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Profile of Uropathogensand their Antibiogram in Pregnant Women with Suspected Urinary Tract Infections

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ABSTRACT
Urinary tract infections (UTIs) are common illnesses that develop when bacteria enter the urethra and infect the urinary tract. Factors such asage, sex, catheterization, pregnancy and hospitalization all have an impact on the relative incidence of the pathogens. Antimicrobial resistance has been reported among several uropathogens, inappropriate use of antimicrobials being one of the major reasons, thus making the treatment of UTI a serious public health concern, particularly in developing nations. thus, the present research was undertaken to study the spectrum of uropathogens and their antibiogram. The present study included all consecutive urine samples from pregnant women with clinical suspicion of UTI received in the Bacteriology section of Microbiology laboratory for culture and sensitivity during January to June 2022. Identification of uropathogens and their antibiogram were determined by standard bacteriological techniques. A total of 283 urinesamplesfrompregnantwomen with clinical suspicion of UTI wereincludedinthestudy. Of the total samples, 28.3% (n=80)were culturepositivewhile71.7%(n=203) were culture negative. Among the uropathogens from pregnant women, E.coli was the most common isolate(60%, n=48), followed by Klebsiella spp. (25%, n=20), Enterococcus spp.(10%, n=8) and Candida spp.5% (n=4). The isolates showed varying degree of resistance to different antibiotics. Urinary tract infections (UTIs) are a common complication that can occur during pregnancy due to the many physiological changes that occur.As a result, it is critical to screen pregnant women on a regular basis in order to reduce the risk to both mother and child.
Keywords:*Urinary Tract Infection, Pregnant Women, Uropathogens, Escherichia coli*

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INTRODUCTION

Urinary tract infections (UTIs) are common illnesses that develop when bacteria enter the urethra and infect the urinary tract [1]. Basedonsite of infection, it can be classified into lower UTI (bladder and urethra are involved) andupper UTI (kidneys,pelvis, and ureter are involved).The majority of UTIs are caused by an ascending infection. Asymptomatic bacteriuria, acute cystitis, and acute pyelonephritis are the three most common clinical manifestations of UTIs in pregnancy [2]. Significant bacteriuria(>10^5CFU/mLofurine) without clinical symptoms of UTIs (such as frequent urination, painful urination or fever) or any other findings is referred as asymptomatic bacteriuria.[2]Factors such asage, sex, catheterization, pregnancy and hospitalization all have an impact on the relative incidence of the pathogens.[3]Globally, the prevalence of UTI has been estimated to be approximately 150 millionpeople per year. In developing countries including India, its rate is reported to be more than 20%.[4] Each year, India reported almost seven million hospital visits, one million of which are emergency visits; this leads to roughly 100,000 hospitalizations due to UTI. Between 2% and 10% of pregnant women are thought to experience asymptomatic UTI globally [5]. According to reports, women in India have a prevalence of UTI that varies between 3% and 24% overall while in the second half of pregnancy, 1 to 4% of pregnant women will experience acute pyelonephritis, and 1 to 2% will experience severe acute pyelonephritis [6]. Significant morbidity is linked to pregnancy-related UTI in both the mother and the foetus [7]. During pregnancy, women are more likely to get UTIs, starting at week six and peaking between weeks 22 and 26 [8]. UTI are more likely to occur during pregnancy because the uterus, lying between the bladder and the rectum, expands and pushes the bladder forward, making it narrower. This increases the frequency of irritation and, as a result, the volume of urine that can be totally emptied. completely.Pregnancy's combination of hormonal, mechanical, and physiological changes resultsin significant changes to the urinary tract [9].

Among the bacterial uropathogens, *Escherichia coli, Klebsiella pneumoniae, Proteus* spp., *Staphylococcus saprophyticus, Enterococcus faecalis* and *Staphylococcus aureus*are frequently isolated bacteria [10].

Antimicrobial resistance has been reported among several uropathogens, inappropriate use of antimicrobials being one of the major reasons, thus making the treatment of UTI a serious public health concern, particularly in developing nations [11]. Additionally, in substantialepisodes of UTI, empirical antimicrobial therapy is initiated before the laboratory findings of urine culture are available; thereby contributing to the prevalence of antibiotic resistance among uropathogens [4]. Third-generation cephalosporins (cefotaxime, cephradine, ceftazidime,and cefaclor), nitrofurantoin, fosfomycin, trimethoprim-sulfamethoxyzole, and penicillin are some of the antimicrobial agents used to treat UTIs. Among these drugs, trimethoprim-sulfonamides,and fluoroquinolones are not recommended during pregnancy [12]. Thus, the present study was undertakenin order to monitor the spectrum of uropathogens and their anitibiogram among the pregnant women with suspected UTIs.

MATERIAL AND METHODS

This study was a prospective observational study that took place from January to June 2022 in a tertiary care hospital in North India.The study included all consecutive urine samples received in the Microbiology laboratory for urine culture and sensitivity from pregnant women with clinical suspicion of UTI. The current study was approved by the institutional ethics committee of SGT Medical College, hospital, and research institute before it was carried out.

Urine samples were processed within two hours after collection.The samples were inoculated onto Cystine Lactose Electrolyte-Deficient (CLED) agar, and the plates were incubated for 24 hours at 37˚C under aerobic conditions. Semi quantitative analysis of coloniesgrownon CLED was performed and interpreted as per Kass criteria [13]. The colony morphology of the significant bacterial growth was observed after incubation, and then subjected for identification by standard microbiological techniques [14]. The antibiotic susceptibility testing for the bacterial isolates was performed using the Kirby-Bauer disc diffusion method on Muller Hinton agar, and the results were interpreted according to Clinical Laboratory Standard Institute (CLSI) standards [15]. For Gram positive cocci, the following antibiotic discs were used: cefoxitin(10µg), ciprofloxacin(5µg), fosfomycin (200µg), nitrofurantoin (300µg), tetracycline (30µg), teicoplanin (30µg), gentamicin (10µg), minocycline (30µg), ampicillin (10µg), piperacillin-tazobactam (100/10µg), amoxy/clavulanicacid (20µg), erythromycin (10µg),co-trimoxazole (25µg), vancomycin 30µg) and linezolid (30µg). While for Gram negative bacterial isolates, the following antibiotic discs were used: ampicillin (10µg), gentamicin (10µg), amikacin (30µg), amoxyclav-clavulanicacid(20µg), piperacillin-tazobactam (100/10µg), cefepime(30µg), ciprofloxacin (5µg), ertapenem (10µg), nitrofuantoin (300µg), fosfomycin(200µg), cefoparazone-sulbactam (30/15µg), ceftriaxone (30µg), levofloxacin (30µg), aztreonam(30µg), tigecycline (15µg) and tetracycline (30µg).

Statistical analysis

Data were entered and recorded in Microsoft excel 2016. The prevalence of UTI and antimicrobial susceptibility were expressed in terms of (number) percentage.

RESULTS

The study included 283 urine samples from pregnant women with clinical suspicion of UTI. Of the total samples, 28.3%(n=80) were culture positive while 71.7%(n=203) were culture negative. Majority of the culture positivity (65%, n=52) was observed in the age group of 18-25 years, followed by 26-32years (20%, n=16) and 33-40 years(15%, n= 12). When the educational status of the study participants with culture positive was analyzed, majority(40%, n=32) were observed among the women who have not received any formal education, followed by upto 5th standard 30% (n=24), 6th to 10thstandard 17.5%(n=14), upto 11th standard and above12.5%(n = 10). Highest prevalence of UTI was found among women with multigravida 38.7%(n=58) followed byprimi gravid 16.92%(n=22). When the incidence of UTI was analyzed in relation to gestational age, highest prevalence was found in 2nd trimester 45%(n=36), followed by 3rd trimester 30% (n=24) and 1st trimester 25%(n=20). Among the uropathogens from pregnant women,*E.coli* was themost common isolate (60%, n=48), followed by *Klebsiella spp.*(25%, n=20), *Enterococcus* spp.(10%, n=8) and *Candida* spp.5%(n=4)shown infig.1.

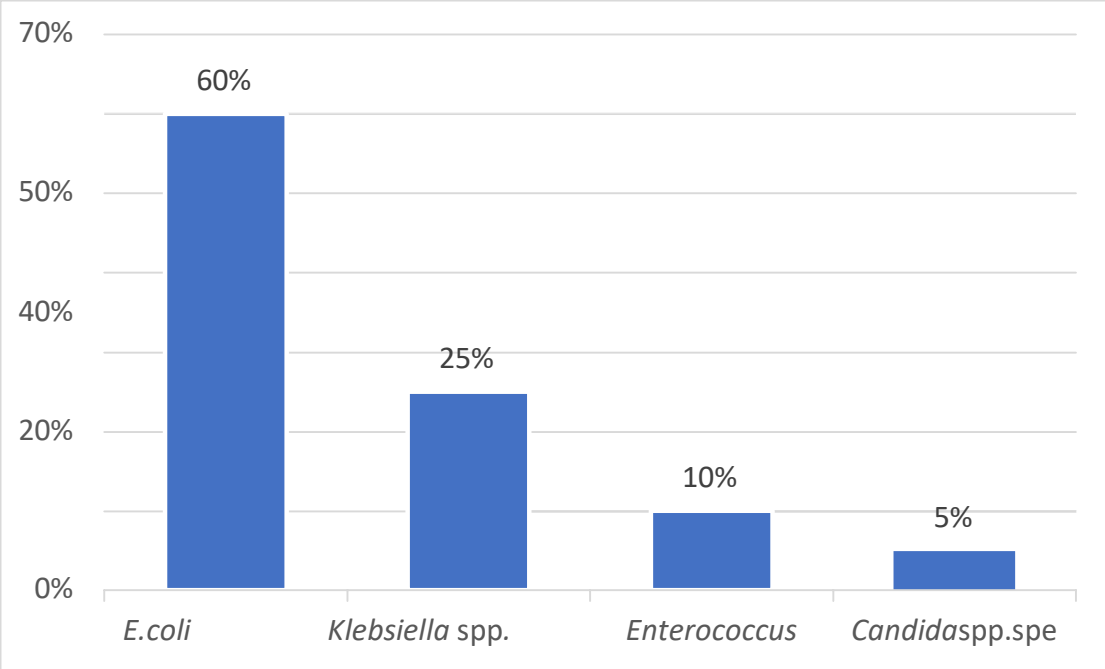
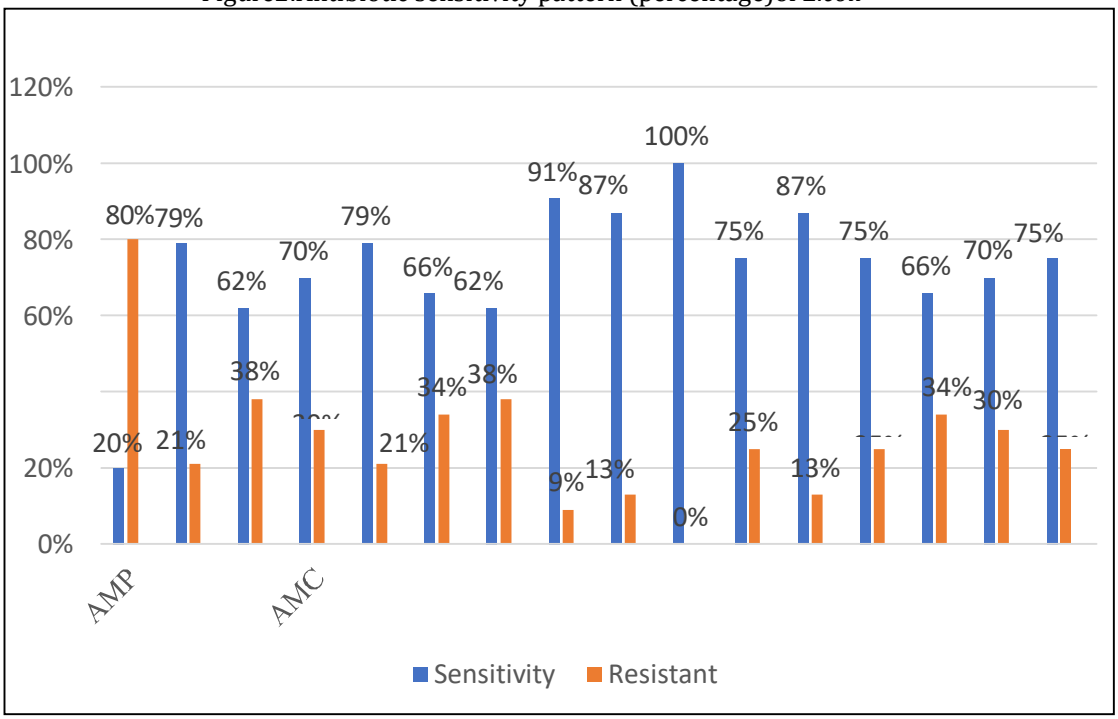


Figure1:Distribution of various isolates obtained from urine culture

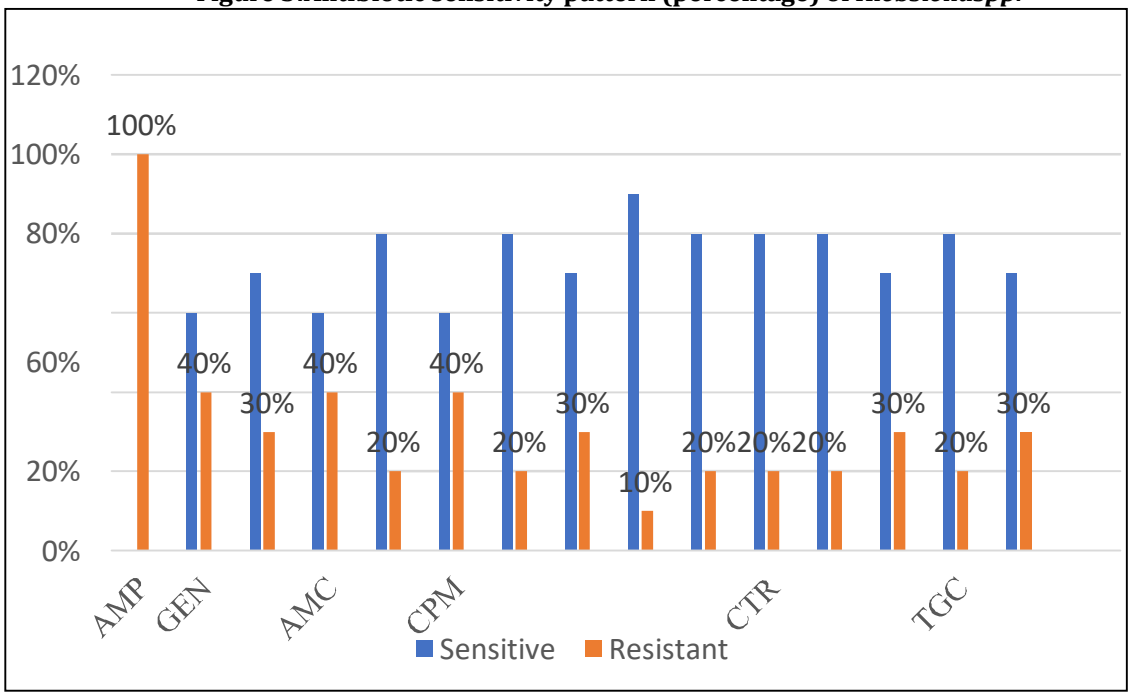
Antibiotic sensitivity rates for*E. coli* isolates to various antibiotics showed 100% sensitive to fosfomycin,91% toertapenem, 87% tonitrofurantoin and ceftriaxone,79% topiperacillin-tazobactam and gentamicin and 75% to levofloxacin, tetracycline and cefoperazone-sulbactam as depicted in fig. 2.

Figure2:Antibiotic sensitivity pattern (percentage)of *E.coli*



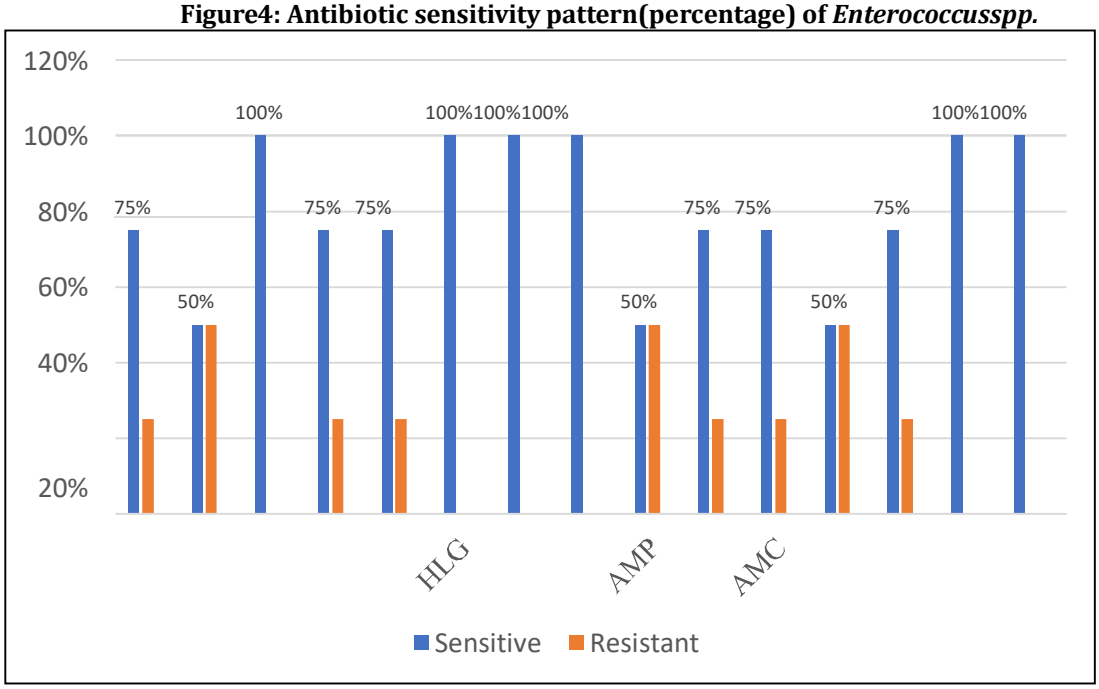
Antibiotic sensitivity pattern of *Klebsiella* isolates showed 90% sensitive to nitrofurantoin, 80% sensitive to piperacillin-tazobactam, cefeperazone-sulbactam, ciprofloxacin, tetracycline and ceftriaxoneas demonstrated infig. 3.

Figure 3:Antibiotic sensitivity pattern (percentage) of *Klebsiellaspp.*



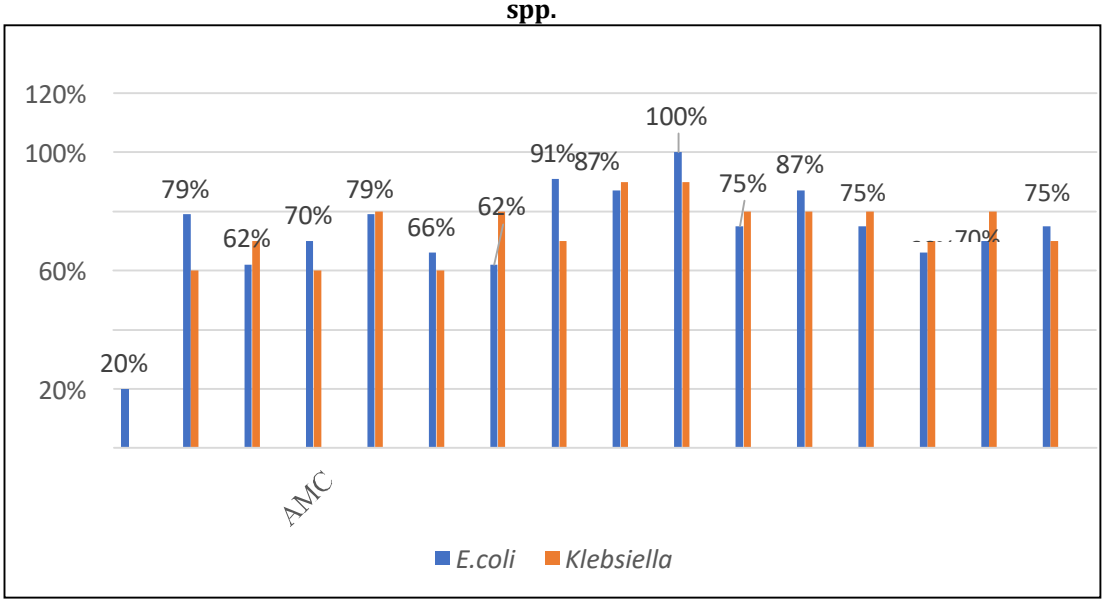
Antibiotic sensitivity pattern of *Enterococcus* isolates showed 100% sensitive to gentamycin, minocycline, teicoplanin, vancomycin and linezolid. 75% sensitive tonitrofurantoin, tetracycline, piperacillin-tazobactam and cotrimoxazole as demonstrated in fig. 4.

Figure4: Antibiotic sensitivity pattern(percentage) of *Enterococcusspp.*



Overall *E. coli* isolates showed higher susceptibility to most of the antibiotics tested when compared with *Klebsiella* spp.

Figure 5: Comparison of Antibiotic sensitivity pattern (percentage) between *E.coli* and*Klebsiella* spp.



DISCUSSION

UTIs are a significant burden on the health care system, owing to their prevalence inboth community and hospital settings. Pregnant women are at an increased risk of urinary tract infections, which begins at week 6 and peaks between weeks22–26.[16]Due to a natural increase in plasma volume during pregnancy, a woman's urine concentration can drop by up to 70%, called glycosuria, and it is one of the main reasons bacteria grow in urine [17]. UTIs can result in severe obstetric complications, such as intrauterine growth retardation, preeclampsia, and preterm birth, which have negative maternal and perinatal consequences.

Moreover, asymptomatic bacteriuria has been associated with cystitis and pyelonephritis, which can induce severe respiratory distress, temporary renal failure, sepsis, and shock during pregnancy [18].

The current study enrolled 280 pregnant women attending an antenatal clinic, with a positive urine culture being detected in 28.3% (n=80) of pregnant women.Yasmin *et al*. reported a 28 % prevalence of urinary tract infection (UTI) among symptomatic and asymptomatic pregnant women in Bihar in 2018 [18]. In rural Haryana,Kant *et al*. reported a prevalence of 33.3 % among pregnant women in 2017[5]. The preceding studies corroborate our findings. Arumaikannu *et al* .2021 reported a low prevalence of 18% among pregnant women in Tamil Nadu [20], whereas Johnson etal.2021 reported a prevalence of 35% among pregnant women with both symptomatic and asymptomatic UTI in the South-Western Ugandaregion [21].

A number of risk factors for UTI have been identified, with age, particularly in the female age group,being a major factor. In our study, the age group 18-25years had the highest incidence of urinary tract infection (65%), followed by 22% in the 26-32age group.In the Saudi Arabian region,Lele et al. (2015) found a 28.6% prevalence, which was particularly high in the age group 26-30 years [22]. Nwachukau et al. (2018) found a prevalence of 48 % in the age group 26-30 years in Nigeria [23]. The reason for this could be that many women in this age groupare likely to have had several children prior to the current pregnancy, and it has been reported that multiparty is a risk factor for bacteriuria during pregnancy.Sexual activity and certain contraceptive methods have also been linked to an increased risk, andwomen of this age are the most sexually active. Arumaikannu et al. reported a high prevalence in the age group of 21-25 years in Tamil Nadu in recent studies[21]. Similar findings were found in a study conducted by Yashmin et al. in Bihar in 2018, which found a high incidence in the 21–25-year age group [19].

In terms of the level of education variable, the findings revealed that there was a significant link between women's UTI and their level of education. The prevalence ofUTI was found to be higher among illiterate women in our study (40%). It could bedue to a lack of concern for personal hygiene and personal care. Sheikh et al. found that education had no effect on the incidence rate of UTIs, whereas Gunes et al. observed that UTI was significantly higher among women with less than a secondary level of education. According to Dimetry et al., those who were illiterate had the highest rate of UTIs among pregnant women,at 61.5% [24].

Multiparity has been linked to a twofold rise in UTI rates in pregnant women. This is because pregnancy causes major physiologic changes to the entire urinary system, which have a considerable impact on the natural history of UTI during gestation. These alterations differ from patient to patient and are more likely

to occur in women who have several pregnancies in a short period of time. According to our study, women with multiple pregnancy had the highest frequency (38.7%).Other studies, such as those conducted by Kant et al. (2017) on pregnant women in Haryana and Negussie et al. (2018) on pregnant women in the Ethiopia region, found an association between multiparity and UTI [5, 25].In our study, there was a higher rate of infection in the second trimester (45%). Urinary tract infections are more common in the second trimester of pregnancy than in the first and third trimesters. This variation could be due to a shift in urine stasis and vesicoureteral reflux, or a drop in urinary progesterone and oestrogen levels throughout pregnancy. These findings are comparable to those reported by Onyango et al. (2018) in South Africa.[26]

The most common uropathogens in our study were *E.coli (*60%),followed by *klebsiella species* of(25%),*Enterococcus species* (10%) and *Candida species* (5%). Recent studies were conducted by Arumaikannu *et al*. (2021) among pregnant women of Tamil Nadu where the prevalence of *E. coli was* 50% and *Klebsiella* spp. was20% [20]. Kaushal *et al.*(2021) reported a study in the region of Maharashtra among pregnant women where *E.coli was* the most commonly isolated bacteria at 62.5% and *Klebsiella was* 6.25% respectively [27]. Similar findings have been reported by Yashmin *et al.* (2018) in Bihar among pregnant women where prevalence of *E. coli and klebsiella species was* 57.14% and 8.16%, respectively [19, 27, 20].

Antibiotic resistance is a major public health concern around the world. Antibioticresistance has emerged in the selection and spread of antibiotic resistant strains ofbacterial pathogens, including uropathogens, due to the widespread use and misuse ofantibiotics. Susceptibility testing of uropathogens, particularly *E. coli*, is advised, as isknowledge of local resistance and surveillance studies to monitor rising patterns ofresistance [28]. In contrast, Kaushal et al.2020 showed a susceptibility pattern of *E.coli* that was highly sensitive to meropenem(100%)and piperacillin-tazobactam(80%).In the study, *Klebsiella* was completely sensitive to meropenem and piperacillin tazobactam, while Enterococcus was completely sensitive to vancomycin [27].A similar sensitivity pattern has been reported by Ali et al. 2020, where 96.7% of *E.coli* were highly sensitive to meropenem (96%), nitrofurantoin (80%), and gentamicin (78*%). K. pneumonia* showed sensitive to meropenem (100%), gentamycin (83%) and nitrofurantoin (66.7%) [29]. In Lucknow India Sonkar et al. 2021 reported that all Gram-negative isolates were mostly sensitive to most of the drugs like piperacillin-tazobactam, cefepime, nitrofurantoin, and meropenem [30]. The *E. coli* and *Klebsiella* species were highly sensitive to Nitrofurantoin (97.08%) reported by Shamim et al.2018 among pregnant women of Bangalore India which gives a similar sensitivity pattern. Multidrug resistance was found in many of the isolates [31]. As a result, the current study provides insight into the commom pattern of developing antibiotic resistance among uropathogens in this region, which could be the result of indiscriminate under dose antibiotic use. As a result, this information may aid physicians in the proper management of urinary tract infections and the avoidance of antibiotic resistance.

CONCLUSION

Due to enhancement of physiological changes during pregnancy UTI being the common complication.In our study isolated bacterial pathogens were shown to be resistant to routinely used antimicrobial drugs so it is important to do early screening of pregnant women for UTI infections and their antibiotic susceptibility pattern to prevent complications that could endanger both the mother and baby. The antenatal care physician should emphasize to all pregnant women about the importance of personal cleanliness and antibiotic resistance.

REFERENCES

1. Urinary tract infections. Centre for Disease Control and Prevention. Available at: https://www.cdc.gov/antibioticuse/uti.html#:~:text=UTIs%20are%20common%20infections%20that,is%20another%20type%20of%20UTI.
2. Negussie A,Worku G ,Beyene E.Bacterial identification and drug susceptibility pattern of urinary tract infection in pregnant Women at Karamara Hospital Jigjiga, Eastern Ethiopia. African J. Bacteriol. Res. 2018;10:15-22.
3. Mahmoud AD**,**Kamel A**,** Ahmed S,El-Hamed. A Prevalence of urinary tractinfections among pregnant women at Sohag University Hospital. Egyptiannursingj 2019; 16:162-174.
4. MalhotraVL, Maheshwari M, Broor S, Devi LS. Profile of bacterial uropathogens and their antibiotic susceptibility patterns in clinically suspected cases of urinary tract infections in a rural hospital in Haryana, India. Indian J Health Sci Care 2016; 3(1): 14-18.
5. Kant S, Lohiya A, Kapil A, Gupta SK. Urinary tract infection among pregnant women at a secondary level hospital in Northern India. Indian J. Public Health2017; 1:118.
6. Samaga MP. Bacteriological Profile of Urinary Tract Infections in Pregnant Women. Indian JMicrobiol Res. 2016; 3:17-21.
7. Alemu A, Moges F, Shiferaw Y, Tafess K, Kassu A, Anagaw B, Agegn A.Bacterial profile and drug susceptibility pattern of urinary tract infection in pregnant women at University of Gondar Teaching Hospital,Northwest

Ethiopia.BMC Researchnotes. 2012; 5:1-7.
8. Mahmoud AD,Kamel A, Ahmed S,El-Hamed. A Prevalence of urinary tractinfections among pregnant women at Sohag University Hospital. Egyptiannursingj 2019; 16:162-174.
9. Ngong IN, Fru-Cho J, Yung MA, Akoachere JF. Prevalence, antimicrobial susceptibility pattern and associated risk factors for urinary tract infections inpregnant women attending ANC in some integrated health centers in the BueaHealthDistrict. BMC Pregnancy and Childbirth.2021; 21:1-10.
10. Koripella R, Kanakadurgamba T, Vasanthi K, Peddapalli AR. Bacteriological Profile & Antibiogram of Urinary Tract Infections in a Tertiary Care Hospital.Int.J.Inf.Res. Rev 2020;7:2454-2237.
11. Thangavel S, Maniyan G, Vijaya S, Venkateswaran C. Bacteriological Profile of Uropathogens and their Antimicrobial Susceptibility Pattern in Isolates from aTertiary Care Hospital.Int.J. Curr. Microbiol.App. Sci.2017;2279-2286.
12. WalkerE, LymanA,GuptaK,MahoneyMV,SnyderGM,HirschEB.Clinical management of an increasing threat: outpatient urinary tract infections due to multidrug-resistant uropathogens.Clin.Infect.Dis 2016;1:960-965.
13. TilleP,(2000). Bailey and Scott's Diagnostic Microbiology13th edition:Elsevier.924
14. Mackey T,ColleeJ and Mc CartneyJ.(2006). Mackie and McCkartney practical medical Microbiology Elsevier. 14th edition:245-58,361-66.
15. CLSI, (2020). Performance Standards for Antimicrobial Susceptibility Testing: 30th Informational supplement M 100-S30.Wayne P A: Clinical and Laboratory Standard Institute.
16. OkonkoI.O,IjandipeL.A.,LusanyaI et al,(2009). "Incidence of urinary tract infection among pregnant women in Ibadan,South Western Nigeria"African J. Biotech. 8(23): 6649-657.
17. Samaga MP. (2016), Bacteriological Profile of Urinary Tract Infections in PregnantWomen. Indian JMicrobiol Res. 3:17-21.
18. El-Kashif M M. (2019). Urinary tract infection among pregnant women and its associated risk factors: A cross-sectional study.Biomed.Pharmacol.J.12:2003-2010.
19. YasminT, Sarwar M Y,Sen A.(2018). Prevalence of urinary tract infection in pregnant women in Katihar district, Bihar.prevalence.J.Med. Dent.Sci. 2:2-6.
20. Arumaikannu J,Jayanthi K, Radhamani M. (2021). Urinary tract infection in pregnancy.Int. j. Clin.Obstet. Gynaecol. 5: 31-33.
21. JohnsonB, Stephen BM,JosephN,AsiphasO,Musak,Taseerak. (2021).Prevalence and bacteriology of culture-positive urinary tract infection among pregnant womenwith suspected urinary tract infection at Mbarara regional referral hospital,South-Western Uganda BMC Pregnancyand CHILDB.1:1-9.
22. Lele U, Amjad AE, Shahane V. (2016). The Prevalence of Urinary Tract Infection among Pregnant Women Attending Antenatal Clinicat A tertiary Care Centrein AlRass, Al Qassim.Int.J. Sci. Res. 5:23-27.
23. NwachukwuE,OnyebuchiO,MichaelO.(2018). Prevalence of urinary tract infections in pregnant women in Onitsha, Nigeria. J Bacteriol Mycol Open Access. 6:284-285.
24. Sheikh MA.(2020). Incidence of urinary tract infection during pregnancy. EMHJ-Eastern Mediterranean Health Journal;6: 265-271.
25. Negussie A, Worku G,Beyene E. (2018). Bacterial identification and drug susceptibility pattern of urinary tract infection in pregnant Women at Karamara Hospital Jigjiga, Eastern Ethiopia. African J. Bacteriol. Res. 10:15-22.
26. Onyango H A,Ngugi C, MainaJ, KiiruJ. (2018). Urinary tract infection among pregnant women at Pumwani Maternity Hospital,Nairobi,Kenya: bacterial etiologic agents, antimicrobial susceptibility profiles and associated risk factors. Advances in Microbiology. 8:175-188.
27. Kaushal P, Misra R, Vyawhare C. (2020). Microbiological profile and antibiogrampattern of bacterial isolates of UTI in pregnant women in tertiary care hospitalin Western Maharashtra.International J.of Health care and Biomedical Research;8:76 – 87.
28. Okonko IO, Ijandipe LA, Ilusanya OA. (2009). Incidence of urinary tract infection(UTI) among pregnant women in Ibadan, South-Western Nigeria. African J of Biotec. 8:6649-6657.
29. Ali AH, Reda DY, Ormago MD. (2022). Prevalence and antimicrobial susceptibility pattern of urinary tract infection among pregnant women attending Hargeisa, Somaliland. Scientific Reports; 12:1-10.
30. Sonkar N, Banerjee M, Gupta S, Ahmad A. (2021). A symptomatic Bacteriuria among Pregnant Women Attending Tertiary Care Hospital in Lucknow, India. DubaiMed.J; 4:18-25.
31. Shamim R,Sathiss R. (2018). Bacterial Profile and Antimicrobial Susceptibility Pattern in Pregnant Women with Urinary Tract Infection Attending the Department of OBGin aTertiary Care Hospital.J PureAppl Microbiol;12:975-979.

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