An appraisal of bacteriological profile and antibiogram patterns among elderly with urinary –tract-infection: A retrospective study

Abstract

Background: A urinary tract infection (UTI) is an infection that can affect any portion of the urinary system (kidneys, ureters, bladder, and urethra). It's worth noting that the majority of UTIs affect the lower urinary tract. This infection has been identified as the most frequent bacterial illnesses, accounting for a significant portion of the workload in microbiological diagnostic laboratories.

UTIs account for 15.5 percent of hospitalizations in individuals over the age of 65, and it has been reported as one of the most common types of infection among the elderly, particularly those in institutionalized care.

Objectives: Our aim was to retrospectively appraise and evaluate the bacteriological profile and antibiogram patterns in elderly adults visiting our private healthcare center.

Methods: The retrospective survey was conducted on elderly patients who visited the hospital within the period of three years (October 2018- October 2021). Questionnaire designed was used to collect data from the Health Information Management unit of the hospital and these information were analyzed using SPSS 20 package with a level of significant set at p-value of < 0.05.

Results: Females made up over 70% of the study participants, while men made up 30.2 percent. A substantial percentage of the elderly (53.8%) between the ages of 60 and 65 had *E. coli* growth as the cause of their UTI. More than a third (33.3 percent) of the elderly between the ages of 60 and 80 had *Staphylococcus* and *Proteus* as the cause of their UTI. The majority of the elderly patients' samples showed *Staphylococcus Aureus* and *E Coli* growth, with E coli growth reported in 33.3 percent and 66.7 percent of male and female participants, respectively, and *Staph. aureus* growth reported in 22.2 percent and 77.8% of male and female participants' urine cultures, accordingly. The majority of the bacteria grown were susceptible to Quinolones and Ceftriazone combination medicine (Ceftriazone + Tazobactan for E. coli and Ceftriazone + Tazobactam/ Sulbactam for *Staphylococcus aureus*), however common hospital antibiotics such as Ceftriazone, Augmentin, Amoxicillin, Cefixime, and cefuroxime were not sensitive to the urine cultured germs.

Conclusion: The rate of UTI in the elderly was relatively high, and antibiotic resistance to routinely administered medicines was surprising. The findings of this study have bolstered the need for comprehensive national control programs to combat antibiotic resistance, as well as the establishment of Geriatric clinics and geriatric public care programs across Nigeria's private and public health institutions, whose responsibility it is to raise awareness about the dangers of UTI and to develop robust treatment plans for the elderly.

Keywords: bacteriological-profile, antibiotic -sensitivity, UTI, elderly

Introduction

Noticeable changes in the aged are common, and these changes might be intrinsic or extrinsic in character, increasing the risk of chronic non-communicable diseases. [1] These chronic diseases vary with age, and in many cases, as people get older, these become a major cause of morbidity and mortality. [1, 2] The aforementioned factors linked to increased aging, changes in immunity, and the use of instrumentation among the elderly have been linked to an increased risk of urinary tract infection among the elderly.[3-4]

Urinary tract infection (UTI) is one of the most common infections in in the elderly.[5-7] It constitutes approximately 25% of all infections in older adults.[5,8] UTI can be broadly defined as an infection of the kidneys, bladder or urethra.

Globally, it has been estimated that the prevalence of UTI among the elderly in non-institutionalized care was 10.9% for men and 14% in women.[9] However, in Nigeria the prevalence of UTI in the elderly have been reported to within the range of 11% - 53%. [10-12] The occurrence of UTI have been reported more among the elderly females because of their short urethra and other associated factors, however, some other studies have reported more UTI infection elderly male. [9,12.]

Common factors and associated conditions that increases chances of UTI in elderly include: hormonal changes, reduction in colonizing lactobacilli causing an increase in vaginal pH, Fecal soiling and poor perineal hygiene neurologic disease (i.e., stroke), fecal impaction, cystocele (in women), incomplete voiding in men and benign prostatic hyperplasia (BPH).[9,13-14]

Furthermore, bacteria that have inhabited the peri-urethral portions of the gastro intestinal tract usually cause urinary tract infections. Gram-negative bacteria such as *E. coli*, *Proteus species*,

Klebsiella species, *Enterobacter species*, and *Pseudomonas* species are the most commonly implicated bacteria. *Staphylococcus aureus Staphylococcus epidermidis* are also among the microorganisms frequently implicated.. [12,15-17]

There is a scarcity of information on the bacterial growth pattern and antibiogram profile of UTI in the elderly who present to non-government institutions. hence this study will bridge this gap by providing the bacteriological profile pattern and sensitivity pattern of the elderly. Furthermore, in order to develop guidelines for better treatment of the elderly with the goal of achieving outstanding results, it is also necessary to identify the common organisms in our hospital that cause UTI and their sensitivity/resistant pattern.

Materials and Methods

Study area

Lily hospital Benin is a multi-bedded hospital established in 2015. The hospital has it's headquarter in Warri, Delta States with branches in other part of Nigeria. The private health institution has a relatively large patient load with a comparatively high number of elderly patient, compared to other private institutions in the South-South Nigeria.

The first class private health care institution offer clinical care, laboratory services, radiological services (MRI, CT scan, X-ray) and occupational health services etc. These services are rendered either on inpatient or outpatient basis. The outpatient clinic is run by consultant family physicians and medical officers in the department of Family Medicine. There are 8 consulting rooms for the following subunits; Emergency room and General outpatient clinic. The clinic is opened 24hours daily including weekends.

Study Design

The study was a hospital based retrospective design.

Study Population

The study population were elderly patients who attended the outpatient clinic of Lily Hospital, Benin City between October 2018 and October 2021.

Study duration

The study exercise was conducted over a period of three months.

Inclusion Criteria

All the elderly patients who visited outpatient clinic during the retrospective review with age 60 years and above with positive bacteria culture tests were included in the study.

Exclusion Criteria

Any elderly patient with a missing information on the electronic medical records were excluded.

Sampling technique

The entire population of the elderly patients who meets the inclusion criteria will be recruited for this study (A general population sampling technique was utilized).

Research Assistants

Research assistants included 6 volunteer health care workers from different units of the hospital. They were trained for 3 days on how to synthesize the data from the hospital patient's records in the hospital health information management department. Additionally, during the three days

training, the research assistants were given a training on the background of urinary tract infection among the elderly.

Study Instruments/Data collection

The data of the elderly were obtained from patient's record in the department of Health Information management of the hospital. The data collected focused on the elderly aged 60 years and above who attended the hospital during the time period under consideration, as well as those who had positive culture tests.

Sample collection and processes

The urine samples were collected using a sterile sample bottles and the urine from the elderly was cultured using a quantitative approach. A calibrated loop was used to cultivate the urine on Cystine-lactose-electrolyte-deficient agar medium. After 24 hours of incubation, gram staining was used to discern positive from negative bacteria, and then a biochemical analysis was utilized to identify the bacterial types and sensitivity patterns.

Data management

Data were entered into a spreadsheet and analyzed using IBM SPSS (statistics product and service solution) version 22. Descriptive data were presented as charts and in frequency distribution tables.

Ethical Considerations

Ethical Approval: Ethical Approval to conduct this research will be obtained from Ethics and Research Committee of Lily Hospital, Warri, Delta State.

Results

One hundred and six elderly with culture-positive UTI were included in the study. Almost 70 percent of the study participants were females while 30.2 percent were females, Table 1.

Table 1: Sex distribution of the elderly

	Frequency	Percentage (%)
MALE	32	30.2
FEMALE	74	69.8

A large proportion (53.8%) of the elderly between the ages of 60-65 had growth of E. coli responsible for their UTI. Greater than one third (33.3%) of the elderly between ages 60-65years and above 80years had *staphylococcus* and *proteus* responsible their UTI(Table 2).

Table 2: Age and bacterial growth pattern among the elderly

BACTERIAL GROWTH	**Age in years**				
	60-65	**66-70**	**70-75**	**76-80**	**>80**
E. COLI	21(53.8%)	2(5.1%)	0(0.0%)	1(2.6%)	15(38.5%)
STAPHYLOCOCCUS AUREUS	15(33.3%)	12(26.7%)	10(22.2%)	7(15.6%)	1(2.2%)
PSEUDOMONAS AERUGINOSA	2(20.0%)	8(80.0%)	0(0.0%)	0(0.0%)	0(0.0%)
PROTEUS SPP	4(66.7%)	0(0.0%)	0(0.0%)	0(0.0%)	2(33.3%)
**OTHERS*	6(100.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)

Others-*Candida, klebsiella, enterococcus

Table 3 showed the sex distribution of UTI by organism, with 77.8% and 66.7% of the total growth of *staphylococcus aureus* and *E. coli* reported in the elderly female while 22.2% and 33.3% were reported responsible for the UTI in males. Other organism (66.7% in males and 33.3% in females) were also responsible for UTI in both sex.

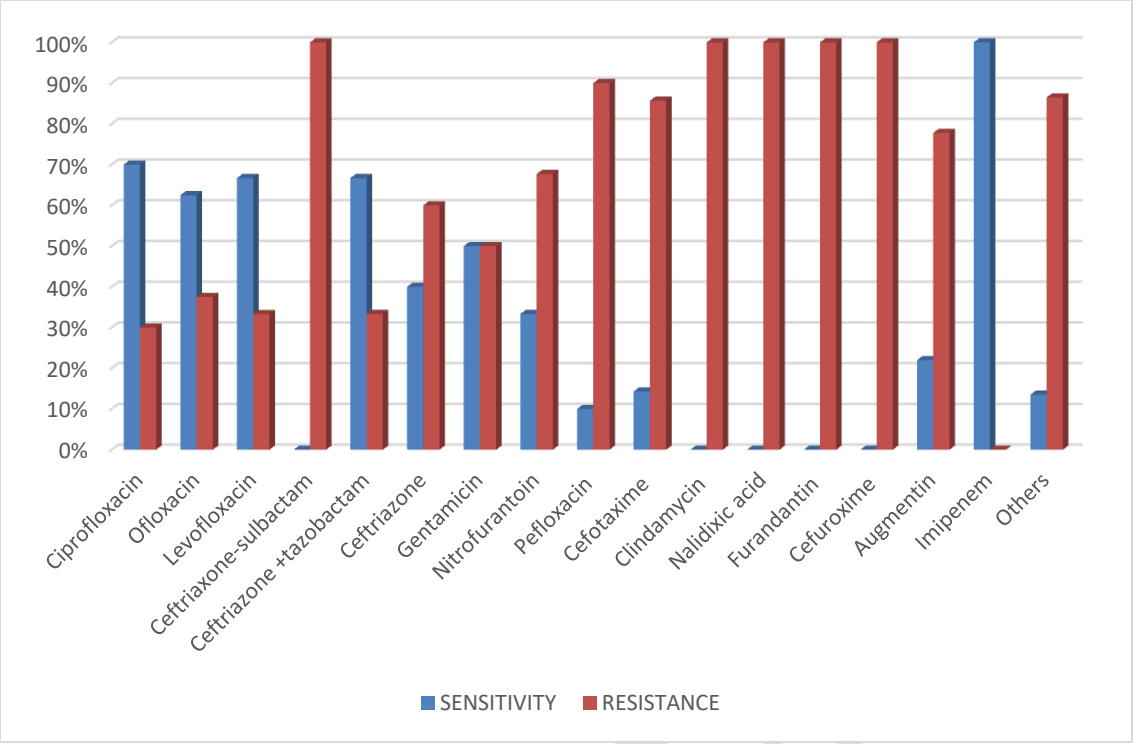
Table 3: Sex distribution of UTI by organism

BACTERIAL GROWTH	MALE	FEMALE
E. COLI	13 (33.3%)	26(66.7%)
STAPHYLOCOCCUS AUREUS	10 (22.2%)	35(77.8%)
PSEUDOMONAS AERUGINOSA	0 (0.0%)	10 (100.0%)
PROTEUS SPP	5(83.3%)	1 (16.7%)

**OTHERS*	4(66.7%)	2(33.3%)

**Klesiella, candida,enterococcus* etc

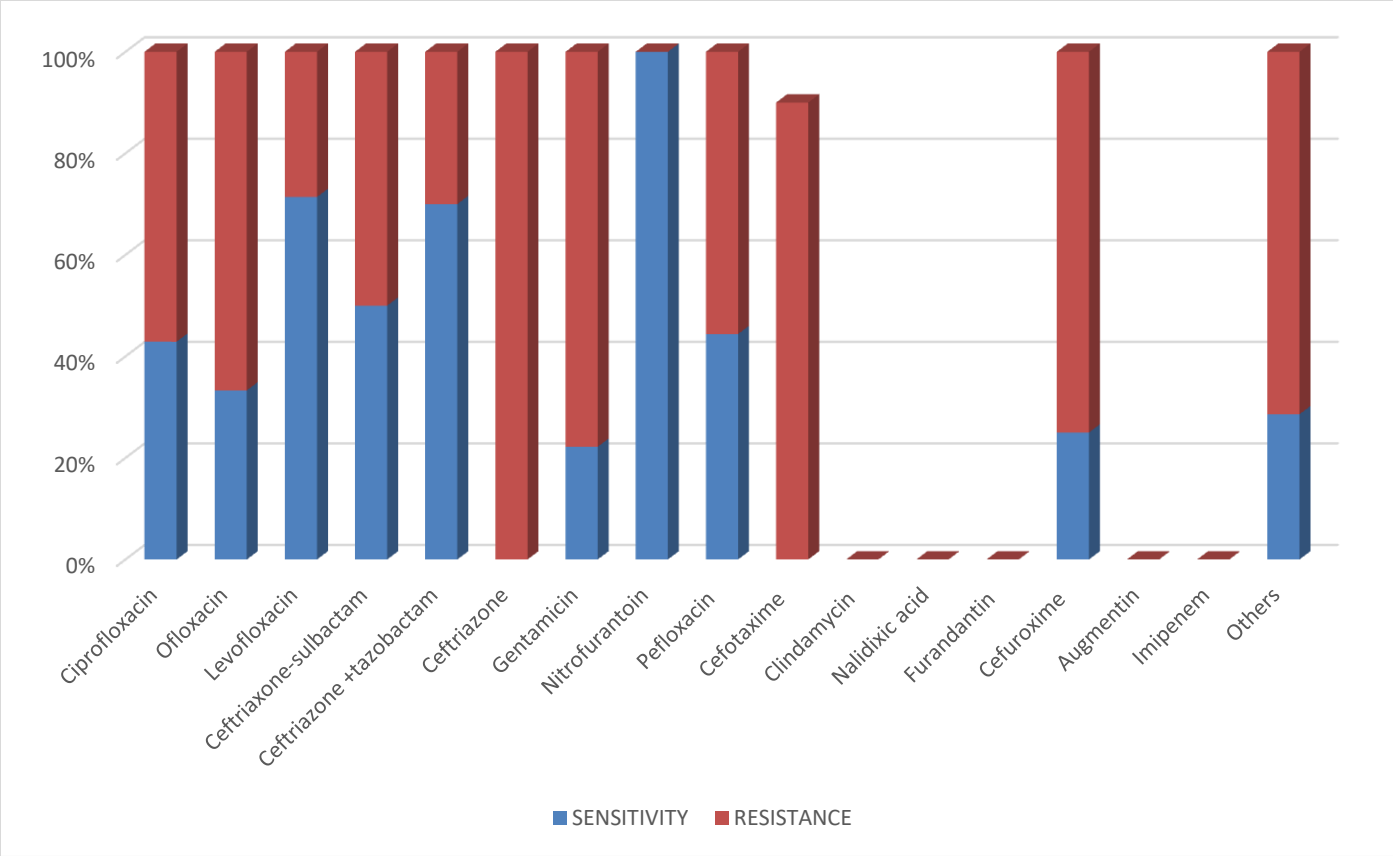
E. Coli was found to more sensitive to quinolones (Ciprofloxacin, Ofloxacin And Levofloxacin). Also Ceftriaxone + Tazobactam And Imipenem were also found to be sensitive to E. coli infection, Figure 1.



*Others- Azithromycin, Septrin and amoxicillin

Figure 1: Antibiotics sensitivity and resistance pattern for E.coli

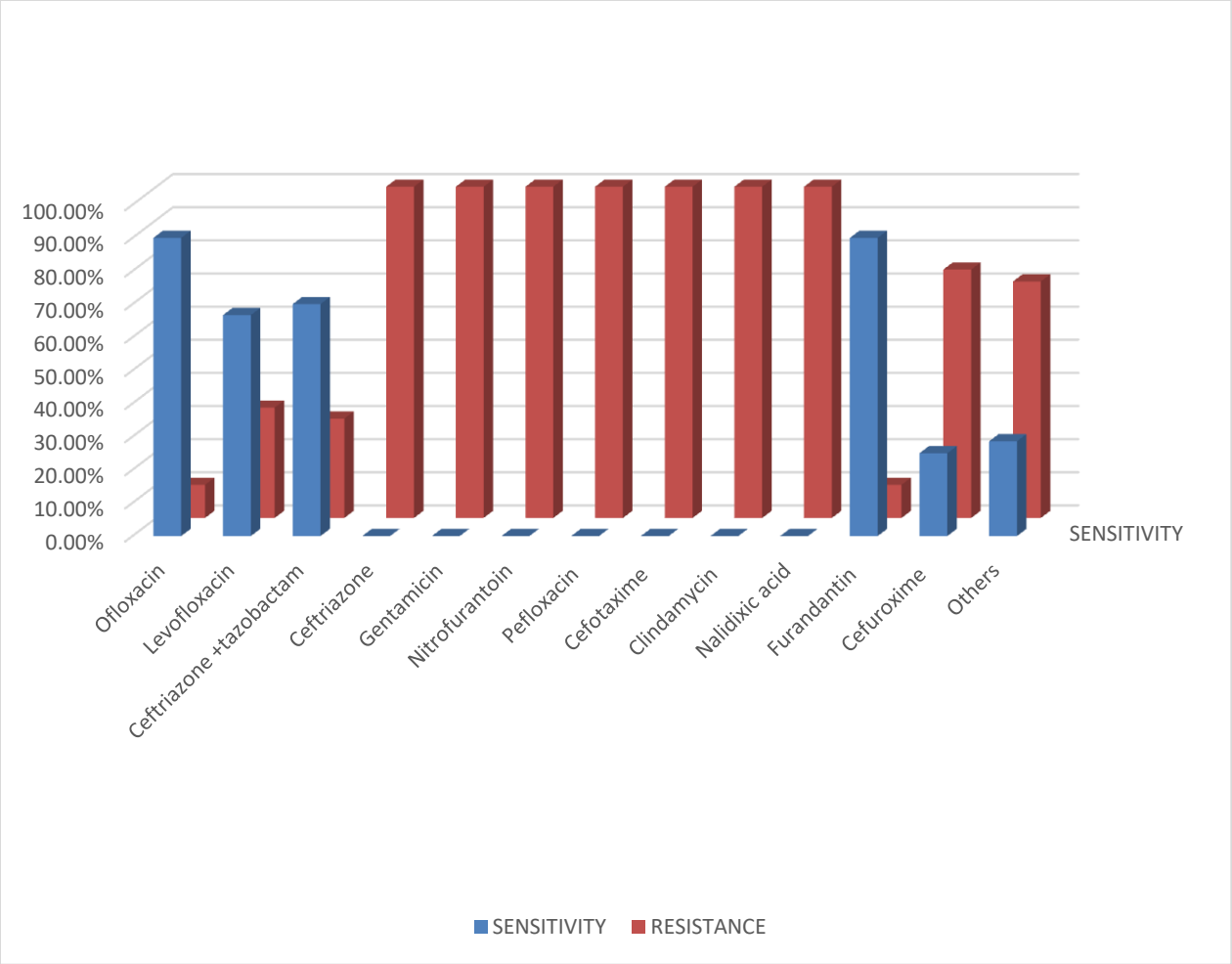
Majority of the Staphylococcus growth were found to be responsive to Leveofloxacin And Ceftriaxone combination antibiotics. Surprisingly there was resistance against ceftriaxone alone (Figure 2).



*Others- Azithromycin, Septrin and amoxicillin

Figure 2: Antibiotics sensitivity and resistance pattern for Staphylococcus aureus

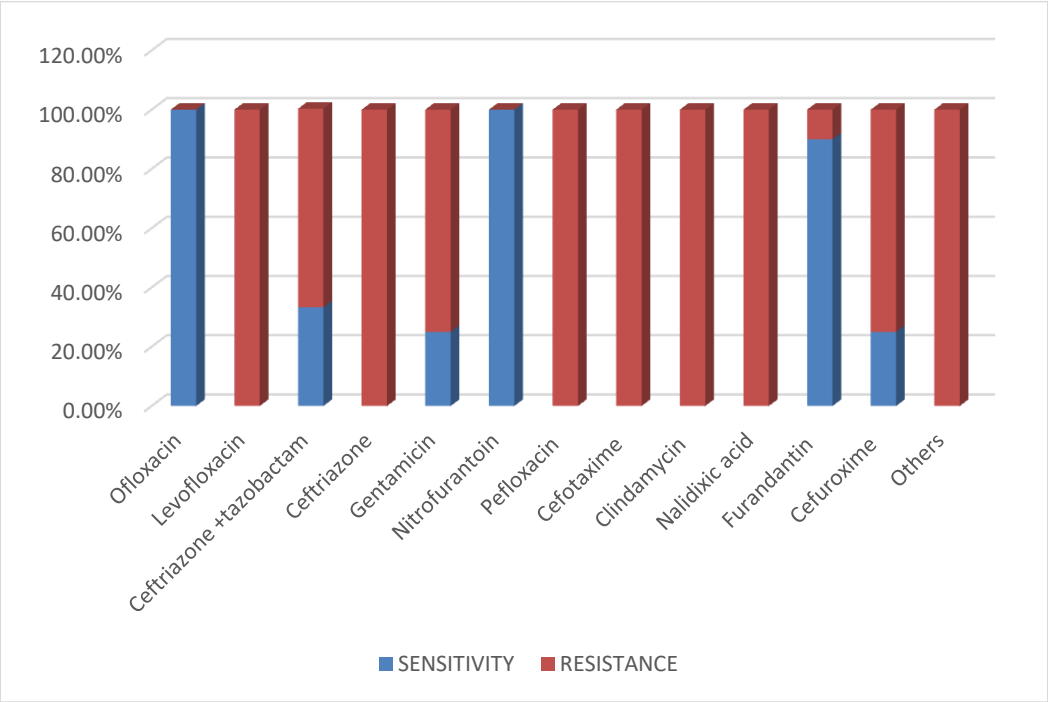
Majority of the Pseudomonas growth were reactive To Ofloxacin, Levofloxacin And Ceftriazone+Tazobactam, Figure 3



*Others- Azithromycin, Septrin and amoxicillin

Figure 3: Antibiotics sensitivity and resistance pattern for Pseudomonas auroginosa

Figure 4 shows that majority of the *Proteus species* growth were reactive to Ofloxacin, Nitrofurotoin and Furandntin



*Others- Azithromycin, Septrin and amoxicillin

Figure 4: Antibiotics sensitivity and resistance pattern for Proteus

Discussion

The clinical presentation of older individuals with UTI is typically unusual, with an increased risk of multiple drug load, drug–drug interaction and co-morbidities.[10-22,22] As a result, identifying the pathogenic agent and its effective antibiotic sensitivity to the UTI in question plays a critical role in effective early management among the elderly around the world. [12, 18 22]

The increase of bacterial resistance to a wide range of antibiotics is raising serious health issues in the world. Infectious microorganisms are increasingly resistant to a variety of medicines, putting drugs' capacity to manage urinary tract infection (UTI) under jeopardy. This problem is exacerbated in the elderly, who are already immune-compromised due to their age and co-morbidities.[3,4,18-21]

The gender distribution of patients in our study matches that of earlier studies, with females having a higher rate of positive urine cultures than their male counterparts. The variations in the structure and microbiota between male and female genitourinary systems may play a role in the preponderance of positive culture among females. [22, 23] However, in another study done in other part of Nigeria, majority of the study participants were males.[10] In addition, it was discovered in this study that elderly people between the ages of 60 and 70 had higher rates of UTI, which supports the findings of another study in Southern Nigeria.[11]

Among the uropathogens analyzed from the retrospective study, *Staphylococcus aureus* was the most common microorganism isolated from the urine culture of the elderly. This finding was not in keeping with finding from other studies were *E. coli* and *Klebsiella* species were attributed as the most common organism causing UTI among the elderly.[10, 11,18,22,24] However, other studies done found *Staphylococcus aureus* to be majorly responsible for the UTI. [15-17] The similarities and discrepancies in the type and distribution of uropathogens could be due to variances in study

regions, host variables, and sample collecting procedures. The importance of using narrow-spectrum antibiotics after culture reports is demonstrated by this finding, with the sole purpose of avoiding inappropriate antibiotic use and preventing antimicrobial resistance.

In contrast to what previous investigations have found, the predominant organisms cultivated in our study (*Staphylococcus aureus and E. coli)* were found to be sensitive to quinolones and Ceftriazone+tazobactam.[20,25] Coincidently, the results were comparable to those of another study, in which many of the aged cultures produced *staphylococcus aureas*, which was sensitive to Levofloxacin.[22] There was also significant resistance to routinely used antibiotics such as Augmentin, Ceftriaxone Cefuroxime, Amoxicillin, and others. This high prevalence of resistance to routinely used antibiotics has sparked widespread concern, echoing findings from earlier studies, and there is a palpable fear that resistance may spread. [10, 11,18,25]

CONCLUSION

Our research clearly identifies the common pathogens, *Staphylococcus aureus* and *E.Coli*, as well as the sensitivity and resistance pattern of UTI in the elderly, This may probably influence the unnecessary use of antibiotics in elderly. Ciprofloxacin, Levofloxacin, Ofloxacin, and Ceftriazone+Tazobactam were the most sensitive antibiotics, whereas Augmentin, Ceftriaxone, Cefuroxime, Ceftazidine, and other antibiotics were the most resistant.

RECOMMENDATIONS

When choosing UTI treatment approaches, the sensitivity and resistance pattern of uropathogens to popular antimicrobial drugs must be considered. Furthermore, in order to permit ongoing observation of the occurrence of antibiotic resistance as these levels and patterns continue to

evolve, the hospital needs to strengthen record keeping and implement a prospective surveillance system.

REFERENCES

1. Cadmus E O, Adebusoye L A, Olowookere O O, Oluwatosin O G, Owoaje E T, Alonge T O. A descriptive study of the morbidity pattern of older persons presenting at a Geriatric Centre in Southwestern Nigeria. Niger J Clin Pract 2017;20:873-8.

2. United Nations World Population Ageing 2015. In: Department of Economic and Social Affairs PD, editor; 2015.

3. Cortes-Penfield NW, Trautner BW, Jump RLP. Urinary tract infection and asymptomatic bacteriuria in older adults. *Infect Dis Clin North Am* 2017; **31**: 673– 88

4. Shimoni Z, Cohen R, Avdiaev R, Froom P. Treatment of febrile geriatric patients with suspected urinary tract infections in a hospital with high rates of ESBL producing bacteria: a cohort study. BMJ Open 2016; 6: e013696.

5. Gauri P. Godbole,Nicole Cerruto, Ruchir Chavada. Principles of assessment and management of urinary tract infections in older adults. Pharm pract. Res. 2020; 50(3):276-283

6. Foxman B, Brown P. Epidemiology of urinary tract infections: transmission and risk factors, incidence, and costs. *Infect Dis Clin North Am* 2003; **17**: 227– 41

7. Mody L, Juthani-Mehta M. Urinary tract infections in older women: a clinical review. *JAMA* 2014; **311**: 844– 54.

8. Ruben FL, Dearwater SR, Norden CW, Kuller LH, Gartner K, Shalley A, *et al*. Clinical infections in the noninstitutionalized geriatric age group: methods utilised and incidence of infections. The Pittsburgh Good Health Study. *Am J Epidemiol* 1995; **141**: 145– 57.

9. Global epidemiology of UTI. Available at: https://www.researchgate.net/publication/287967035_Global_publication . Accessed at:7th October, 2021

10. Saka SA, Okunuga BE. Profiling Urinary Tract Infections Bacteria Among Elderly Population In A Nigerian Teaching Hospital. AJOL. 2018;6(30);15-22

11. Richard Omoregie. Isaac OhiorenuanIgbarumah, Christopher Ayegbe, Helen Ogefere. Urinary Tract Infections Among the Elderly in Benin City, Nigeria. Elsevier. 2010;2(3,4):90-93

12. Ogbukagu, C. , Anakwenze, V. , Ekwealor, C. , Ezemba, C. and Ekwealor, I. (2016) Incidence of Urinary Tract Infections (UTI) amongst Patients Attending Primary Health Centres in Anambra State. *Advances in Microbiology*, **6**, 537-547. doi: 10.4236/aim.2016.67054.

13. Gomolin IH, McCue JD. *Urinary Tract Infection in the Elderly Patient*. Darien, CT: Cliggott Publishing; 2000.

14. Shortliffe LM, McCue JD. Urinary tract infection at the age extremes: pediatrics and geriatrics. *Am J Med*. 2002;113(suppl 1A):55S-66S.

15. Naylor, G.R. (1984) A 16-Month Analysis of Urinary Tract Infection in Children. Journal of Medical Microbiology, 17, 31-36.

16. Travis, L.B. and Bruhard, B.H. (1991) Infections of the Urinary Tract. In: Rudolph, A.M., Ed., Rudolph's Paediatrics, 19th Edition, Appleton and Lange, Stamford.

17. Eghafona, N.O., Evbagharu, P.A. and Aluyi, H.A.S. (1998) Paediatric Urinary Tract Infection in Benin City, Nigeria. Journal of Medical Laboratory Sciences, 7, 59-61.

18. Sunayana Saha, Sridhara Nayak, Indrani Bhattacharyya, Suman Saha, Amit K. Mandal, Subhanil Chakraborty et al. Understanding the patterns of antibiotic susceptibility of bacteria causing urinary tract infection in West Bengal, India. Front. Microbiol., 18 September 2014;5:1-7

19. Bahadin, J., Teo, S. S. H., and Mathew, S. Aetiology of community-acquired urinary tract infection and antimicrobial susceptibility patterns of uropathogens isolated. *Singapore Med. J.2011;*52: 415–420.

20. Sood, S., and Gupta, R. . Antibiotic resistance pattern of community acquired uropathogens at a tertiary care hospital in Jaipur, Rajasthan. Indian *J. Community Med.2012;*37: 39–44. doi: 10.4103/0970-0218.94023

21. Tseng, M. H., Lo, W. T., Lin, W. J., Teng, C. S., Chu, M. L., and Wang, C. C. Changing trend in antimicrobial resistance of pediatric uropathogens in Taiwa. *Pediatr. Int.* 2008;50:797–800. doi: 10.1111/j.1442-200X.2008.02738.x

22. Dhevahi Elumalei, Sumathi.G, Sambandan AP, Natrajan VS, Dinakaran N. tudy on Uropathogens with Antimicrobial Susceptibility Pattern in the Elderly at a Tertiary Care Hospital- Mangadu, South Chennai India. JMSCR Vol||04||Issue||04||Page 10026-10032

23. Shyamala R. and Janardhan Rao. The Incidence of uropathogens and their resistance pattern in a tertiary care hospital Der Pharmacia Lettre, 2013, 5 (1):316-317

24. Geriatrics Linda M. Dairiki Shortliffe, et., al. Urinary Tract Infection at the Age Extremes: Pediatrics. The American J Med. 2002; 113 (1A):57S

25. Razak SK, Gurushantappa V. Bacteriology of urinary tract infection and antibiotic susceptibility pattern in a tertiary care hospital in South India. Int J Med Sci Public Health. 2012; 1(2):109-12.