PREDISPOSING FACTORS AND AETIOLOGY OF URINARY TRACT INFECTIONS IN PREGNANT WOMEN

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ABSTRACT

BACKGROUND

Urinary tract infection (UTI) is a common infection in pregnant women. It is responsible for range of complications causing perinatal and maternal morbidity and mortality.

AIM

To assess the associated risk factors, aetiology and their antibiogram of UTI among pregnant women.

METHODOLOGY

This is a cross-sectional study carried out in Department of Microbiology & Department of Obstetrics from March 2015 to February 2016. The patient details and risk factors were recorded. Midstream & catheter urine specimens from pregnant women with symptoms of UTI were collected and sent for routine microscopy, culture and sensitivity.

RESULTS

In 550 pregnant women, 122(22.18%) had significant bacteriuria and 72(17.72%) had low colony count UTI. The most affected number age group was 25-35 years (58.85%) followed by 15-25 years. Of the associated risk factors, multiparity 45.31%, low socioeconomic status 42.18%, anaemia 39.06% etc. were important. Escherichia coli was most frequently isolated with a percentage of 29.14%, followed by Klebsiella species (17.49%), S. aureus (14.34%) etc. Other isolated micro-organisms included Enterococci, Proteus mirabilis, Citrobacter, Pseudomonas, Acinetobacter species. The antibiotics with more than 50% sensitivity against Gram-negative isolates were Imipenem (74.7%), Levofloxacin (73.17%), Ciprofloxacin (69.10%), Amikacin (57.72%), Amoxiclav (55.28%), and Cefoperazone/Sulbactam (50.40%). The antibiotics for Gram-positive isolates were Linezolid (88.46%), Cefoxitin (78.84%), Teicoplanin (69.23%) and Vancomycin (65.22%).

CONCLUSION

We found associated risk factors such as multiparity, low socioeconomic status, etc. E. coli was the most common bacteria isolated in our setting. Therefore, pregnant women should be assessed for associated risk factors and evaluated for the pathogenic organism during their regular follow-up. The drug sensitivity should be taken into consideration with their side effects related to pregnancy.

KEYWORDS

UTI, Pregnancy, Multiparity, Escherichia Coli, Sensitivity.

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INTRODUCTION: Urinary tract infection is generally defined as the inflammatory response of epithelium of urinary tract to bacterial invasion, which is typically associated with bacteriuria and pyuria.

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UTIs are the commonest bacterial infection which occurs during pregnancy. Pregnant women are more inclined to UTIs due to profound changes in the urinary tract ensuing in urinary stasis and an augmented concentration of amino acids and glucose in the urine.

Three grades of UTIs can be observed in pregnant women: asymptomatic bacteriuria (ASB), cystitis, pyelonephritis and urosepsis with systemic inflammatory response syndrome (SIRS). Various studies have reported that the frequency of asymptomatic bacteriuria in

pregnancy ranges between 2%-18.5%.[1] Cystitis, in contrast, complicates about 1.3% of pregnancies.

Pyelonephritis occurs in 2-4% of pregnancies and has a recurrence rate of 23% immediately after birth.[2] Pregnancy predisposes the women to develop a UTI. The prevalence of UTI in pregnancy is closely related with socio-economic status of the women, risk factors like diabetes mellitus, recurrent UTI, anatomical abnormalities of the urinary tract, etc. Among the aetiological agents, E. coli records for the majority of UTIs, followed by Klebsiella and Enterobacter. Proteus species and Enterococci cause uncomplicated cystitis and pyelonephritis. Candida species are a significant cause of fungal UTIs particularly in immunocompromised patients and in patients with in-dwelling catheters.[3]

Therefore, keeping in view of the complications and the fact like asymptomatic bacteriuria increases the risk of pyelonephritis in pregnant women, unlike in healthy non-gravid women, the early diagnosis and treatment is of substantial importance not only to thwart the complications to the women but also to reduce prematurity & foetal death.

MATERIALS & METHODS:

Study Type & Period: This cross-sectional study was carried out in Department of Obstetrics & Gynaecology at RMCH, Bareilly, UP over a period of one year from March 2015 to February 2016 after the approval by IEC of the institute.

Sample Size: A total of 550 consecutive samples were processed.

Inclusion Criteria: Pregnant women with symptoms of UTI (Dysuria, Frequency, Urgency, Fever, etc.).

Exclusion Criteria:

- History of antibiotic therapy in previous two weeks.
- Known congenital anomalies of urinary tract.

The data regarding age, patient identification numbers, clinical history, risk factors (Age, Parity, Education, History of sexual activity, past history of UTI, anaemia (Haemoglobin level), etc. were collected.

METHODOLOGY: The mid-stream urine and catheter specimen were sent to Department of Microbiology in a universal container within two hours of collection. Routine Microscopy of the specimens were done to detect the presence of the pus cells, RBCs, bacteria, yeast like cells, casts, crystals, etc. The culture was done on MacConkey agar, 5% sheep blood agar and Cystine Lactose Electrolyte Deficient (CLED) medium by standard calibrated loop method and incubated at 37° C for 24 hours. The isolates were identified by colony morphology, Gram-staining, motility test, catalase test, oxidase test, coagulase test, and other biochemical tests according to standard microbiological procedures. Colony counts were identified according to Kass's criteria.[4]The antibiotic susceptibility testing were done by using Kirby-Bauer disc diffusion method on Muller Hinton agar plate (Hi Media, Mumbai) according to recommendations by CLSI.[5]

The antibiotics discs used were Ciprofloxacin (5 mcg, CIP), Norfloxacin (10 mcg, NX), Levofloxacin (5 mcg, LE), Ampicillin (10 mcg, AMP), Amoxiclav (30 mcg, AMC), Amikacin (10 mcg, AK), Cotrimoxazole (25 mcg COT), Cefotaxime (30 mcg, CTX), Ceftazidime (30 mcg, CAZ), Nitrofurantoin (300 mcg, NIT), Imipenem (10 mcg, IMP), Cefepime (30 mcg CPM), Cefoperazone/Sulbactam (75/10 mcg CFS),. For Gram-positive isolates, antibiotic discs used were Oxacillin (1 mcg, OX), Cefoxitin (30 mcg, CX), Doxycycline Hydrochloride (30 mcg, DO), Nitrofurantoin (300 mcg, NIT), Gentamicin (10/120 mcg, GEN), Norfloxacin (10 mcg, NX), Teicoplanin (30 mcg, TEI), Ciprofloxacin (5 mcg, CIP), Ofloxacin (5 mcg, OF), Vancomycin (30 mcg, VA), Netilmicin (30 mcg, NET), Linezolid (30 mcg, LZ).

STATISTICS: Data were analysed by using SPSS 17th version. Chi square test were used for statistical analysis. P value (p value <0.05) was considered as statistically significant.

RESULTS: Out of 550 pregnant women examined for UTI, 249(45.27%) specimens were found to be sterile. About 109(19.81%) specimens were grossly contaminated. The significant bacteriuria i.e. more than 10^5 cfu/mL was found in 122(22.18%) specimens and low colony count UTI in 70(17.72%) specimens. Monomicrobial infection was seen in 91 specimens while two bacteria have been isolated from 31 samples [Table 1]. The most number of culture-positive cases among the pregnant women were in the age group of 25-35 years n=113(58.85%), followed by 15-25 years, n=61(31.77%) and ≥36 years, n=18(0.94%). The youngest pregnant woman with positive culture was 18 years old while 44 years lady was the oldest [Figure 1].

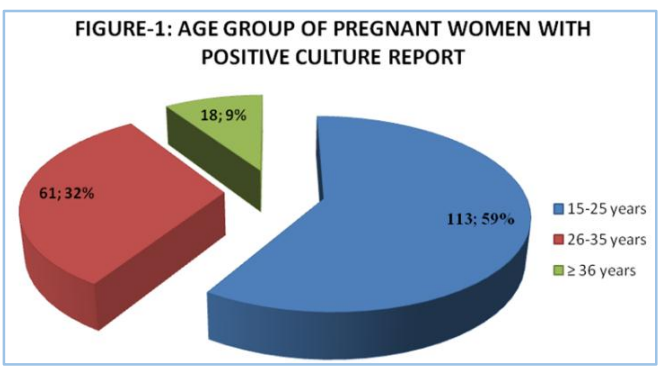
The evaluation of associated risk factors of UTI among the cases indicated that history of, multiparity n=87 (45.31%), low socioeconomic status like illiteracy, low income n=81 (42.18%), anaemia n=75(39.06%), recurrent UTI n=63 (32.81%) were statistically significant for UTI in pregnancy while sexual activity n=31 (16.14%) was found to be insignificant. [Table 2]. The total isolates were 223 (91 from 91 cases and 62 from 31 cases). The most common isolate was Escherichia coli n=65 (29.14%), followed by Klebsiella species n=39 (17.49%), S. aureus n=32 (14.34%), Enterococci spp n=31 (13.90%) etc. which is tabulated in [Table-3].

The antibiotic susceptibility testing showing the antibiotics with more than 50% sensitivity in Gram-negative isolates were Imipenem (74.7%), Levofloxacin (73.17%), Ciprofloxacin (69.10%), Amikacin (57.72%), Amoxiclav (55.28%), Cefoperazone/Sulbactam (50.40%). The antibiotic showing less than 50% sensitivity were Nitrofurantoin (48.78%), Ceftazidime (43.90%), Cefotaxime (40.64%), Cefepime (30.89%), Norfloxacin

(11.38%), Ampicillin (7.32%) as shown in [Figure 2]. The antibiotic sensitivity testing of Gram-positive isolates showed sensitivity as Linezolid (88.46%) Cefoxitin (78.84%), Teicoplanin (69.23%), Vancomycin (65.22%). The rest of the antibiotics sensitivity is depicted in Figure 3.

Culture Report	No. of Cases	(%)
Significant Bacteriuria (One Bacteria + Two Bacteria)	122 (91+31)	22.18%
Low Colony Count UTI	70	17.72%
Contaminated Samples	109	19.81%
Sterile	249	45.27%
TOTAL	**550**	**100%**

Table 1: Cultures Reports of Urine Specimens from Pregnant Women



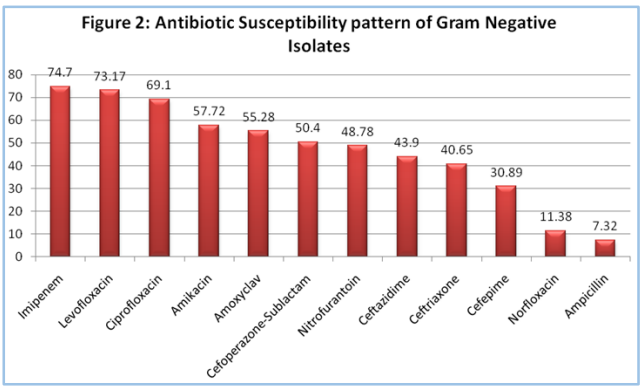
Risk Factors	Present	Absent	P (value)	Remarks
Multiparity	87	35	<0.05	Significant
Low socioeconomic status like illiteracy, low income	81	41	<0.05	Significant
Anaemia	75	47	<0.05	Significant
Recurrent UTI	63	59	<0.05	Significant
Sexual Activity	31	91	>0.05	Non-significant

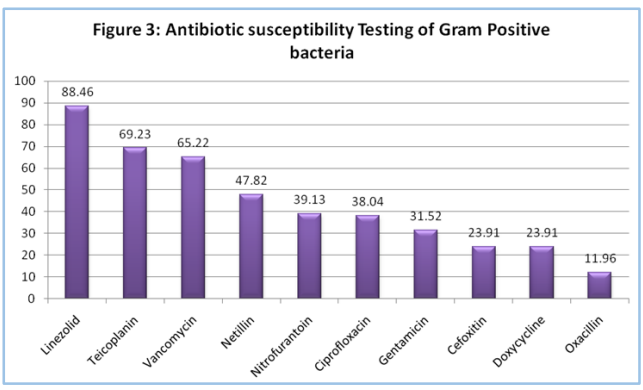
Table 2: Risk Factors Associated with UTI in Pregnancy

Note: ≠ various patients had multiple risk factors.
≠ Significance was measured using Chi square test.

Aetiological Agent	No. of isolates	%
Escherichia coli	65	29.14%
Klebsiella spp	39	17.49%
S. aureus	32	14.34%
Enterococcus spp	31	13.9%
Candida spp	29	13 %
Citrobacter spp	08	3.58%
Proteus spp	07	3.13%
Pseudomonas aeruginosa	07	3.13%
Acinetobacter spp	03	1.34%
Enterobacter spp	02	0.9%
Total	**223**	**100%**

Table 3: Aetiology of UTI in Pregnant Women





DISCUSSION: In our study, the prevalence rate of UTI among pregnant females were found to be 22.18% which is quite similar to the study conducted by Kawser P et al.[6]The studies from the African countries like Nigeria showed varied higher prevalence rate of 32-35%.[7-9] Our study showed that the most number of culture-positive cases among the pregnant women were in the age group of 25-35 years n=113(58.85%), followed by 15-25 years, n= 61(31.77%) and ≥ 36 years, n=18(0.94%). The youngest pregnant woman with positive culture was 18 years old while 44 years was the oldest. The above-mentioned age groups were also presented with most number of positive cultures in previous studies.[7,9,10]We found the associated risk factors of UTI among the cases in our study as multiparity, low socioeconomic status like illiteracy, low income, anaemia, recurrent UTI and sexual activity.

The association between UTI and multiparity is owing to profound physiologic changes affecting the whole urinary tract during pregnancy which has a significant impact. These changes vary among patients and are more likely to occur in females having frequent pregnancies.[10] Our analysis of the result showed that low socioeconomic status was one of the factors that were noticeably associated with increased incidence of UTI. A similar result has been reported by a study from Pakistan. Maternal anaemia was also found to be an important risk factor in our study, which can be related to poor socioeconomic status and malnutrition among the patients. This could be due to pregnant women with anaemia are more prone to develop UTI as compared to one who is not anaemic as explained by other studies.[11-14] Sexual activity was found to be insignificantly associated with UTI.

But several studies have stated that pregnant women who had frequent sexual intercourse (3 or 4 times per week) were more likely to have UTI than those who had lesser. This may be due the fact that sexual activity increases the chances of contamination of female urethra with bacterial flora.[15]The most common isolates in our study was Escherichia coli 29.14%, followed by Klebsiella species, S. aureus, Enterococci spp and others. Candida species were the important cause of fungal UTIs. E. coli, Klebsiella, S. aureus, Candida spp remains the predominant organisms isolated from urinary tract infection in pregnant women as reported by past studies. [9,3,16]The percentage of isolation of E. coli in our study area was lesser than compared to certain developing countries. [17] Among the Gram-positive isolates, the isolation rate of S. aureus was 14.34%. This is similar to findings of other studies. [8,18] Enterococci have been distinguished as a notable bacterial isolate in UTI patients with pregnancy.[18, 19]

Among the antibiotics tested for Gram-negative isolates, the highest sensitivity pattern in our study was by Imipenem 74.7% which is carbapenem, though it was tested as third line of antibiotics and not for all. The 2nd best antibiotic was levofloxacin (73.17%) which is a quinolone. This is in line with the studies where quinolones were the most effective and sensitive antibacterial agent against the bacteria causing UTI. The other quinolone ciprofloxacin used also showed a good sensitivity pattern of 69.1%.[20,21] Some studies have found increased risk of teratogenicity in first trimester and risk of auditory and vestibular toxicity in the foetus in later trimesters, hence are contraindicated in pregnancy. [21]

In our study, the Amikacin, Amoxiclav, Cefoperazone/Sulbactam showed sensitivity pattern in the range of 50%-58%. Among the cephalosporins; ceftazidime, ceftriaxone and cefepime sensitivity pattern of less than 50% i.e. 43.9%, 40.65%, and 30.89% respectively. This might be due to increase in multidrug resistance. This type of study pattern has also been reported by a study in Southern India. [22] In the Gram-positive isolates, the most sensitive 2nd and 3rd line drug were Linezolid 88.46%, Teicoplanin 69.23%, and Vancomycin 65.22%. The first line drug Nitrofurantoin showed sensitivity of 39.13% which can be used safely in pregnancy.

In conclusion, our study showed the prevalence of UTI as 22.18% in pregnant women. In addition to various complications, certain comorbidities have been associated with increased risk for UTI during pregnancy. In this study, the risk of UTI was higher among pregnant women in the presence of associated risk factors such as multiparity, low socioeconomic status, maternal anaemia, recurrent UTI, etc. E. coli was the most common bacteria isolated in our setting. Therefore, pregnant women should be assessed for associated risk factors and evaluated for the pathogenic organism during their regular follow-up. However, considering the morbidity and mortality that may complicate UTI in pregnancy if not effectively managed, can pose a great threat to the quality of life of pregnant women and the new born.

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