Journal Of Medical Science And Clinical Research

IGM Publication   An Official Publication Of IGM Publication

Original Research Article

Incidence of urinary tract infections among pregnant women and identification of etiological agents with the antibiotic sensitivity patterns

Authors
Smrutirekha Mishra[1], Dr (Mrs.) Sukantibala Mohapatra[2], Dr M R Ranjit[3], Dr G K Panda[4]
[1]PhD Scholar (Microbiology), Utkal University, Vanivihar, Bhubaneswar
[2]Associate Professor, Dept. of Microbiology, OUAT, Bhubaneswar
[3]Scientist F, ICMR- Regional Medical Research Centre, Bhubaneswar-751023
[4]Associate Professor, Dept. of PTSR, MSM Institute of Ayurveda, BPSMV, Khanpur kalan, Sonipat, Haryana
Corresponding Author
Smrutirekha Mishra
PhD Scholar (Microbiology), Utkal University, Vanivihar, Bhubaneswar

Abstract
Objective: *The study was carried out to identify the etiological agents along with the factors responsible for the incidence of urinary tract infections among pregnant women and to determine the antibiotic sensitivity pattern.*
Materials and Methods: *The research analysis was performed for 300 urine samples and was screened for culture followed by identification by conventional methods and then the antibiotic sensitivity tests were done by disc diffusion methods.*
Results: *It had observed that UTI is the more frequent in women of 26-30 years of age group. The incidence rate of UTIs during pregnancy was high with a rate of 61%. Females belonging to lower socio-economic status were more susceptible to UTIs. The isolated and identified uropathogens from pregnant women were E coli (74.3%), Klebsiella spp. (12.5), Citrobacter spp. (6.5%), Proteus spp. (5.4%), Staphylococcus spp. (1.09%). The isolated organisms showed sensitivity to nitrofurantoin followed by amikacin.*
Conclusion: *Urinary tract infections are the most common bacterial infections in pregnant women and one of the contributing factors for complications during pregnancy. So it is important to diagnose UTI properly by routine screening of all pregnant women to avoid the general complications during pregnancy.*
Keywords: *Urinary tract infections, pregnant women, uropathogens.*

Introduction

Urinary Tract Infection (UTI) has become the most common hospital-acquired infection, accounting for as many as 35 % of nosocomial infections, and it is the second most common cause of bacteraemia in hospitalized patients

(Epoke *et al*., 2000). Urinary tract infection is a common health problem among pregnant women (Mittal *et al*., 2005). Pregnant women are more prone than non-pregnant women to develop UTI because of physiological changes in urinary tract during pregnancy. Beginning in 6th week reaching peak by 22nd to 24th weeks approximately 90% of pregnant women develop urethral dilation, which will remain until delivery (Hydronephrosis of pregnancy). Increased bladder volume and decreased bladder tone, along with decreased urethral tone, contribute to increase in urinary stasis and urethero reflux (Delzell *et al*., 2000; Singh *et al*., 2013; Lavanya *et al*., 2002).

The changes that occur both in the structure and function of the urinary tract in pregnancy encourage to the upper urinary tract infections, which include the dilatation of the renal calyces and the ureters, thus implicating hormonal relaxation of the muscular layers of the renal tract (Cunningham *et al*., 2005). Increased vesicourethral reflux also increases this potential for multiplication of bacteria within the renal tract. As a result, urinary tract infections are the most common infections complicating pregnancy. Definite bacteriuria is defined as the presence of up to 100,000 colony forming units (CFUs) of the pathogen per ml of clean catch urine specimens or a single catheterization specimen (Cunningham *et al*., 2005).The prevalence of UTI in pregnancy varies across the various regions of the world. In Nigeria the highest incidence of 86.6% was reported in Benin City, Niger Delta area (Akerele *et al*, 2001). Symptomatic and asymptomatic bacteriuria has been reported 17.9% and 13.0% among pregnant women, respectively as stated by Masinde A *et al*., (2009).

Bacteria causing UTI are 80 – 85 % Gram negative and 15 – 20 % Gram positive. Among Gram negative bacteria, *Escherichia coli* are most frequent pathogen. It is responsible for 70 – 80% of acute infection in general population and 50% hospital acquired infections. Second most common cause of UTI is *Klebsiella species* and other is *Proteus species especially Proteus*

mirabilis, Enterobacter, Citrobacter, Pseudomonas and Serratia (Nadia *et al*., 2004).

The improper treatment of UTIs can lead to obstetric and neonatal complications. Among them, the early rupture of membranes, premature delivery and labor, restriction of intrauterine growing, low birth weight, abortion and fetal death are the commonly encountered problems (Jacociunas *et al.,* 2007). Other complications have been associated with UTIs: hypertension, preeclampsia, anemia, chorioamnionitis, endometritis, septicemias (Schieve *et al.,* 1994).

Therefore, the present study was conducted to determine the incidence of UTI among pregnant women along with the influence of sociodemographic characteristics as well as the evaluation of the uropathogens. The findings from this study will form the basis about recommendations with respect to routine screening for bacteriuria among pregnant women.

Material and Methods

An investigational study was conducted on 300 midstream urine samples obtained by informed consent of the pregnant women who were suspected to have UTI, attending different antenatal clinics at Bhubaneswar and puri.

Demographic and clinical information of the subjects (the cases and the controls) were obtained by chart abstraction and recorded. The study groups were also stratified by Age distribution. Information was collected on the women's age, occupation (economic status), gestational age, and parity etc, (Okonko, *et al*., 2009). The pregnant women who were on antibiotic therapy within last two weeks were not been involved in the study.

The methods applied for the Identification and characterization of the etiological agents include microscopic examination, colony morphology on blood agar and Mac-conkey's agar, gram staining followed by standard biochemical tests according to Cheesbrough (2002,2004) and the isolates were identified by Bergey's Manual of Systematic Bacteriology (Buchanan and Gribbons, 1974). All the isolates were subjected to antibiotic

susceptibility testing using Kirby-Bauer disc diffusion method (Collee *et al*., 1996), which was done on Mueller Hinton Agar plate by using the different antimicrobial agents, as per the CLSI guidelines.

Results

Table -1: Microscopic examination of the urine samples.

Quantitative Count (Cfu/ml)	Number(%) from Urine samples	Various pathological conditions
$\geq 10^5$	110 (36.6)	Definite Bacteriuria
10^3-10^5	62 (20.6)	Moderate Bacteriuria
$\leq 10^3$	16 (5.3)	Probability of infection
No Growth	112 (37.3)	Sterile
Total	300	

Table 1 represents the viable count of the bacteriuria in the samples collected from the pregnant women. The pour plate method was applied to study the plate count of the samples. A total of 110 (36.6%) samples were observed to contain $\geq 10^5$ bacteria/ml indicating definite bacteriuria followed by moderate bacteriuria in 62(20.6%) cases and 16(5.3%) cases indicating a condition for probability of infection.

Table 2: Age-wise distribution of UTI in pregnant women

Age group (in years)	No. of Samples Tested	No. of Positive Samples (%)	No. of Negative Samples (%)
21-25	140	88(62.8)	52(37.1)
26-30	68	49(72.0)	19(27.9)
31-35	53	20(37.7)	33(62.2)
36-40	39	26(66.6)	13(33.3)
Total	300	183(61.0)	117(39.0)

The occurrence of UTIs in relation to age is presented in Table -2 which revealed that prevalence of UTIs was observed to be highest In the age bracket of 26-30 years with a frequency of 72%, i.e 49 positive cases out of 68 urine sample collected; followed by 66.6% in the age bracket of 36-40. Least infection was noticed in the age group of 31-35 years, with a frequency of 37.7% positive cases. Looking at the complete data, it

emerges that 61% of the total population studied in the area was found to be positively infected while 39% was negative.

Table-3: Incidence of UTI by parity (No. of pregnancy)

Parity	No. of sample tested	No. of positive sample (%)	No. of negative sample(%)
1st pregnancy	138	76(55.0)	62(44.9)
2nd pregnancy	64	39(60.9)	25(39.0)
3rd pregnancy and above	98	68(69.3)	30(30.6)
Total	300	183(61.0)	117(39.0)

The incidence of UTI in pregnant women based on parity (Table-3) indicated that women in their 3rd or higher number of pregnancy had a greater possibility of UTI. In the present study, the incidence of UTI in the first pregnancy was least in comparison to the others. Looking at the total data, it was observed that the chances of UTI increased with the increase in the number of times a woman became pregnant.

Table-4 Incidence of UTI by trimester periods

Trimester period	No. of samples tested	No. of positive cases (%)	No. of negative cases (%)
I trimester	52	20(38.4)	32(61.5)
II trimester	92	56(60.8)	36(39.1)
III trimester	156	107(68.5)	49(31.4)
Total	300	183(61.0)	117(39.0)

[Note- I trimester is 1st three months, II trimester is 2nd three months, III trimester is 3rd three months]

The incidence of UTI by trimesters is summarized in Table- 4, which indicated that women in their 3rd trimester and 2nd trimester had a greater number of UTI in the cases studied with an incidence of 68.5% and 60.8% respectively. The lowest percentage (38.4%) was found in the 1st trimester.

Table-5 Incidence of UTI with reference to gestational age (Age of pregnancy)

Age of pregnancy (in months)	No. of samples screened	No. of positive samples (%)	No. of negative samples (%)
3	52	20 (38.4)	32 (61.5)
4	26	19 (73.0)	7 (26.9)
5	32	17 (53.1)	15 (46.8)
6	34	20 (58.8)	14 (41.17)
7	53	44 (83.0)	9 (16.9)
8	38	25 (65.7)	13 (34.2)
9	65	38 (58.4)	27 (41.5)
Total	300	183(61.0)	117(39.0)

The gestational age (age of pregnancy) distribution of the women suffering from UTI (Table-5) indicated that the prevalence rate was least in the 3rd month of pregnancy, having a frequency rate 38.4% and the highest prevalence rate (83.0%) was obtained in the 7th month of pregnancy.

Table-6 Incidence of UTI among pregnant women in relation to Socio-economic Status

Socio-Economic Status	No. of samples	Number positive (%)	No. of negative samples (%)
Lower	98	72 (73.4)	26 (26.5)
Middle	116	72 (62.0)	44 (37.9)
Upper	86	39 (45.3)	47 (54.6)
Total	300	183(61.0)	117 (39.0)

(Note: - Lower Status Group having income <Rs 10,000/- per month, Middle Group having income > Rs 10,000/- and < Rs 25,000/- per month and Upper Status Group having income >Rs 25000/- per month.)

The incidence of UTI in reference to the socio-economic status of the pregnant women (Table 6) revealed that as the socio-economic status declined, the frequency of UTI positive cases increased. The cases belonging to the lower socio-economic status found in higher frequency (73.4%) of UTI than those belonging to the upper socio-economic status (45.3%).

Table-7 Spectrum of Urinary pathogens isolated from urine samples of pregnant women.

Isolated Organisms	No. of Samples Positive	Percentage (%)
E.coli	136	(74.3)
Klebsiella spp.	23	(12.5)
Citrobacter spp.	12	(6.5)
Proteus spp.	10	(5.4)
Staphylococcus aureus	2	(1.09)
Total	183	(61.0)

The distribution of microorganisms from the cases presented in Table 7, it was found that out of the 183 isolates obtained, Gram-negative bacteria occurred more frequently than Gram-positive bacteria. *E.coli* was the most frequently isolated organism having 74.3% of occurrence followed by *Klebsiella* spp. with 6.5% frequency. *Staphylococcus aureus* was present in 2 cases (only 1.09%) making it the least frequent organism. Moreover, *Citrobacter* spp. and *Proteus* spp. accounted for 12 (6.5%) and 10 (5.4%) cases respectively.

Table 8 Antibiotic sensitivity pattern of the isolated Uropathogens

Antibiotics	Sensitive	Percentage (%)
Amikacin (Ak)	146	(79.7)
Ampicillin/sulbactam (A/S)	85	(46.4)
Ceftazidime (Caz)	53	(28.9)
Cefotaxime (Ctx)	66	(36.0)
Cefuroxime (Cxm)	62	(33.8)
Ciprofloxacin (Cip)	102	(55.7)
Gentamycin (G)	143	(77.7)
Imipenem (I)	141	(76.6)
Nitrofurantoin (Nit)	156	(85.2)
Norfloxacin (Nx)	115	(62.8)
Piperacillin/Tazobactam(P/T)	140	(76.5)

The antibiotic sensitivity study of all the 183 isolates revealed that nitrofurantoin (Nit) was the most effective drug to which 85.2% of isolates were sensitive followed by amikacin (Ak) to which 79.7% of the isolates were sensitive. Ceftazidime was found as the least effective drug to which only 28.9 % of isolates showed sensitivity.

Discussion

UTI is a serious problem for women and up to a third of all women may experience UTI at some point in their life. The patients in this study were the representative of pregnant woman with symptoms of UTI attending different antenatal clinics. As part of a large prospective, sampling procedure and data collection were performed according to a standardized protocol (Haider *et al*., 2010).

Quantitative analysis of uropathogens was made to see the pathological conditions of the infections in which significant bacteriurea [quantitative cultures $\geq 10^5$ colony forming units (CFU) of bacteria per ml of urine] was found 36.6% of total urine specimens collected from pregnant woman. This finding is closely similar to a retrospective analysis carried out by Poonam *et al.,* (2013) who derived 32.85% of cfu/ml $> 10^5$ from urine samples out of which gram negative bacteria were more prevalent than gram positive bacteria. This is also consistent in the present study.

The findings of this study revealed a high rate of urinary tract infections (UTI) in the studied area with an incidence rate of 61% which is consistent with the results from previous report on pregnant women in Aba, Southeastern Nigeria having incidence rate of 61.5 % UTIs (Ezeigbo *et al*., 2016). The prevalence of UTI in pregnancy varies widely among regions and even within the same country. This study result found higher as comparable to 49.4% reported in Karnataka, South India Nigeria (Manjula *et al*., 2013). However, it is lower than 86.6% reported in Benin City, Nigeria (Akerele *et al*., 2001).

The occurrence of UTI in relation to age in the present study (Table 2) showed that there was high incidence of UTIs between age groups 26-30 years (72.0%) followed by 36-40 years (66.6%). Comparatively same prevalence was derived with relatively lower than the rate of UTI in age groups 25-29 by Akobi *et al*., (2014) with an incidence of 45.9%. According to literature, increase of maternal age leads to increase in risk of UTI, which is not supported by the present study.

The present study showed that 69.3% of women who had UTI in their 3rd pregnancy and above with high incidence rate, followed by 60.9% in 2nd pregnancy. These results are almost comparable to results reported by Okonko *et al*., (2009) from Nigeria and Manjula *et al*., (2013) from Karnataka region,(except in 2nd pregnancy).So, parity is one of the possible factors affecting the prevalence and incidence rate of UTI among pregnant women. This study revealed that more than 50% incidence of UTI in pregnant women occurs in the 4th and 7th month of their pregnancy. This is also supportive up to some extend to earlier reports (Manjula *et al*., 2013).

UTIs are caused by a variety of organisms, including both gram positive and gram negative ones. In the present study *E.coli* (74.3%) was predominant isolate followed by *Klebsiella* spp. (12.5%). Akobi *et al*., (2014) also derived *E.coli* (60%) as the most common uropathogen and also it is in support of other findings where *E.coli* was reported as a major etiological agent (Agersew *et al*., 2012; Okonko *et al*., 2009).

Nitrofurantoin (Nit) was observed as the most effective drug against the pathogens (85.2%) in the present study. It was also in concordance with the previous study observed by Akobi *et al*.,(2014) that nitrofurantoin was susceptible to most of the isolated uropathogens supporting to the similar report of Aziz *et al*, & colleagues, (2006) who reported about most of the isolates (88.89%) were sensitive to nitrofurantoin,

Conclusion

The high incidence rate of UTI among pregnant women obtained in this study indicates the need for routine screening for UTIs among the antenatal mothers in the studied area. It was also observed that *Escherichia coli* were the most frequently isolated organism in urinary tract infection and also concluding that increased parity are prone for UTI apart from individual hygiene and economical status. This study highlights the need to raise awareness of UTI and to expand services for prevention of UTI during pregnancy

by maintaining hygienic conditions. Patients from lower socio economic group had significantly higher prevalence of UTI. Antibiotics for treatment of UTI should be those having perfect efficacy with consideration to the drug safety and cost effectiveness in making the appropriate choice for each patient. Antibiotics like nitrofurantoin, amikacin, imipenem (safe to have during pregnancy according to FDA guidelines) derived as the most effective drugs.

References

1. Epoke CO, Anyanwu GO, Opara AA: The Prevalence of Significant Bacteriuria in Diabetic Patients. Diabetic International 2000; 10:16–17.
2. Mittal P, Wing DA: Urinary tract infections in pregnancy. Clin Perinatol 2005; 32:749–7641.
3. Delzell, J.E., and Lefevre, M.L., Urinary tract infection during pregnancy. *Am Fam Physician.* 2000; 1; 61(3):713-720.
4. Singh G., Raksha and Urhekar AD. (2013). Urinary tract infections: Prevalence and antimicrobial susceptibility pattern. *Int.J.Curr.Microbiol.App.Sci*. 2013; 2(7): 188-19.
5. Lavanya SV. and Jogalkashmi D. Asymptomatic bacteriuria in antenatal women. *Indian Journal of Medical Microbiology*. 2002; 20, No. 2, Page No. 105 – 106
6. Cunningham FG, Leveno KJ, Bloom SL, Hauth JC, Gilstrap111 LC, Wenstrom KD.. *Renal and Urinary Tract Disorders in Williams Obstetrics* 2005; (22nd edn)*.* McGRAW-HILL Medical Publishing Division: USA.
7. Akerele J, Abhulimen P, Okonofua F. Prevalence of asymptomatic bacteriuria among pregnant women in Benin City, Nigeria. *J Obstet Gynaecol.,* 2001; 21(2): 141- 144.
8. Masinde A, Gumodoka B, Kilonzo A, Mshana SE: Prevalence of urinary tract infection among pregnant women at Bugando Medical Centre, Mwanza, Tanzania. Tanzan J Health Res. 2009; 11 (3): 154-9.
9. Nadia Gul., Samia Ahmad and Talat Y. Mujahid. "Isolation, Identification and Tract infection Patients" *Pakistan Journal of Biological Science*. 2004; 7 (12): 2051-2054.
10. Jacociunas LV, Picoli SU. Avaliação de infecção urinária em gestantes no primeiro trimestre de gravidez. *Rev Bras Anal Clin.* 2007; 39:55-7.
11. Schieve LA, Handler A, Hershow R, Persky V, Davis F. Urinary tract infection during pregnancy: its association with maternal morbity and perinatal outcome. *Am J Public Health.*1994; 84:405-10.
12. Okonko, I. O., Ijandipe, L. A.,Ilusanya, A. O.,Donbraye-Emmanuel, O. B., Ejembi, J., Udeze A. O.,Egun O. C.,Fowotade A.and Nkang A. O. Detection of Urinary Tract Infection (UTI) among pregnant women in Oluyoro Catholic Hospital, Ibadan, South-Western Nigeria. Malaysian Journal of Microbiology, 2010;Vol 6(1), pp. 16-24
13. Cheesbrough, M. Medical laboratories manual for tropical countries. Cambridge University Press. 2002; pp. 479.
14. Cheesebrough, M. District laboratory practice in tropical countries. Cambridge University Press. 2004; Pp 357.
15. Buchanan, R. E. and Gribbons, N. E. Bergey's Manual of Determinative Bacteriology (8th edition). 1974; Williams & Wilkins Co. Baltimore USA.
16. Collee JG, Mles RV, Watt B. Tests for identification of bacteria. In: Collee JG, Fraser AG, M armon BP, Simmons A, editors. Mackie and McCartney Practical Medical Microbiology in 14th Ed. New York: Churchil Livingstone; 1996; p.131-49.
17. Haider G, Zehra N, Munir AA, Haider A: Risk factors of urinary tract infection in

pregnancy. J Pak Med Assoc. 2010; 60 (3): 213-6.

18. Poonam U. Sharma and Ulka Bidwai. Isolation and identification of bacteria causing urinary tract infections in pregnant women in vidarbha and their drug susceptibility patterns in them. Int.J.Curr.Microbiol.App.Sci. 2013; 2(4): 97-103

19. O. R. Ezeigbo, R. I. A. Nnadozie , N. Asuoha-Chuks , V. U. Ojiako , I. N. Awurum and M. G. Ugochukwu. Incidence of Urinary Tract Infection (UTI) Among Pregnant Women Attending Antenatal Clinics at Some Selected Hospitals in Aba, Southeastern Nigeria. Int. J. Curr.Microbiol. App.Sci ,2016; 5(1): 193-199

20. Manjula N. G., Girish C. Math., Shripad A. Patil, Subhashchandra M. Gaddad, Channappa T. Shivannavar. Incidence of Urinary Tract Infections and Its Aetiological Agents among Pregnant Women in Karnataka Region. *Advances in Microbiology*, 2013; 3, 473-478.

21. Akobi OA *et al*. Incidence of Urinary Tract Infection among Pregnant women attending Antenatal clinic at Federal Medical Centre,Bida,Niger-State, North Central Nigeria. American Journal of Infectious Diseases and Microbiology. 2014; 2(2):34-8. http://dx.doi.org/10.12691/ajidm-2-2-2

22. Agersew A, *et al*. Bacterial Profile and Drug Susceptibility Pattern of Urinary Tract Infection in Pregnant women at University of Gondar Teaching Hospital, Northwest Ethopia.BMC Research Notes.2012; 5:197:1-7.

23. Aziz marjan khattak, Habib-ullah khan, Ihsan-ullah mashud Bushra ashiq and Syed humayun shah. Antimicrobial sensitivity pattern of urine isolates from asympto-matic bacteriuria during pregnancy. 2006; E:/Biomedica Vol.22 Jan. – Jun. /Bio-9