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Original Research Article

Prevalence and antibiotic susceptibility pattern of uropathogens causing urinary tract infection among pregnant women in Ujjain M.P. (India)

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ABSTRACT

Urinary tract infection is one of the most prevalent frequently found disorders in pregnant women caused by bacteria and if it is not diagnosed then untreated UTI can cause serious maternal and fetal complications. The purpose of this work was to study the prevalence of urinary tract infection among pregnant women of Ujjain and to identify uropathogens and their antibiotic susceptibility pattern in pregnant women of Ujjain. A total of 120 midstream urine samples of pregnant women were collected aseptically and cultured on different growth media. The isolated bacteria were identified by standard microbiological procedure and the antibiotic susceptibility pattern was recorded using Kirby-Bauer disc diffusion method. Out of 120 urine samples, 78 samples tested positive for UTI suggesting that (65%) of pregnant women suffered from UTI and most prevalent bacterial pathogen was *E. coli* (41.0%) followed by *K. pneumoniae* (23.0%), *P. aeruginosa* (11.5%), *S. aureus* (14.1%) and *E. faecalis* (10.2%). Majority of the isolated uropathogens were showing high sensitivity towards Doripenem, Meropenem and Imipenem while very less sensitivity towards Ampicillin and Penicillin. The study shows high prevalence of UTI among pregnant women and occurrence of high resistance towards antibiotics. So routine screening of the pregnant women having UTI and proper selection of antibiotic for treatment is needed for reducing the risk of serious complications during pregnancy.

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1. Introduction

Urinary tract infection is one of the most prevalent medical problem found in pregnant women during pregnancy and occurs due to physiological, hormonal and morphological changes in the genitourinary tract at pregnancy period.¹ Urinary tract infection is common disorder caused by bacteria in pregnant women, if it is not treated timely and appropriately then it causes serious complications and adversely affect the health of both mother and fetus.² UTI's during pregnancy reported

as major health problem worldwide. The prevalence of UTI in pregnant women is higher as compared to non pregnant women, about 20% of pregnant women having UTI and hospitalized in obstetrical wards.³ UTI's are second most common complication in pregnant women after anemia.⁴ Pregnant women are more susceptible for UTI due to their anatomy of urinogenital system, short length of urethra and contamination of urinary tract with fecal flora. During pregnancy urinary tract infection classified into two categories asymptomatic and symptomatic. In asymptomatic UTI, lower urinary tract involved, it is most common during pregnancy due to anatomical and physiological changes while in symptomatic UTI, upper

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urinary tract is involved and it is most common cause of pre-delivery due to acute pyelonephritis. The prevalence of asymptomatic bacteriuria in pregnant women is 6.2% and symptomatic bacteriuria is 1-18%.⁵ The incidence of UTI increases with pregnancy, it starts with the 6th week of pregnancy and reaches its peak level at 22nd to 24th week of pregnancy due to increased volume of bladder, dilation of urethra and expanded ureter.⁶ During pregnancy pressure of gravid uterus on ureters obstruct the urine flow and causes humoral and immunological changes and increases the risk of UTI.⁵ The increase level of glucose in urine changes the composition of urine which promote the growth of bacteria and increases the chances of UTI.⁶ The risk factors associated with UTI in pregnant women are increasing age, parity, gravity, past history of UTI, anemia, number of sexual activity, individual hygiene, lack of awareness, socioeconomic status, functional abnormalities of urinary tract and diabetes. Urinary tract infections are more frequently caused by gram negative bacteria than gram positive bacteria.⁷ The major gram negative bacteria includes *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *P. mirabilis*, *Citrobacter* while in gram positive bacteria *S. aureus*, *S. saprophyticus*, *E. faecalis* and *Streptococcus species*.^{1,8} The management of UTI can be done by effective medical treatment and proper identification of uropathogenic bacteria causing UTI and their susceptibility.¹

2. Material and Methods

This study was carried out in SRL Laboratory, Ujjain for one-year period starting from November 2018 to October 2019 to find out prevalence of common uropathogenic bacteria causing UTI, their frequency, prevalence their antibiotic susceptibility pattern in pregnant women. The samples were collected from different hospitals of Ujjain (M.P.) were received in SRL laboratory and processed.

The urine samples were collected from pregnant women having suspected symptoms of UTI. By giving proper instructions, the midstream urine sample was collected in sterile container aseptically and after labeling, it was stored in refrigerator at 4°C until used to avoid contamination.

After collecting urine samples physical examination of urine sample was done for observing volume, pH, color, odor and turbidity of sample then wet mount was prepared for detection of pus cells, epithelial cells, cast, R.B.Cs and bacteria.

After examination, the urine sample (0.001 ml) of collected urine was inoculated on Blood agar, MacConkey agar and Chrome agar plate by streak plate method and incubated at 37°C for 24 hours. After incubation, colonies were counted. For confirmation of isolated uropathogen, the isolated colonies were further identified by morphological, microscopic and biochemical tests as per the standard procedures.⁹

2.1. Antibiotic susceptibility test

Antibiotic susceptibility test was performed using Kirby-Bauer Disc Diffusion method as per Clinical Laboratory Standards Institute (CLSI) guidelines for determination of susceptibility of uropathogens causing UTI against antimicrobial agents. The antibiotic susceptibility test was performed using Mueller-Hinton agar plates for this inoculum of selected bacterial colony was prepared in peptone broth and incubated at 37°C for 2 hours and its turbidity was adjusted to 0.5 McFarland standards and spread on Muller Hinton Agar by sterile swab using lawn method.¹⁰ A sterile forceps was used to transfer commercially available antibiotic Himedia disc on this lawn and plate was incubated at 37°C for 24-48 hours. After incubation, size of zone of inhibition was measured to differentiate between resistant and sensitive isolates of bacteria, according to CLSI guidelines.¹¹

3. Results

The total number of examined pregnant women was 120 among them 78 pregnant women having UTI and prevalence rate of UTI was 65% (Table 1)

The relation of UTI with different age group in pregnant women is calculated and the results shows that higher incidence of UTI was seen in age group of 25-30 year and it was (47.4%) which was followed by the age group of < 25 years (35.8%) and > 35 years (16.6%) (Table 2).

The Prevalence of UTI in pregnant women based on gravidity is shown in Table 3. The results shows that maximum cases of UTI are found in primary gravida that was (52.5%) which was followed by secondary gravida, its occurrence was (28.2%), and comparatively less occurrence was recorded in multigravida, which was (19.2%). The results are shown in Table 3.

The prevalence of UTI concern with trimester of pregnancy regarding gestational age was also studied and its incidence in trimester 3rd, 2nd and 1st were 48.7%, 34.6% and 16.6% respectively. The results are shown in Table 4.

3.1. Frequency of isolated uropathogenic bacteria

In this study, six different uropathogenic bacteria were isolated and identified from pregnant women. The majority of the isolates of gram negative were high as compared to gram positive isolates. *E. coli* was found to be the most frequently isolated predominant uropathogen (41.0%), followed by *K. pneumoniae* (23.0%), *S. aureus* (14.1%), *P. aeruginosa* (11.5%) and *E. faecalis* (10.2%) (Figure 1).

3.2. Antibiotic susceptibility pattern

Gram negative bacteria showed a high level of sensitivity against Doripenem, Meropenem, Amikacin, Gentamicin and Nitrofurantoin and highest resistance against

Table 1: Prevalence of UTI in pregnant women.

S. No.	Total Number of pregnant women	Number of pregnant women having UTI	Prevalence of UTI (%)
1.	120	78	65%

Table 2: Relation of UTI with different age groups of pregnant women.

S. No.	Age (years)	Pregnantwomen (%)
1.	< 25 years	35.8
2.	25-30 years	47.4
3.	> 35 years	16.6

Table 3: Prevalence of UTI in pregnant women in relation to gravidity

S. No.	Gravidity	Pregnant women (%)
1.	Primary gravida	52.5
2.	Secondary gravida	28.2
3.	Multigravida	19.2

Table 4: Prevalence of UTI in pregnant women in relation to gestational age.

S. No.	Gestational age	Pregnantwomen (%)
1.	1 st trimester	16.6
2.	2 nd trimester	34.6
3.	3 rd trimester	48.7

Ampicillin, Amoxicillin-Clavulanic acid, Ciprofloxacin and Norfloxacin while Gram positive bacteria showed highest sensitivity to Teicoplanin and Nitrofurantoin and highly resistant to Penicillin. *E. coli* isolates were showing highest sensitivity to Doripenem (93.7%), Meropenem (90.6%), Amikacin (65.6%), Nitrofurantoin (62.5%) and Gentamicin (59.3%) while they were showing higher resistance towards Ampicillin (87.5%). Amoxicillin-Clavulanic acid (78.1%), Ciprofloxacin (84.3%), Norfloxacin (81.2%) and Ceftazidime (75.0%).

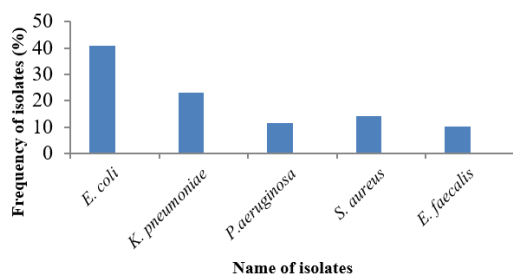


Fig. 1: Frequency of different uropathogens causing UTI in pregnant women.

Similar antibiotic susceptibility pattern were also shown by other gram negative isolates. Gram positive *S. aureus* and *E. faecalis* were highly susceptible to Teicoplanin and their sensitivity was (81.8%) and (87.5%) respectively while both *S. aureus* and *E. faecalis* was highly resistant to Penicillin and their resistance was (90.9%) and (62.5%) respectively. The antibiotic susceptibility patterns of different isolates are

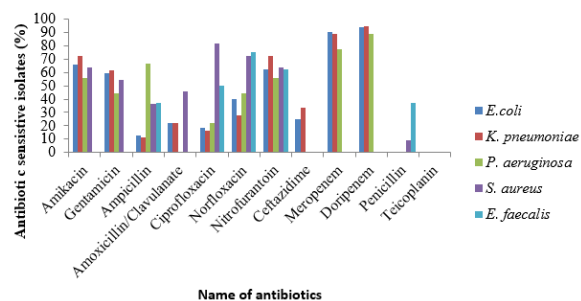


Fig. 2: Antibiotic sensitivity pattern of uropathogenic isolates.

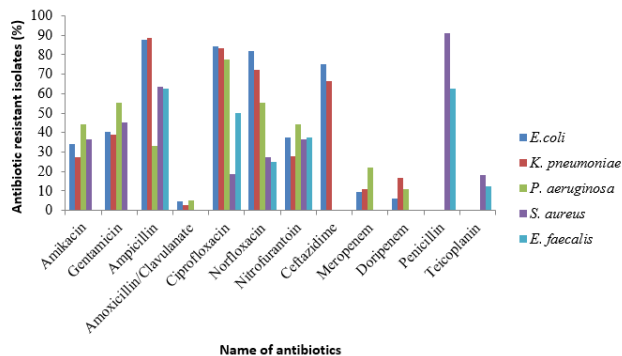


Fig. 3: Antibiotic resistance pattern of uropathogenic isolates.

Table 5: Antibiotics susceptibility of uropathogens during study

S. No.	Name of antibiotics and concentration	Antibiotic susceptibility									
		U1 (32)		U2 (18)		U3 (09)		U4 (11)		U5 (08)	
		S	R	S	R	S	R	S	R	S	R
1.	Amikacin (30 mcg)	21 (65.6)	11 (34.3)	13 (72.2)	05 (27.2)	05 (55.5)	04 (44.4)	07 (63.6)	04 (36.3)	NA	NA
2.	Gentamicin (10 mcg)	19 (59.3)	13 (40.6)	11 (61.1)	07 (38.8)	04 (44.4)	05 (55.5)	06 (54.5)	05 (45.4)	NA	NA
3.	Ampicillin (10mcg)	04 (12.5)	28 (87.5)	02 (11.1)	16 (88.8)	06 (66.6)	03 (33.3)	04 (36.3)	07 (63.6)	03 (37.5)	05 (62.5)
4.	Amoxicillin-Clavulanate (20/10mcg)	07 (21.8)	25 (78.1)	04 (22.2)	14 (77.7)	NA	NA	05 (45.5)	06 (54.5)	NA	NA
5.	Ciprofloxacin (5mcg)	05 (18.7)	27 (84.3)	03 (16.6)	15 (83.3)	02 (22.2)	07 (77.7)	09 (81.8)	02 (18.8)	04 (50.0)	04 (50.0)
6.	Norfloxacin (10 mcg)	06 (40.0)	26 (81.7)	05 (27.7)	13 (72.2)	04 (44.4)	05 (55.5)	08 (72.7)	03 (27.2)	06 (75.0)	02 (25.0)
7.	Nitrofurantoin (300 mcg)	20 (62.5)	12 (37.5)	13 (72.2)	05 (27.7)	05 (55.5)	04 (44.4)	07 (63.6)	04 (36.3)	05 (62.5)	03 (37.5)
8.	Ceftazidime (30mcg)	08 (25.0)	24 (75.0)	06 (33.3)	12 (66.6)	NA	NA	NA	NA	NA	NA
9.	Meropenem (10mcg)	29 (90.6)	03 (9.3)	16 (88.8)	02 (11.1)	07 (77.7)	02 (22.2)	NA	NA	NA	NA
10.	Doripenem (10mcg)	30 (93.7)	02 (6.2)	17 (94.4)	03 (16.6)	08 (88.8)	01 (11.1)	NA	NA	NA	NA
11.	Penicillin (10mcg)	NA	NA	NA	NA	NA	NA	01 (9.0)	10 (90.9)	03 (37.5)	05 (62.5)
12.	Teicoplanin (30mcg)	NA	NA	NA	NA	NA	NA	09 (81.8)	02 (18.1)	07 (87.5)	01 (12.5)

U1: *E. coli*, U2: *K. pneumoniae*, U3: *P. aeruginosa*, U4: *S. aureus*, U5: *E. faecalis*

R: Resistant, S: Sensitive, NA: Notapplicable.

*Values in columns show number of cultures while values in parenthesis show percentage of cultures resistant to antibiotic.

shown in Table 5.

4. Discussion

UTI is most common disorder in pregnant women and become a serious problem worldwide. In this study prevalence of UTI in pregnant women was 65% these resembles with the study done in Iraq by Mamoryi and Salman in 2019,¹² they were found 64.6% prevalence while in other study done in Libya by Tamalli *et al* in 2013 reported 30% prevalence of UTI.¹³ Beside this low prevalence were recorded in India and Ethiopia and it was only 7.7% and 9.5% respectively.^{14,15} The variation in prevalence might be due to the difference in sample size and geographical conditions. The majority of UTI cases among pregnant women observed in age group of 25-30 years but previous study Ranjan *et al* found higher incidence in age less than 25 years in 2017 while Ayoyi *et al* reported higher cases of UTI in age of more than 35 years.^{5,16} The risk of UTI may increases with increase in maternal age. According to previous studies, multigravida is major risk factor for developing bacteriuria in pregnant

women but in current study highest incidence of UTI was seen in primary gravida (52.5%) and lowest incidence in multigravida (19.2%). The higher prevalence of UTI found in third trimester followed by second trimester and first trimester, it was accordance with the study done by Ranjan *et al*.⁵ The increased incidence of UTI in third trimester may be due to mechanical obstruction due to enlarge uterus. The most prevalent bacterial pathogen was *E.coli* (41.0%) followed by *K. pneumoniae* (23.0%), *P. aeruginosa* (11.5%), *S. aureus* (14.1%) and *E. faecalis* (10.2%). The most prevalent isolated uropathogen identified in this study was *E. coli*, which is in accordance with studies conducted in Ethiopia and India.^{7,17} The major factor responsible for higher frequency of *E. coli* in pregnant women is urine stasis in pregnancy, which promotes the growth and colonization of bacteria. Majority of the isolated uropathogens were found to be highly sensitive for Doripenem, Meropenem and Imipenem while resistant for Ampicillin and Penicillin. These results of antibiotic susceptibility were similar to the study done by Trupthi gowda and Rajni in India¹⁷ and Tula *et al* in Ethiopia.⁷ Thus, emergence of resistant isolates is due to improper use of antibiotics without consulting with

physician.

5. Conclusion

The overall prevalence of UTI among pregnant women in Ujjain is very high. The most prevalent and dominant causative agent of UTI was *E. coli*. The most effective antibiotic for treatment of UTI is Carbapenems and Nitrofurantoin. The antibiotic should be prescribed carefully; they may not cause any side effect in pregnant women during treatment. The screening of UTI in pregnant women during pregnancy will improve the quality of prenatal care and reduce the risk of complications during pregnancy.

6. Source of Funding

None.

7. Conflict of Interest

None.

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