Original Article

Bacteriological profile of Urinary Tract Infections in pregnant women – Future Challenges

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Abstract

Background: Pregnancy causes numerous changes in the woman's body. Hormonal and mechanical changes increase the risk of urinary stasis and vesicoureteral reflux. These changes, along with an already short urethra and difficulty with hygiene due to a distended pregnant belly, increase the frequency of urinary tract infections (UTIs) in pregnant women. Indeed, UTIs are among the most common bacterial infections during pregnancy, Urinary tract infections remain one of the most common infections and a leading cause of morbidity in human population. **Aims and Objectives:** To study Bacteriological Profile of Urinary Tract Infections in Pregnant women at a Tertiary health care center **Methodology:** This was a cross-sectional study carried out in the department of Microbiology in association with department of Obstetrics and Gynaecology of a tertiary health care center during one year period i.e. March 2013 to March 2014 in 280 Samples of Suspected UTI in pregnant women. Fifty six samples were culture positive and were addressed for Antibiotic Sensitivity Testing (AST) as per the standard protocols. **Results:** The most commonly observed bacteria was E. coli (39.29%) and Staphylococcus aureus (19.64%), followed by Coagulase negative staphylococcus (16.07%), Klebsiella sp. (12.50%), Enterococci sp. (8.93%) and Acinetobacter sp. (3.57 %). Escherichia coli was most commonly sensitive to Nitofurantoin (77.27%), Klebsiella to Norfloxacin (71.43%), and Acinetobacter was 100% senstive to Amoxiclav, Amikacin, Tetracyclines and Norfloxacin. In Gram positive pathogens, Staphylococcus aureus was mostly sensitive to Cotrimoxazole and Erythromycin. **Conclusion:** It can be concluded from our study that commonly observed bacteria were E. coli and Staphylococcus aureus causing UTI in pregnant women. All pregnant women should be screened for UTI with a urine culture and treated with antibiotics if the culture is positive

Key Words: Urinary Tract Infection (UTI), Bacteriological Profile, Antibiotic Sensitivity Testing (AST).

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INTRODUCTION

Urinary tract infections (UTI's) are common in pregnant women and poses a great therapeutic challenge, since the risk of serious complications in both the mother and child is high.[1] Urinary tract infections remain one of the most common infections and a leading cause of morbidity in human population. It has been estimated that approximately 150 million people suffer with UTI annually all over the world accounting for as many as 40-50% of nosocomial infections.[2]They may lead to long term complications like hypertension and chronic renal disease. Hence, timely detection and proper treatment of UTIs is very important. The spectrum of micro-organisms causing UTIs is wide.[3] Previous studies have suggested E. coli to be the most common cause of UTIs in Indian population, followed by other uro-pathogens like Gram negative isolates (e.g. Klebsiella spp., Pseudomonas spp., proteus spp.) and Gram positive isolates (S. aureus, Enterococcus spp.).[3,4] It has been observed that females, are more susceptible to UTI, more so the pregnant females as compared to males due to shorter and wider urethra.[5]

MATERIAL AND METHODS

This was a cross-sectional study which was carried out in the department of Microbiology in association with

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department of Obstetrics and Gynecology of tertiary health care center during one year period i.e. March 2013 to March 2014 in 280 samples of suspected UTI. The study population was those pregnant women attending antenatal clinic (ANC) at the hospital during the study period and who did not initiate antibiotic therapy during the last two weeks and during data collection. Mid-stream urine samples were collected using sterile, wide mouthed universal containers. On the urine sample containers, patient's name, age, and time of urine collection was indicated. Study participants were informed to clean their hands with water and their genital area with swab soaked in normal saline before collection of the clean catch mid stream urine samples. Urine specimens were processed in the laboratory within 2 hours of collection and specimens that were not processed within 2 hours were kept refrigerated at 4 °C until it was processed. A calibrated sterile platinum wire loop that has a 4.0 mm diameter designed to deliver 0.01 ml was used for the semi-quantitative method and plating. A loopful of the well mixed urine sample was inoculated on MacConkey and Blood Agar plates. All plates were then incubated at 37^{o}C aerobically for 24h. The plates were then examined macroscopically for bacterial growth. The bacterial colonies were counted and multiplied by 100 to give an estimate of the number of bacteria present per milliliter of urine.[6] Out of 280 suspected UTI samples, 56 positive culture samples were addressed for Antibiotic Sensitivity Testing (AST) as per the standard protocols. The antibiotics used for Gram negative bacteria were AMP-Ampicillin, AMC-Amoxiclav, CTX-Cefotaxime, CTR-Ceftriaxone, CIP-Ciprofloxacin, GEN-Gentamicin, AK-Amikacin, NIT-Nitrofurantoin, T-Tetracycline, NX-Norfloxacin, IPM-Imipenem and for Gram positive were AMP-Ampicillin, AMC-Amoxiclav, CTX-Cefotaxime, CTR-Ceftriaxone, CIP-Ciprofloxacin, GEN-Gentamicin, C- Chloramphenicol, NX-Norfloxacin, COT-cotrimoxazole, T-Tetracycline, LZ- linezolid.

RESULTS

The commonly observed pathogen was *E. coli* (39.29%) and *Staphylococcus aureus* (19.64%), followed by CONS (16.07), Klebsiella sp. (12.50%), Enterococci sp. (8.93%) and least was Acinetobacter sp. (3.57%). [Table. 1] E. coli (22) were most commonly sensitive to NIT 77.27%, Klebsiella (7) to NX -71.43%, and Acinetobacter to AMC, AK, T, NX -100%. [Table. 2] Staphylococcus aureus was mostly sensitive to COT and E i.e. 72.73% and CONS and Enteroccocus were 100% and 80% senstive to LZ respectively. [Table 3]

Table 1: Distribution of pathogens causing Urinary tract infections in pregnant women

Pathogen	No.(n =56)	Percentage (%)
E.coli	22	39.29
Staphylococcus aureus	11	19.64
CONS (Coagulase negative Staphylococci)	9	16.07
Klebsiellaspp	7	12.50
Enterococci	5	8.93
Acinetobacter	2	3.57

Table 2: Percentage of antibiotic senstivity in Gram-negative isolates causing Urinary Tract Infections in pregnant women

	AMP	AMC	CTX	CTR	CIP	GEN	AK	NIT	T	NX	IPM
E. coli (22)	4 (18.18)	11 (50.0)	13 (59.09)	8 (36.3)	14 (63.64)	7(31.82)	12 (54.55)	17 (77.27)	5 (22.73)	15 (68.18)	16 (72.73)
Kleb(7)	1(14.29)	2(28.57)	4(57.14)	3(42.86)	2(28.57)	1(14.29)	2()	3(28.57)	5(42.86)	5(71.43)	6(85.71)
Acineto bacter(2)	1(50)	2(100)	1(50)	1(50)	1(50)	1(50)	2(100)	1(50)	2(100)	2(100)	1(50)

Table 3: Percentage of antibiotic senstivity in Gram-positive isolates causing Urinary Tract Infections in pregnant women

Staphylococcus aureus (11)	3(27.27)	5(45.45)	3(27.27)	7(63.64)	5(45.45)	2 (18.18)	5 (45.45)	6 (54.55)	8 (72.73)	3 (27.27)	11(100.00)	8 (72.73)	10 (90.91)
CONS (9)	4 (44.44)	4 (44.44)	7 (77.78)	2 (22.22)	3(33.33)	7(77.78)	1(11.11)	4(44.44)	5(55.56)	5(55.56)	6(66.67)	5(55.56)	9(100.00)
Enterococci (3)	0	2(40)	1(20)	0	3(60)	2(40)	0	1(20)	2(40)	1(20)	3(60)	2 (40)	4(80)

DISCUSSION

Urinary Tract Infections (UTIs) are defined by the presence of a growth of more than 10^5 colony forming units (CFU) of bacteria per ml of urine for asymptomatic individual and much lower for symptomatic individual (~10^3 CFU/ml).[7] In urine sample obtained by supra pubic

aspiration or in-and-out catheterization and in samples from a patient with an indwelling catheter, colony count of 10^2 -10^4 /ml generally indicates infection.[8] Urinary tract infection (UTI) is one of the most commonly occurring community acquired infections in developing countries owing to lack of sanitation and unhygienic toilet habits. Urinary tract infections (UTI) are caused by pathogenic invasion of the urinary tract which leads to an inflammatory response of the uroepithelium. Proliferation of bacteria in the urinary tract is the cause of urinary tract infection.[9] An estimate of patients suffering from UTI is around 150 million per annum across the globe which may rise to75% in the female population by the age of 24 years and 15-25% of this group may suffer from the relapse of this diseases.[10] Infections result from ascending colonization of the urinary tract, primarily by existing vaginal, perineal, and fecal flora. Various maternal physiologic and anatomic factors predispose to ascending infection in pregnant women. Such factors include urinary retention caused by the weight of the enlarging uterus and urinary stasis due to progesterone induced ureteral smooth muscle relaxation. Blood volume expansion is accompanied by increase in the glomerular filtration rate and urinary output. Loss of ureteral tone combined with increased urinary tract volume results in urinary stasis, which can lead to dilatation of the ureters, renal pelvis, and calyces. Urinary stasis and the presence of vesicoureteral reflux predispose some women to upper urinary tract infections (UTIs) and acute pyelonephritis. Calyceal and ureteral dilatation are more common on the right side; in 86% of cases, the dilatation is localized to the right. The degree of calyceal dilatation is also more pronounced on the right than the left (average 15 mm vs 5 mm). This dilatation appears to begin by about 10 weeks' gestation and worsens throughout pregnancy. This is underscored by the distribution of cases of pyelonephritis during pregnancy: 2% during the first trimester, 52% during the second trimester, and 46% in the third trimester.[11] Typical symptoms associated with UTI include the triad of dysuria (painful urination), urgency (the enhanced desire to void the bladder) and frequency (increased rate of urination). The evidence of UTI is confirmed by the presence of 10^5 microorganisms or of a single strain of bacterium per milliliter in two consecutive midstream samples of urine.[12] UTIs are caused by bacteria in the gastro intestinal tract that have colonized the peri urethral area. Gram negative bacteria such as *Escherichia coli*, Proteus species, Klebsiella species, Enterobacter species, Serratia species and Pseudomonas species are usually detected in recurrent infections especially in association with stones, obstruction, urologic manipulation and nosocomial catheter-associated infections.[13-16]Other bacterial pathogens frequently isolated include *Staphylococcus aureus, Staphylococcus epidermidis* and *Enterococcus faecalis.*[14] It has been recognized that asymptomatic bacteriuria is common in pregnancy, thus women are of increased risk of UTIs.[17] In our study we have found that that the most commonly observed bacteria were E. coli (39.29%) and Staphylococcus aureus (19.64%) followed by CONS, Klebsiella sp., Enterococci and Acinetobacter. E. coli was most commonly sensitive to NIT (77.27%), Kleb to NX (71.43%), and Acinetobacter to AMC, AK, T, NX (100%). In Gram positive isolates, Staphylococcus aureus was mostly sensitive to COT and E. This was similar to another study [18] in which a total of 124 urine samples were received from pregnant women and processed in Microbiology laboratory from Jan to Dec 2014. Among 124 samples, 45 (36.2%) samples yielded significant bacterial growth. E.coli (19, 42.2 %) was isolated as predominant pathogen. 14 (73.7%) E. coli and only 2 (40%) Klebsiella strains were sensitive to nitrofurantoin which can be used in pregnancy. Only 2 (10.5%) E.coli isolates were sensitive to Ampicillin with remaining 17(89.5%) being resistant but C. M. Ogbukagu[19] found that Staphylococcus aureus was sensitive to Cephalexin, Penicillin V, Erythromycin and Gentamycin while Pseudomonas aeruginosa was resistant to all the antibiotics. Escherichia coli and Klebsiella spp. were resistant to all the antibiotics except Gentamycin. In another study done by Demilie T *et al*, E. coli was the most common isolated pathogen. The major contributing factor for isolating higher rate of *E.coli* is due to urine stasis in pregnancy which favors for *E.coli* strain colonization. Another reason could be due to poor genital hygienic practices by pregnant women who may find it difficult to clean their anus properly after defecating or clean their genital after passing urine during their pregnancy.[20] In the similar study, maximum sensitivity of E. coli was seen to Nitofurantoin and that of S. aureus to Cotrimoxazole which is again similar to the present study.

FUTURE CHALLENGES

Due to the potential risk to mother and fetus, detection and effective treatment of UTIs remains an important clinical problem. It is advisable to assess risk factors for UTI in pregnancy, bearing in mind that some diagnostic procedures are not feasible and advisable to perform i.e. urodynamic studies.[19] Unfortunately, in contrast to the overall population, available data are scant; and the management guidelines were published several years ago and were largely opinion-based. The development of new recommendations requires well-planned, extensive studies that would answer the still open questions regarding the frequency of screening and follow-up examinations, purposefulness of prophylaxis, safety of

hitherto insufficiently studied or new antibiotics in pregnancy, and choice of optimum treatment regimens. If possible, any antibiotic use should be avoided in the first trimester, as this is the period of fetal organogenesis and nervous system development, with the highest risk of teratogenic effects of drugs. Another disturbing problem, particularly in the aspect of fetal safety associated with therapeutic limitations, is the observed rapid development of antibiotic resistance. In general, this is applicable to diverse bacterial pathogens in many different clinical settings, and is becoming one of the most significant future threats to public health. In gram-negative bacilli the resistance is associated with their ability to synthesize extended spectrum β-lactamases (ESBLs), as well as carbapenemases. The rapid spread of resistance is due to the fact that genes encoding β-lactamases and carbapenemases (particularly of the KPC type) are localized on mobile genomic elements (plasmids) easily transferable within the strain and among different strains of bacteria, even if the bacteria are not related to each other.[21] The introduction of new diagnostic methods with genetic typing may provide new opportunities in this area. It is believed that currently more than a half of *E. Coli* strains and more than one third of *Klebsiella*are ESBL+, leading to the resistance to third generation cephalosporins.[22-25] Enterobacteriaceae strains are resistant to all β-lactam and carbapenem antibiotics.[19]Another commonly observed phenomenon that has been known already for some years is methcillin resistance of Gram-positive cocci, which in practice often translates to multidrug resistance of these bacteria. One should also remember that antibiotic resistance of bacteria may differ depending on geographic area, hospital and even hospital ward, and the information on this topic may be crucial when making therapeutic decisions. Despite the diet in pregnancy is not generally different, we may think about some dietary approaches to change urinary pH as a prophylaxis of UTI in pregnancy.[25]

CONCLUSION

By all counts, and with proven results, it is considered and can be concluded from our study that commonly observed bacteria were E. coli and Staphylococcus aureus for UTI and E. coli were sensitive to Nitrofurantoin, Acinetobacter to Amoxiclav, Amikacin, Tetracyclines, Norfloxacin, Staphylococcus aureus to Cotrimoxazole and Erythromycin, CONS and Enterococci to Linezolid. Therefore, early screening of pregnant woman for UTI causing bacterial uropathogens and determining their antibiotic susceptibility pattern is an important intervention to prevent complications that may endanger the life of both the pregnant women and the fetus.

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