug resistant organisms leading to failure of most of the oral and parenteral antibiotics-[2] It is not uncommon to see multidrug resistant (MDR) E. coli in all the age groups but is more common in case of the elderly population as noted in various studies.[3,4]

The microorganism may show different levels of drug sensitivity in the young and elderly population in which case the selection of antibiotic as an empirical therapy may be difficult. In a Korean study [5] there was comparison between the elderly and nonelderly showing antimicrobial susceptibility of Enterobacteriaceae isolated from the elderly or non-elderly women with community-acquired non-obstructive acute pyelonephritis. We have undertaken this study which includes patients with urinary tract infection irrespective of the site affected with E. coli positive urine culture and the susceptibility pattern. A direct comparison was done between elderly and nonelderly patients with respect to comorbidities, antibiotic susceptibility, and multidrug resistance. To the best of our knowledge there is no such article previously published and hence we took this as a pilot project.

AIM

To compare the antimicrobial susceptibility of E. coli in nonelderly with the elderly patients with urinary tract infection.

MATERIALS AND METHODS

Total 100 patients were included in the study over a period of one year and were divided into nonelderly and elderly groups taking 50 cases in both the groups. This is a retrospective comparative study which was taken as a pilot project. For analysis midstream first morning samples were taken with due precautions to avoid contaminations. Identification of isolates was done by inoculation on CLED (Cysteine lactose electrolyte deficient) agar and the antibiotic susceptibility was tested by Vitek 2 system.

Inclusion Criteria:
1. Patients admitted with symptoms of UTI.
2. Age >18 years.
3. Urine culture positive with E. coli.

Exclusion Criteria:
1. Age < 18 years
2. Contaminated urine samples
3. Mixed microbial growth

We used SPSS version 27 to analyse the data. Chi square test was used to calculate p values and if it was less than 0.05 the result was considered statistically significant.

Table 1: Age Group Distribution

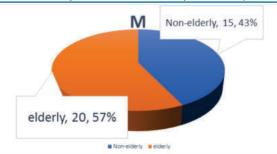| Age group (years)	Nonelderly (n=50)	Age group (years)	Elderly (n=50)
<20	0		
20-29	8	60-70	18
30-39	10	71-80	28
40-49	14	>80	4
50-59	18		

Figure 1: distribution Of E.coli Positive Urinary Tract Infections In Male Patients
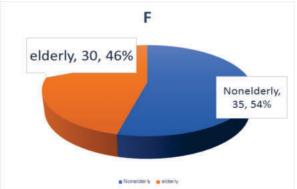

Figure 2: Distribution of E.coli positive urinary tract infections in female patients

Table 2: Association Of Comorbidities In Nonelderly Versus Elderly Patients

Co-morbidity (n=65)	Nonelderly-%(n)	Elderly-%(n)	p-value
Diabetes mellitus	34% (17)	60% (30)	0.009
Hypertension	44% (22)	56% (28)	0.230
Obstructive airway disease	16% (8)	22% (11)	0.053
Hypothyroidism	20% (10)	20% (10)	1.000
Nephropathy	14% (7)	24% (12)	0.202
Cerebrovascular accident	10% (5)	14% (7)	0.538
Psychiatric illness	8% (4)	12% (6)	0.504
Chronic heart failure	16% (8)	20% (10)	0.602
Anaemia	44% (22)	52% (26)	0.423
Prostatomegaly	10% (5)	18% (9)	0.249
Bedridden status	4% (2)	18% (9)	0.025
Catheterized bladder	4% (2)	16% (8)	0.045
Malignancy	4% (2)	10% (5)	0.239
Renal/ureteric stones	8% (4)	14% (7)	0.337
Chronic liver disease	4% (2)	6% (3)	0.646

Table 3: Antibiotic Susceptibility In Nonelderly Versus Elderly Patients-

Antibiotics susceptibility	Nonelderly %(n)	Elderly %(n)	p-value
Ampicillin	4% (2)	8% (4)	0.399
Amoxycillin	56% (28)	46% (23)	0.317
Cotrimoxazole	52.2% (24)	42% (21)	0.546
Cefuroxime	10% (5)	14% (7)	0.538
Ciprofloxacin	14% (7)	10% (5)	0.538
Nalidixic acid	4% (2)	2% (1)	0.557
Nitrofurantoin	72% (36)	70% (35)	0.825
Ceftriaxone	44% (22)	32% (16)	0.216
Cefipime	70% (35)	50% (25)	0.041
Cefoperazone +Sulbactam	78% (39)	76% (38)	0.812
Piperacillin +Tazobactam	76% (38)	74% (37)	0.817
Amikacin	96% (48)	86% (43)	0.080
Gentamycin	64% (32)	74% (37)	0.279
Imipenem	86% (43)	82% (41)	0.585
Meropenem	88% (44)	80% (40)	0.275
Ertapenem	86% (43)	84% (42)	0.779
Colistin	98% (49)	96% (48)	0.557

Table 4: Prevalence Of MDR Strain In Nonelderly And Elderly Irrespective Of Comorbid Conditions-

Resistance type	Nonelderly %(n)	Elderly % (n)	p-value
Non MDR	24% (12)	24% (12)	1.000
MDR	76% (38)	76% (38)	

Table 5: Prevalence Of MDR Strain In Nonelderly And Elderly With Comorbid Conditions-

Comorbidities	Nonelderly (n)	MDR	Elderly (n)	MDR	p-value
More than 3	8	8	10	10	
3	6	5	9	9	
2	10	8	12	9	0.020
1	4	2	6	4	
None	22	15	13	6	

RESULTS

Of the total cases (n=100), a female preponderance (figure 1 and 2) was noted in both nonelderly and elderly groups with ratio of 2.3 and 1.5 respectively. Maximum cases were seen in the age group 40-49 and 50-59 years (n=14 and 18) in the nonelderly and 70-79 and 60-69 years (n=28 and 18) in the elderly persons (table 1).

There were associated illnesses in many of these patients. Most of the patients had more than three (n=18), three (n=15) and two (n=22) comorbid conditions (table 5). From the table-2 we saw hypertension(n=50), diabetes mellitus(n=47), anaemia(n=48), hypothyroidism (n=20) and nephropathy (n=19) were common ones. Statistically significant correlation between the two groups and the comorbidities with p-value <0.05 was noted in those with diabetes mellitus, foleys' catherization and fracture with bed ridden status.

Looking at the antibiotic susceptibility in the two groups (table 3), it was noted that Ampicillin, Ciprofloxacin, Nalidixic acid and Cefuroxime were least effective (<15%) on E. coli in our study. Susceptibility to Amoxycillin was seen in 56% and 46% and to Cotrimoxazole, was seen in 52% and 42% cases in the nonelderly and the elderly group respectively. As noted, Nitrofurantoin (with the >80% effectiveness) was the best oral antibiotic while amongst the injectables Cefoperazone with Sulbactam and Piperacillin with Tazobactam were effective in more than 75% patients of both the groups. Susceptibility to the three Carbapenems (Imipenem, Meropenem and Ertapenem) was seen in more than 80% cases with no statistically significant difference between the two groups. The only antibiotic in the list with a significant difference (p-value<0.05) was noted with Cefepime being 20% less effective in elderly than nonelderly patients. Susceptibility to Amikacin and Gentamicin were found to be 96% and 64% in nonelderly while it was 86% and 74% in elderly. Highest susceptibility was noted to Colistin with 98% and 96% in both the groups respectively. The MDR E. coli was seen equally (76%) in both the groups that was three times more than the non MDR (table 4). Elderly with comorbid conditions had significant (p-value < 0.020) association MDR E.coli compared to nonelderly it(table 5).

DISCUSSION

Fast growing concern over the emergence of antibiotic resistant organism more so in the hospital setup has made the clinicians all over the word think twice before they prescribe the antibiotics. With the thought of elderly patients behaving differently to the microorganisms and the antibiotics, we conducted this study to find out whether there is a significant difference in between nonelderly and elderly patients.

There was a female predominance in our study (65%) like other studies which showed a dominance of 62%-72%-[6,7]

Oral antibiotics are easily available and are being utilized to treat infections and, in many instances, even when there is no proper indication. Our study has shown poor sensitivity (<15%) to oral antibiotics like Ampicillin, Ciprofloxacin, and

Cefuroxime while it was 3% ,35% and 32 % in a study by Fatima S, et al-[8]   and 9%,25% and 8% in another study from Southern India- [9]

The common intravenous third generation Cephalosporin prescribed in India is Ceftriaxone but there is resistance to it in 44% and 32% cases in nonelderly and elderly respectively in our study. It was less than that noted by Fatima et al-[8] (58.5%) and Gufran et al -[9](more than 80%) in their studies. There was a big difference from a Korean study [5] that revealed poor susceptibility to Ampicillin (35%), and good to Fluoroquinolone (80%) and Cefuroxime (90%) in both nonelderly and elderly groups. The Fluoroquinolones are preserved for uses in infections other than UTI in Korea which may be a reason for it showing high potency. These differences in India are probably due to non-judicious use of these antibiotics in any type of infection. Susceptibility to third generation Cephalosporins was 89% in one study [10] and 91-97% in the other one [5] while we had it quite lower (32-44%). Cefepime, the 4th generation cephalosporin in the current study depicted 70% and 50% efficacy in nonelderly and elderly patients with a p-value <0.05 showing a way to start it as empirical therapy in nonelderly if indicated. It was 88.6% in a study from US- [10]. The Korean researchers noted susceptibility to be 96.3% and 92.8% in nonelderly and elderly patients but there was no statistical significance. The aminoglycosides being less commonly used due to nephrotoxicity have good (>85%) susceptibility patterns in most of the studies including ours. [11]. Hence it becomes cost-effective in those with no renal compromise though in elderly due precautions must be taken. A high-level susceptibility was shown to Colistin, Carbapenems, Cefoperazone/sulbactam, Piperacillin/tazobactam amongst injectables showing good options for those in sepsis or in presence of MDR microorganisms. Susceptibility to Carbapenems was almost 100% in many studies [5,10] but we had it above 85% in nonelderly and 80-84% in elderly patients like studies from North India and Iran- [12,13]

MDR was seen in both the groups with equal prevalence (76%) in our study while in a Mexican cross-sectional study it was 63%- [14]

Almost all those showing resistance to Ampicillin, Ciprofloxacin and Cefuroxime were MDR in our study while another study revealed MDR E.Coli also being resistant to beta-lactams, Aminoglycosides, Fluoroquinolones, Nitrofurans, and Sulfonamides-[7].

The level of MDR amongst the UTI isolates always varies. It was reported to be 7.1% in USA [15]-. and 42% of the UPEC isolates in Slovenia were MDR.[16]

Several studies have shown that age remains an important risk factor of carriage of MDR organisms, independent of other determinants -[17,18,19]

MDR E.coli in urine was significantly associated with comorbidities in elderly patients compared to nonelderly. This was like many other studies due to more virulent behaviour and risk factors in elderly-[20]

When we observed prevalence of MDR in elderly not in relation to comorbidities, there was no significant association.

CONCLUSIONS
Though there is significantly more prevalence of MDR E.coli in elderly patients with comorbid conditions and more resistance to commonly available oral antibiotics in many other studies, we did not find any such significant difference. This may be due to a small number of patients taken for the study. Oral antibiotics to choose empirically are Nitrofurantoin, Cotrimoxazole and Amoxycillin in both the groups. The significant difference of injection Cefepime

being more sensitive in nonelderly with no such difference in other injectables remains unexplained.

Limitations
A study with a large sample in a prospective term may show better conclusions.

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