

Research Article



Prevalence of Urinary Tract Infections and Its Etiological Agents among Pregnant Women in Malabar Region of Kerala

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ABSTRACT

Urinary tract infections are the one of the most commonly observed infectious disease during pregnancy. It may cause several complications such as pyelonephritis, chronic renal failure, anemia, preeclampsia, premature delivery and fetal mortality. Idea about the uropathogens responsible for urinary tract infections and their sensitivity profile towards commonly using antibiotics may assist the clinician to select the appropriate and accurate treatment. Hence the present study was design to identify the pathogenic agents of UTI among pregnant women and to find out the drug susceptibility patterns of isolated organism against commonly prescribed antibiotics. Prospective analysis was carried out for 385 mid-stream urine specimens, processed for culture and antimicrobial drug susceptibility testing. In 65 cases the urine culture was positive, giving an incidence of 16.88%. Gram-negative bacteria were more prevalent with 89.79% than Gram-positive bacteria with 10.29%. Of the 67 isolates, the most commonly isolated bacteria were *Escherichia coli* 23 (33.82%). Other organisms like *Klebsiella spp* 22.05%, *Citrobacter* 14.71%, *Enterobacter spp* 5.88%, *Pseudomonas* 4.41% and *Acinetobacter* 7.35% were also found in this study. The isolated Gram negative uropathogens showed high resistance to and Ampicillin, Amoxicillin clavulanate, Ceftriaxone, Cefuroxime, Vancomycin and sensitive to Imipenem, Amikacin, Gentamicin and Ciprofloxacin.

Keywords: Urinary tract infection, prevalence, bacteriuria, pregnant women, uropathogens, antimicrobial susceptibility pattern.

INTRODUCTION

Urinary Tract Infection (UTI) is a most common infectious disease which can affect people with all ages, sex and from all cultures. However, some special groups of people are more prone to UTI than others, such as women are in a greater risk compared to men due to their shorter urethra which is continually contaminated with pathogens from vagina and rectum. Frequent sexual intercourse is also a promoting risk factor for developing UTI in them.

Urinary tract infection during pregnancy is a common alignment and has been reported among 20% of the pregnant women with prime reason for admission in obstacle ward.

Specific physiological changes during pregnancy like changes in the ureters, decrease in the bladder tone, sluggish rate of urine flow, mechanical effect of pregnant uterus are the predisposing factors for UTI during pregnancy.¹

Untreated Urinary tract infection in pregnancy can lead to serious obstetric complications, poor maternal and perinatal outcomes like intrauterine growth restriction, preeclampsia, caesarean delivery and preterm deliveries.²

Moreover, it has been reported that asymptomatic bacteriuria can progress to cystitis and pyelonephritis.³ This can lead to acute respiratory distress, transient renal failure, sepsis and shock during pregnancy.⁴ Screening of

pregnant lady for Urinary tract infection can reduce all UTI associated complications.⁵

The pathological agents for UTI and its susceptibility pattern can vary according the geographical, social and biological settings.⁶

Therefore, it is necessary to identify the etiological agent and its susceptibility pattern in order to select appropriate antimicrobial drugs for the management of patients suffering from UTIs.

Hence, the present study was carried out to determine the range of bacterial isolates and their antibiotic susceptibility among pregnant women attending antenatal clinic.

MATERIALS AND METHODS

Study area and population

A prospective study was conducted in both pregnant outpatient and pregnant inpatients visited to the department of OBG at MES Medical College, 750 bedded tertiary care teaching hospital at Perinthalmanna, Kerala, India during the period of January 2014 to December 2014.

Inclusion criteria

Pregnant women comprised of varying ages from 18 years to 40 years. Subjects from varying gravida were studied and subjects from all three trimesters were included.



Exclusion criteria

Non pregnant women and the pregnant women who took any antibiotics during the last two weeks were excluded from the present study. Sample was not considered in case of improper sample collection and the Individuals suffering from STD's.

Ethical considerations

Ethical approval was obtained from institutional ethics committee of MES Medical College. Informed written consent was obtained from the study participants. They were explained about the study.

For each confirmed infection case, the responsible clinicians of the participant were informed and treatments were started as per the culture result and drug susceptibility pattern.

Bacterial isolation and antimicrobial susceptibility testing

Patient is instructed to collect 30 ml of mid stream urine specimen in a sterile bottle. Information regarding age, parity, date of last menstruation period and history of urinary tract infection in the past, history of concurrent diabetes, hypertension and other diseases was documented.

Urine samples were plated on Mac-Conkey and Blood agar plates and incubated at 37°C for 24 hours.

A significant bacterial count was taken as count equal to or in excess of 10⁵ per milliliter. Identification of pure isolates was done by observing morphological, cultural and biochemical characters.⁷

Antibiotic sensitivity testing was performed using the Kirby–Bauer disc diffusion method according to the Clinical and Laboratory Standards Institute Guidelines.

Antimicrobial drug susceptibility testing for Ampicillin, Amoxicillin clavulanate, Nitrofurantoin, Cotrimoxazole, Gentamicin, Amikacin, Ciprofloxacin, Cefuroxime, Vancomycin, Ceftriaxone, Imipenem was done on all bacteria isolated. Interpretation of results was done based on the diameter of the zone.

RESULTS

A total of 385 urine samples were collected and screened for microscopic examination and culture. Out of which 65 cases the urine culture was positive, giving an incidence of 16.88% in this study. Among 385 samples 342 patients were asymptomatic and 43 were symptomatic. Bacteriuria found among symptomatic and asymptomatic cases were 12 (19.04 %) and 53 (16.45%) respectively.

Among the pregnant women, the incidence of bacteriuria was increased with age (Table-1). It was more in age group Above 35 (37.7%) compare to other groups. Incidence of bacteriuria was seen to increase with rising parity (Table-2). In multi gravida, the incidence was almost twice when compared to that in the primi gravida.

In present study, bacteriuria was found during all the three trimesters (Table-3). The incidence of bacteriuria during First, second and third trimester was found to be 13.95%, 14.28% and 18.69% respectively with a high incidence in third trimester.

From Table-4 it is clear that, the factors like Hypertension, Long term treatments, history of a previous surgery, History of contraceptive use and Personal hygiene not has a significant role in UTI in pregnancy. But out of 13 diabetic pregnant women bacteriuria was found in 6 cases and out of 47 pregnant women with past history of UTI 14 were had a bacteriuria.

Significant proteinuria was present in 73.48% of bacteriuric cases. However, 12.30% of the bacteriuric women did not show any proteinuria. 13.84% bacteriuric women revealed a trace of proteinuria.

Urine showing 3 or more pus cells per field was considered as significant. Significant pyuria was present in 63.07% of bacteriuric cases.

The gold standard for detecting bacteriuria in pregnancy is urine culture. Table-5 shows the frequency of various isolated pathogens during pregnancy.

From present study 67 pathogens were isolated from 65 patients (two cases shows 2 organism) out of that 61 organisms were Gram negative (89.71%) and 7 organisms were Gram positive (10.29%).

Among the isolates *E.coli* had the highest percentage of isolation (34.33%) followed by *Klebsiella pneumonia* (22.39%), *Citrobacter spp* (14.93%), *Acinetobacter spp* (7.46%), *Enterobacter spp* (4.48%), *Pseudomonas aeruginosa* (4.48%), *Staphylococcus aureus* (4.48%), *Staphylococcus Saprophyticus* (2.98%), *Enterococcus spp* (2.98%) and *Providencia* (1.49%) respectively.

Isolated Bacterial uropathogens shows a high level of multiple antimicrobial resistances against commonly prescribed drugs. Among gram negative organisms (Table-6), the commonest organism *E.coli* showed the high percentage of resistance to Ampicillin (95.65%), Cefuroxime (95.65%), Amoxicillin clavulanate (91.13%), Ceftriaxone (91.13%), Ciprofloxacin (60.87%), Vancomycin (52.17%), Gentamicin (43.48%), Cotrimoxazole (43.48%), Nitrofurantoin (26.09%) and Amikacin (17.39%), but all were sensitive to Imipenem.

The second most prevalent pathogen *Klebsiella pneumonia* displayed hundred percent resistant to Ampicillin. The resistance against other drugs was found to be Amoxicillin clavulanate (93.33%), Nitrofurantoin (66.67%), Cefuroxime (53.33%), Ceftriaxone (53.33%), Vancomycin (53.33%), Cotrimoxazole (46.67%), Ciprofloxacin (26.67%), Gentamicin (13.33%), and Amikacin (13.33%) but all were sensitive to Imipenem. However, all others gram negative isolates were similarly resistant to most of the antibiotics as that of *E. coli* and *Klebsiella pneumonia*.



Table 1: Age distribution in pregnant women with Bacteriuria

Age in years	Total No. Screened	Cases with Bacteriuria		P value
		Number	Percentage	
17-20	94	16	17.02	0.0965
21-25	125	16	12.8	
26-30	108	17	15.74	
31-35	42	10	23.80	
Above 35	16	6	37.7	
Total	385	65	16.88	

Table 2: Relationship of Parity and Bacteriuria during Pregnancy

Gravida	Total No. Screened	Cases with Bacteriuria		P value
		Number	Percentage	
First	171	25	14.61	0.1243
Second	126	19	15.07	
Three or >3	87	21	24.13	
Total	385	65	16.88	

Table 3: Relationship of duration of pregnancy and bacteriuria

Trimester	Total No. Screened	Cases with Bacteriuria		P value
		Number	Percentage	
First	43	6	13.95	0.5117
Second	112	16	14.28	
Third	230	43	18.69	
Total	385	65	16.88	

Table 4: Treatment history in Bacteriuric Women

History		Total no	Cases with Bacteriuria	Cases without Bacteriuria	P value
Present history of Diabetic mellitus	Yes	13	6	7	0.0120*
	No	372	59	313	
Present history of Hypertension	Yes	16	3	13	0.7400
	No	369	62	307	
Long term treatments	Yes	32	6	26	0.8051
	No	353	59	294	
Surgery	Yes	32	6	26	0.6205
	No	353	56	297	
Past history of UTI	Yes	47	14	33	0.0203*
	No	338	51	287	
History of contraceptive use	Yes	23	3	20	0.7788
	No	362	62	300	
Personal hygiene (satisfactory)	Yes	280	45	235	0.5414
	No	105	20	85	

Table 5: Organisms isolated

Organisms	Number	Percentage
<i>Escherichia coli</i>	23	34.33
<i>Klebsiella pneumonia</i>	15	22.39
<i>Citrobacter spp</i>	10	14.93
<i>Accinitobactor</i>	5	7.46
<i>Enterobactor spp</i>	3	4.48
<i>Pseudomonas aeruginosa</i>	3	4.48
<i>Providencia</i>	1	1.49
<i>Staph. aureus</i>	3	4.48
<i>Staph. Saprophyticus</i>	2	2.98
<i>Enterococcus spp</i>	2	2.98
Total	67	100

Table 6: Antibiotic sensitivity pattern of gram negative bacteria

Drugs		<i>E.coli</i>	<i>Kleb</i>	<i>Citro</i>	<i>Acine</i>	<i>Entero</i>	<i>Pseudo</i>	<i>Provi</i>	<i>Total</i>
		23	15	10	5	3	3	1	60
Ampicillin	S	1 (4.35)	0 (0)	1 (10)	0 (0)	1 (33.33)	0 (0)	0 (0)	3 (5)
	R	22 (95.65)	15 (100)	9 (90)	5 (100)	2 (66.66)	3 (100)	1 (100)	57 (95)
Amoxicillin clavulanate	S	2 (8.7)	1 (6.67)	4 (40)	2 (40)	1 (33.33)	1 (33.3)	0 (0)	11 (18.3)
	R	21 (91.3)	14 (93.3)	6 (60)	3 (60)	2 (66.66)	2 (66.66)	1 (100)	49 (81.67)
Nitrofurantoin	S	17 (73.91)	5 (33.3)	7 (90)	1 (20)	1 (33.33)	1 (33.33)	0 (0)	32 (53.33)
	R	6 (26.09)	10 (66.67)	3 (30)	4 (80)	2 (66.66)	2 (66.66)	1 (100)	28 (46.67)
Cotrimoxazole	S	13 (56.52)	8 (53.33)	7 (70)	3 (60)	1 (33.33)	2 (66.66)	0 (0)	34 (56.67)
	R	10 (43.48)	7 (46.67)	3 (30)	2 (40)	2 (66.66)	1 (33.33)	1 (100)	26 (43.33)
Gentamicin	S	13 (56.52)	13 (86.67)	9 (90)	4 (80)	3 (100)	3 (100)	0 (0)	45 (75)
	R	10 (43.48)	2 (13.33)	1 (10)	1 (20)	0 (0)	0 (0)	1 (100)	15 (25)
Amikacin	S	19 (82.61)	13 (86.67)	9 (90)	4 (80)	3 (100)	3 (100)	0 (0)	51 (85)
	R	4 (17.39)	2 (13.33)	1 (10)	1 (20)	0 (0)	0 (0)	1 (100)	9 (15)
Ciprofloxacin	S	9 (39.13)	11 (73.33)	9 (90)	4 (80)	3 (100)	3 (0)	0 (0)	39 (65)
	R	14 (60.87)	4 (26.67)	1 (10)	1 (20)	0 (0)	0 (0)	1 (100)	21 (35)
Cefuroxime	S	1 (4.35)	7 (46.67)	4 (40)	1 (20)	1 (33.33)	3 (100)	0 (0)	17 (28.33)
	R	22 (95.65)	8 (53.33)	6 (60)	4 (80)	2 (66.66)	0 (0)	1 (100)	43 (71.67)
Vancomycin	S	11 (47.83)	7 (46.67)	5 (50)	2 (40)	1 (33.33)	3 (100)	0 (0)	29 (48.33)
	R	12 (52.17)	8 (53.33)	5 (50)	3 (60)	2 (66.66)	0 (0%)	1 (100)	31 (51.66)
Ceftriaxone	S	2 (8.7)	7 (46.67)	4 (40)	1 (20)	1 (33.33)	3 (100)	0 (0)	18 (30)
	R	21 (91.3)	8 (53.33)	6 (60)	4 (80)	2 (66.66)	0 (0)	1 (100)	42 (70)
Imipenem	S	23 (100)	15 (100)	8 (80)	5 (100)	3 (100)	3 (100)	0 (0)	57 (95)
	R	0 (0)	0 (0)	2 (20)	0 (0)	0 (0)	0 (0)	1 (100)	3 (5)

E.coli-*Escherichia coli*, *Kleb*- *Klebsiella spp*, *Citro*- *Citrobacter spp*, *Acine*- *Accinitobactor*, *Entero*- *Enterobactor spp*, *Pseudo*- *Pseudomonas aeruginosa*, *Provi*-*Providence*



Table 7: Antibiotic sensitivity pattern of gram positive bacteria

Drugs		Staph. aureus	Staph. Sapro	Enterococcus	Total
		3	2	2	7
Ampicillin	S	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	R	3 (100%)	2 (100%)	2 (100%)	7 (100%)
Amoxicillin clavulanate	S	2 (66.67%)	2 (100%)	1 (50%)	5 (71.43%)
	R	1 (33.33%)	0 (0%)	1 (50%)	2 (28.57%)
Nitrofurantoin	S	2 (66.67%)	1 (50%)	0 (0%)	3 (42.86%)
	R	1 (33.33%)	1 (50%)	2 (100%)	4 (57.14%)
Cotrimoxazole	S	2 (66.67%)	2 (100%)	0 (0%)	4 (57.14%)
	R	1 (33.33%)	0 (0%)	2 (100%)	3 (42.86%)
Gentamicin	S	3 (100%)	2 (100%)	1 (50%)	6 (85.71%)
	R	0 (0%)	0 (0%)	1 (50%)	1 (14.29%)
Amikacin	S	3 (100%)	2 (100%)	2 (100%)	7 (100%)
	R	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ciprofloxacin	S	3 (100%)	2 (100%)	0 (0%)	5 (71.43%)
	R	0 (0%)	0 (0%)	2 (100%)	2 (28.57%)
Cefuroxime	S	2 (66.67%)	2 (100%)	1 (50%)	5 (71.43%)
	R	1 (33.33%)	0 (0%)	1 (50%)	2 (28.57%)
Vancomycin	S	2 (66.67%)	1 (50%)	2 (100%)	5 (71.43%)
	R	1 (33.33%)	1 (50%)	0 (0%)	2 (28.57%)
Ceftriaxone	S	2 (66.67%)	2 (100%)	1 (50%)	5 (71.43%)
	R	1 (33.33%)	0 (0%)	1 (50%)	2 (28.57%)
Imipenem	S	3 (100%)	2 (100%)	2 (100%)	7 (100%)
	R	0 (0%)	0 (0%)	0 (0%)	0 (0%)

S. Aureus- staphylococcus aureus, S. Saprophyticus- staphylococcus Saprophyticus

Of the Gram-positive organisms (Table-7) 100% resistance to Ampicillin, Nitrofurantoin (57.14%), Cotrimoxazole (42.86%), Amoxicillin clavulanate (28.57%), Ciprofloxacin (28.57%), Cefuroxime (28.57%), Vancomycin (28.57%), Ceftriaxone (28.57%), Gentamicin (14.29%) was noted. All

the Gram-positive organisms were sensitive Imipenem and Amikacin.

DISCUSSION

Urinary tract infections (UTI) are the one of the most commonly observed infectious disease during pregnancy.



It may cause several complications such as pyelonephritis, chronic renal failure, anemia, preeclampsia, premature delivery and fetal mortality. Research about the uropathogens responsible for urinary tract infections and their sensitivity profile towards commonly using antibiotics may assist the clinician to select the appropriate and accurate treatment.

From the present study overall prevalence of UTI in pregnancy was found as 16.88%. This is comparable to the prevalence of urinary tract infection reported in Northern Tanzania (16.4 %).⁸ But some studies shown a lower prevalence like study in North-western Tanzania (14.6 %),⁴ Tamilnadu in India (14.19%),⁹ Sudan (14.0 %),¹⁰ Addis Ababa at Ethiopia (11.6 %),¹¹ North West Ethiopia (9.5%),¹² Northwest Ethiopia (11.6 %),¹³ Andhra Pradesh in India (7.7%),¹⁴ Hyderabad in India (7.5%),¹⁵ Pakistan (4.3%).¹⁶ Some studies also shows a higher prevalence like studies conducted in Karnataka in south India (49.4%),¹⁷ Egypt (31.3%),¹⁸ Dhaka (26.0%),¹⁹ Libya (30%),²⁰ Southern Nigeria (25.3%),²¹ Makah in KSA (20%).²² All this variation may be due to the difference in the geographical, environmental and social habits of the population.

Bacteriuria among symptomatic and asymptomatic cases were found as 12 (19.04 %) and 53 (16.45%) respectively. Symptoms did not associate with the prevalence of symptomatic UTI in this study ($p=0.7189$). Some studies like study conducted in Addis Ababa Ethiopia and Tanzania reported same findings.^{8,4}

In this study, the association between maternal age, gravidity and parity with bacteriuria was found to be non significant. Previous studies conducted in Northwest Ethiopia,¹³ Sudan¹⁰ and Tanzania⁴ was agreed with this study. However some study reports that the maternal age and parity as a risk factors for UTI among pregnant women.¹⁶ Closer analysis of the previous literature shows that the age and parity effects are poorly influence pregnant bacteriuria because some studies report an increase in prevalence with increased with age,²³ were others report it more with younger age group.²⁴

The present study agree with previous studies conducted in Pakistan²⁵ and Northwest Ethiopia¹³ on relationship between prevalence of UTI in pregnancy with previous history of urinary tract infection. Prevalence of UTI in pregnant lady with prior history of UTI was significantly higher than the one without previous history UTI ($p = 0.0203$). It may be due to drug resistant organism from those who had previous history of urinary tract infection.

This study reports that the Present history of Diabetic mellitus can be a promoting factor of Urinary tract infection during pregnancy. The Prevalence of UTI in pregnant lady with Present history of Diabetic mellitus was significantly higher than the one without previous history Diabetic mellitus ($p = 0.0120$). This may be due to their weakened immune systems. In addition to that patients with diabetes may develop nephropathy,

cystopathy, and renal papillary necrosis. Long-term diabetic cystopathy can cause vesicourethral reflux and recurrent urinary tract infection. All this complications can contribute to the severity and frequency of urinary tract infection in female diabetics. The factors like Hypertension, Long term treatments, history of a previous surgery, History of contraceptive use and Personal hygiene not has a significant role in UTI in pregnancy.

Presence of Gram-negative organisms was more common 60 (89.55%) compare to Gram-positive bacteria 7 (10.45%) which is in line with others studies.²⁶⁻³⁰ This may be due to the existence of unique structure in Gram negative bacteria which assist for attachment to the uroepithelium and prevent pathogens from urinary lavage, allow for growth and tissue invasion resulting in invasive infection and pyelonephritis during pregnancy.³¹

The frequency and pattern of isolated micro organism reported in this study was similar to that of previous reports.^{27,11,32-35} *E.coli* was the most common isolate with an isolation rate of (34.33%). It is Comparable to various studies conducted in Yemen 41.5 %, ³⁶ Sudan 42.4 %, ¹⁰ Nigeria 42.1 % ³⁷ and Ethiopia 44%. ¹¹ The most common micro organism found in vaginal and rectal area is *E. Coli*. During pregnancy, it is very difficult to maintain personal hygiene due to anatomical and functional changes in them. This may increases the chance of *E.coli* infection during pregnancy.

The second most common organism found in the present study was *Klebsiella pneumonia* (22.39%) followed by *Citrobacter spp* (14.93%), *Acinetobacter spp* (7.46%), *Enterobacter spp* (4.48%), *Pseudomonas aeruginosa* (4.48%) and *Providencia* (1.49%) respectively. This is comparable to most of the world wide studies and the difference found in this study was the high prevalence of *Citrobacter* (14.93%) compare to other study. Gram positive organisms were also found common as previous reported studies *Staphylococcus aureus* (4.48%), *Staphylococcus Saprophyticus* (2.98%), *Enterococcus spp* (2.98%).

The resistances among uropathogens against the commonly used antibiotics are serious issue, which limits drug of choice for the treatment of UTI.^{11,6} Hence it got an importance to find sensitivity pattern of commonly using drugs against the causative pathogen. In this study, susceptibility pattern of Gram-negative bacteria showed that most of the isolates were sensitive towards Imipenem 95%, Amikacin 85%, Gentamicin 75%, Ciprofloxacin 65%, Cotrimoxazole 56.67% and Nitrofurantoin 53.33%. The sensitivity towards other drug was found as minimum like Vancomycin 48.33%, Ceftriaxone 30%, Cefuroxime 28.33%, Amoxicillin clavulanate 18.3% and Ampicillin 5%.

As these drugs are cheaply available over the counter, it can lead to improper and unsystematic use. This can



cause to the emergence of drugs resistance towards these drugs.

Gram-positive bacterial isolates showed a complete sensitivity towards Amikacin 100%, Imipenem 100%. The sensitivity towards other drugs was found as Gentamicin 85.71%, Amoxicillin clavulanate 71.43%, Ciprofloxacin 71.43%, Cefuroxime 71.43%, Vancomycin 71.43%, Ceftriaxone 71.43%, Cotrimoxazole 57.14% and Nitrofurantoin 42.86%. But Ampicillin showed a complete resistance towards the isolated Gram-positive organisms.

CONCLUSION

To conclude, overall prevalence of UTI in pregnancy in study region was found as 16.88%. As the symptomatic and asymptomatic bacteriuria was common during pregnancy, it is highly recommended to carry out a urine culture as a part of antenatal care in all pregnancies. Maternal age, gravidity, parity, hypertension, long term treatments, history of a previous surgery, history of contraceptive use and Personal hygiene do not have a significant role in UTI in pregnancy. But a factor like past history of UTI and diabetic during pregnancy has a significant role in UTI in pregnancy. Both gram positive and gram negative organisms were act as causative organism for UTI in pregnancy, but gram negative bacteria's are the most common organisms isolated. *E.coli* is the most predominant organism found in pregnant UTI patients. In the current study most of isolated uropathogens showed multiple antibiotics resistance against commonly prescribed antibiotics. This shows a picture about the current trend of high antibiotic resistance of pathogenic bacteria in this location, which may be due to the difference in geographic location or due to unsystematic use of antibiotics. This data may help for proper treatment of pregnant UTI patients and discourage the unsystematic use of antibiotics to prevent further development of drug resistance.

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