Original Research Article

Prevalence of UTI in pregnant women and sensitivity pattern of uropathogens in a tertiary hospital in Western India

Neha Agrawal[1], Geeta Parihar[2*]

[1]Resident, [2]Senior Professor and HOD, Department of Microbiology, J. L. N. Medical College, Ajmer, Rajasthan. INDIA.
Email: agrnehadr@gmail.com, drmohitbansal_2000@yahoo.com

Abstract

Urinary tract infections (UTI) are one of the most common bacterial infections during pregnancy. Untreated UTI can be associated with serious obstetric complications. Total 200 pregnant women with or without signs and symptoms of UTI were included in the study. Clean catch midstream urine samples [MSU], of these patients were collected and Semi-quantitative urine culture was performed. The uropathogens were identified by using standard microbiological procedure followed by antimicrobial susceptibility testing. Using $\geq 10^5$ cfu/ml as significant level of bacteriuria, the prevalence was found to be 24.0%. Higher prevalence was found in third trimester (26.21%) and in 21-25 years age group (45.8%) and 26 -30 years age group (31.2%). Prevalence of UTI with asymptomatic bacteriuria (ASB) was more than that of symptomatic bacteriuria (17.5% and 6.5% respectively). *E. coli* (37.5%) was the most predominant isolate, followed by *S. saprophyticus* (25.0%), *K. pneumoniae* (14.6%) and *E. faecalis* (10.4%). *E. coli* isolates exhibited high sensitivity towards imipenem (94.4%), nitrofurantoin (94.4%), norfloxacin (72.2%) and aztreonam (72.2%) while resistance was observed against ampicillin and cefazolin. *K. pneumoniae* isolates exhibited high sensitivity towards nitrofurantoin (85.7%), norfloxacin (85.7%), imipenem (71.4%) and more resistance to cefazolin, ampicillin, and ofloxacin. Most effective antibiotics against gram positive cocci were vancomycin and linezolid while high resistance was observed towards cotrimoxazole and penicillin-G. In enterobacteriaceae, 22.22% *E. coli* isolates and 42.86% *K. pneumoniae* isolates were detected to be ESBL producers. The issue of multidrug resistance by various mechanisms is increasingly encountered. Hence, treatment strategy should be based on the known or suspected local susceptibility pattern to maintain efficacy and limit the emergence of the resistance.

Key Words: Antimicrobial resistance, Asymptomatic bacteriurea, Sensitivity pattern of uropathogens, UTI in pregnancy.

***Address for Correspondence:**
Dr. Geeta Parihar, Senior Professor and Head, Department of Microbiology, J.L.N. Medical College, Ajmer, Rajasthan -305001, INDIA.
Email: agrnehadr@gmail.com
Received Date: 04/05/2018 Revised Date: 20/06/2018 Accepted Date: 03/07/2018
DOI: https://doi.org/10.26611/1008711

Access this article online

Quick Response Code:

Website: www.medpulse.in

Accessed Date: 19 July 2018

INTRODUCTION

Urinary Tract Infections (UTIs) are one of the most common bacterial infections encountered, second only to respiratory tract infections in primary health care setting.[1] Women are particularly at risk of developing urinary tract infections due to short and straight urethra in close proximity to anal and perineal region; reproductive physiology and certain behavioural factors which include delay in micturition, sexual activity, lack of hygiene etc.[1] Urinary tract infections (UTI) are one of the most common bacterial infections that complicate pregnancy. Untreated UTI can be associated with serious obstetric complications.[2] While several rapid screening tests have been evaluated, a semi-quantitative urine culture remains the best test for detecting bacteriuria.[2] The treatment of UTI is generally started on empirical basis that is generally governed by the patterns of practice in the particular region and local resistance. This cross-sectional study was carried out to determine the prevalence of UTI among pregnant women attending ante natal clinic in a tertiary hospital in west India and the sensitivity pattern in these Uropathogens.

How to cite this article: Neha Agrawal, Geeta Parihar. Prevalence of UTI in pregnant women and sensitivity pattern of uropathogens in a tertiary hospital in Western India. *MedPulse International Journal of Microbiology.* July 2018;7(1): 01-06.
https://www.medpulse.in/Microbiology/

MATERIAL AND METHODS

After obtaining approval from the institutional ethics committee total 200 pregnant women with or without signs and symptoms of UTI attending the antenatal clinic were included in the study from October 2016 to September 2017.

Inclusion Criteria: Pregnant females attending antenatal clinic of the hospital with or without signs and symptoms of UTI.

Exclusion Criteria

1. Patients with history of recent use of antibiotics i.e. within previous 2 weeks.
2. Patients with known anatomical and/or neurological urinary tract abnormality.
3. Patients with history of instrumentation within the past two months.

Clean catch midstream urine samples [MSU], of these patients were collected and immediately transported to the laboratory and processed. Semi-quantitative urine culture was performed by inoculating samples on Blood agar and Cystine lactose electrolyte deficient (CLED) agar by direct streak method. The plates were incubated overnight at 37^0C. Colony count of $\geq 10^5$ CFU/ml of urine was taken as significant bacteriuria. A pure culture of staphylococcus, even a single colony count was considered significant and processed further. The uropathogens were identified by using standard microbiological procedure by colony characteristics, morphology, motility testing and standard biochemical test. Each isolate was subjected to antimicrobial susceptibility test by Kirby Bauer disc diffusion technique as per CLSI 2016 guidelines. The zone sizes were interpreted (as per CLSI recommendations), as Sensitive, Intermediate or Resistant to the agents tested.[3] Antimicrobial sensitivity disc manufactured by Himedia laboratory were used. Each batch of MHA and antibiotic discs were tested by using following standard control strains:

- *E. coli* ATCC 25922.
- *Staphylococcus aureus*ATCC 25923.
- *Pseudomonas aeruginosa* ATCC 27853.

RESULTS

Among the total of 200 pregnant females satisfying the inclusion criteria, the mean age was 24.6 years with 51.5% from the age group of 21 -25 year followed by 31% from 26-30 years age group. Trimester wise distribution of the study population show 103 pregnant females (51.50%) in the third trimester, 91 (45.5%) in the second trimester and 6 (3.0%) in the first trimester. All the patients were asked for symptoms of urinary tract infection like fever, frequency, urgency, burning micturition, suprapubic discomfort/pain, renal angle pain and anuria/ oliguria/ hematuria. 23.5% gives history of one or more symptom suggestive of urinary tract infection. The prevalence of UTI was found to be 24.0% (total 48 cases). Of the rest 152 cases, 143 (71.5%) yielded no pyogenic aerobic bacterial growth on culture, in 4.5% cases various contaminants including mixed flora and budding yeast cells were grown. Difference in prevalence of UTI in different trimesters was not statistically significant.

Among gram negative bacilli, *Escherichia coli, Klebsiella pneumoniae, Enterobacter aerogenes* and *Pseudomonas aeruginosa* were found and among gram positive cocci, *S. saprophyticus, E. faecalis, S. aureus* were found. *E. coli* (37.5%) was the most predominant isolate, followed by *S. saprophyticus* (25.0%), *K. pneumoniae* (14.6%) and *E. faecalis* (10.4%). *E. aerogenes, P. aeruginosa* and *S. aureus* (4.2% each) were also found in the study population. *E. coli* isolates exihibited high sensitivity towards imipenem (94.4%), nitrofurantoin (94.4%), norfloxacin (72.2%) and aztreonam (72.2%) while resistance was observed against ampicillin and cefazolin. *K. pneumoniae* isolates exhibited high sensitivity towards nitrofurantoin (85.7%), norfloxacin (85.7%), imipenem (71.4%) and more resistance to cefazolin, ampicillin, and ofloxacin.

Table 1: Prevalence of UTI in different trimesters of pregnancy

		Total	Significant bacteriurea present	Prevalence (%)
Trimester	I	6	1	16.67
	II	91	20	21.98
	III	103	27	26.21

Table 2: Prevalence of Symptomatic and Asymptomatic UTI in prgnancy

Presentation	UTI Cases	Prevalence of UTI (n=200)
Symptomatic	13	6.5%
Asymptomatic	35	17.5%

Table 3: Distribution of bacterial uropathogens isolated from pregnant women

	Bacterial species	Frequency	Percentage
Gram negative bacilli	*Escherichia coli*	18	37.50%
	Klebsiella pneumoniae	7	14.60%
	Enterobacter aerogenes	2	4.20%
	Pseudomonas aeruginosa.	2	4.20%
Gram positive cocci	*Staphylococcus saprophyticus*	12	25.00%
	Enterococcus faecalis	5	10.40%
	Staphylococcus aureus	2	4.20%
	Total	**48**	**100.00%**

Table 4: Number (percentage) of gram negative isolates sensitive

	Enterobacter aerogenes (Total=2)	*Escherechia coli* (Total=18)	*Klebsiella pneumoniae* (Total=7)	*Enterobacteriaceae* (Total=27)	*Pseudomonas aeruginosa* (Total=2)
AK	0 (0%)	11(61%)	4 (57%)	15(55%)	2 (100%)
AMP	0 (0%)	3 (17%)	1 (14%)	4 (15%)	--
AT	1 (50%)	13 (72%)	3(43%)	17(63%)	2 (100%)
CPM	1 (50%)	6 (33%)	2 (29%)	9 (33%)	0 (0%)
CAZ	1 (50%)	9 (50%)	2 (29%)	12 (44%)	2(100%)
CZ	0 (0%)	4 (22%)	0 (0%)	4 (15%)	--
CXM	1 (50%)	7 (39%)	2 (29%)	10 (37%)	--
GEN	0 (0%)	9 (50%)	2 (29%)	11 (41%)	2 (100%)
IMP	2 (100%)	17 (95%)	5 (71%)	24 89%)	2 (100%)
NIT	2 (100%)	17 (95%)	6 (86%)	25 (93%)	2 (100%)
NX	1 (50%)	13 (72%)	6 (86%)	20 (74%)	1 (50%)
OF	0 (0%)	9 (50%)	1 (14%)	10 (37%)	1 (50%)
PI	0 (0%)	7 (39%)	1 (14%)	8 (30%)	0 (0%)

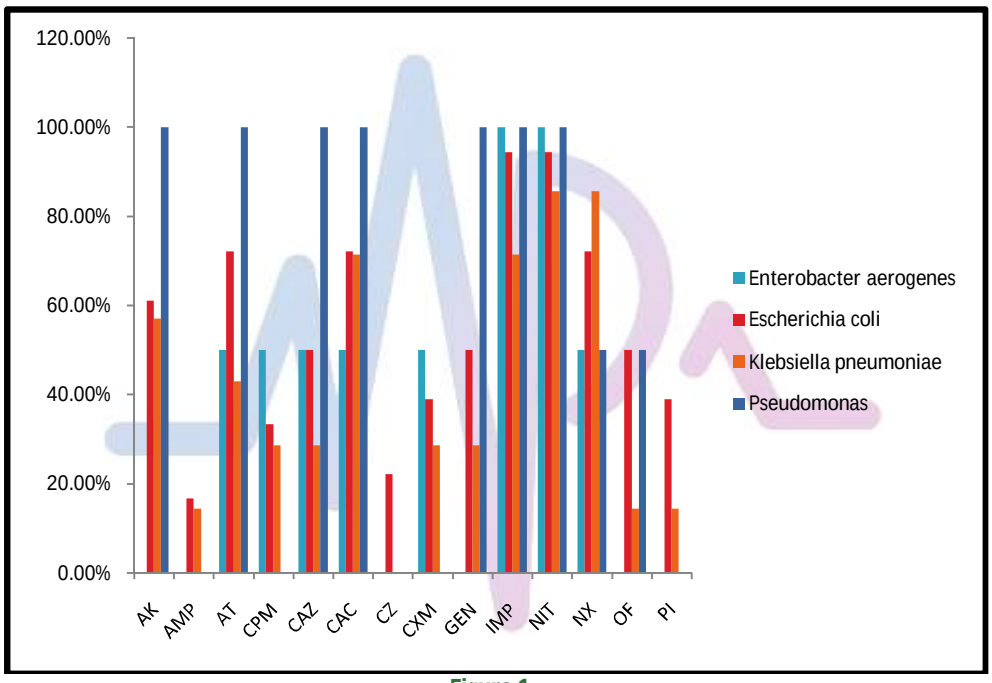

Figure 1:

Table 5: Culture sensitivity of gram positive isolates

	E. faecalis (Total=5)	*S. saprophyticus (Total=12)*	*S. aureus (Total=2)*
AMP	2 (40%)	--	--
AMC	3 (60%)	9 (75%)	2 (100%)
CIP	2 (40%)	9 (75%)	0 (0%)
CX	2 (40%)	11 (92%)	2 (100%)
CD	1 (20%)	9 (75%)	2 (100%)
E	2 (40%)	8 (67%)	2 (100%)
GEN	1 (20%)	11 (92%)	1 (50%)
LZ	5 (100%)	12 (100%)	2 (100%)
COT	--	1 (8%)	0 (0%)
NET	3 (60%)	10 (83%)	1 (50%)
OX	3 (60%)	10 (83%)	1 (50%)
P	0 (0%)	5 (42%)	0 (0%)
VAN	5 (100%)	12 (100%)	2 (100%)

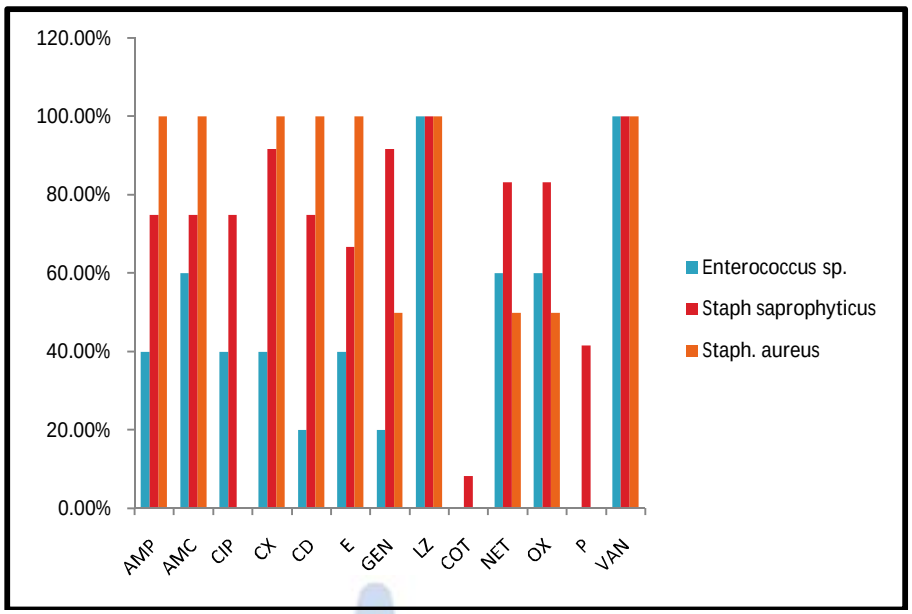

Figure 2:

Overall susceptibility of Enterobacteriacae was more for nitrofurantoin, imipenem, norfloxacin, aztreonam and amikacin. While resistance was observed against ampicillin, cephazolin, piperacillin, cefepime and cefuroxime. *Pseudomonas aeruginosa* was sensitive to amikacin, aztreonam, ceftazidime, gentamicin, imipenem, nitrofurantoin while resistant to cefepime and piperacillin. Most effective antibiotics against gram positive cocci were vancomycin and linezolid while high resistance was observed towards cotrimoxazole and penicillin-G. *S. saprophyticus* shows high sensitivity to cefoxitin (91.7%), gentamicin (91.7%), oxacillin (83.3%) and netilmicin (83.3%) while high resistance towards cotrimoxazole and penicillin-G. Vancomycin and linezolid show 100% sensitivity. *E. faecalis* isolates were 100% sensitive to vancomycin and linezolid followed by oxacillin, netilmicin and amoxycillin + clavulinic acid. While resistant was seen towards penicillin-G, clindamycin and gentamicin. In enterobacteriaceae, 22.22% *E. coli* isolates and 42.86% *K. pneumoniae* isolates were detected to be ESBL producers. 58.3% of *S. saprophyticus* and 100% of *S. aureus* were found to be penicillinase producing while 8.3% of *S. saprophyticus* were having mec-A gene mediated oxacillin resistance.

DISCUSSION

Various studies conducted of UTI during pregnancy have shown varied prevalence and variation in the pattern of organisms isolated and culture sensitivity, in India and globally. Hence it is imperative to study the regional epidemiology to understand the magnitude of problem and guide appropriate antimicrobial therapy for better patient management. There is an increase in UTI during pregnancy due to anatomical and physiological changes of pregnancy. Less effective maternal defences in pregnancy adds to the susceptibility to infection. During pregnancy bacterial growth is favoured by increased urinary content of sugar, amino acids and other nutrients which encourage growth and multiplication of bacteria. The prevalence of UTI in pregnancy varies with the location and population studied. Various studies from India have reported similar prevalence like Agarwal P et al quoted 25.2%,[4] Sabharwal E et al found 24% prevalence[5], Nithyalaxmi J et al observed 14.19%[6] The study by R. Sujatha et al among asymptomatic patients only has stated 7.3% prevalence of ASB.[7] In a study by El-Sokkary M. comparing those with premature uterine contractions and others with no history of uterine contractions prevalence of asymptomatic bacteriuria (ASB) was 23.5% and 16.9% respectively.[8] 4.5% were various contaminants including mixed flora and budding yeast cells. R. Sujatha et al have found contamination in 13.3%.[7] Even with satisfactory standard collection techniques contamination is sometimes unavoidable and as the pregnancy advances, it becomes difficult for the woman to take care of perineal hygiene and follow standard MSU sample collection practices. Prevalence rate of UTI was found to be increasing with the course of pregnancy, although the difference in third trimester (26.21%), second trimester (21.98%) and first trimester (16.67%) was not statistically significant. Similar results were obtained by Agarwal P et al.[4] The hormonal changes causing ureteral dilatation, bladder atony, decreased ureteral peristalsis, increased residual volume and obstructive changes by the progressively enlarging uterus like ureteral obstruction at pelvic brim are more

pronounced in the third and second trimester of pregnancy. Habit of drinking water in lesser quantity with the fear of frequent micturition may also be a contributory factor. In the present study, the prevalence of symptomatic UTI was 6.5% and that of asymptomatic bacteriuria was 17.5%. One of the important risk factor for symptomatic UTI in pregnancy is the asymptomatic bacteriuria. Similar results were obtained in other studies.[4, 5, 6] If ASB is left untreated, 30% women can develop symptomatic infection in the form of acute pyelonephritis compared with 1.8% in abacteriuric controls.[9] Gram negative bacilli predominated in both the asymptomatic as well as symptomatic categories of UTI as most urinary infections are caused by faecal flora. Enterobacteriaceae have several factors responsible for their attachment to the uroephithelium like toxins, adhesions, pili, fimbriae etc.[9] The coagulase negative cocci, especially *Staphylococcus saprophyticus*, is identified as the second most frequently cultured uropathogen. It displays strong adhesion and invasive properties helpful in establishing infection. Alpha 1 microglobulin may have a possible role. Nitrofurantoin retained good sensitivity against enterobacteriaceae isolates. It is orally effective and safe in pregnancy. Its use is defined for uncomplicated lower UTI only. Chances of development of resistance are low as it is not indicated for treatment of other infectious diseases. The high resistance detected toward cephalosporins like cefazolin, cefepime, cefuroxime in the present study could be because of incorrect prescription policies, over the counter availability and widespread use of these drugs in the community leading to emergence and spread of drug resistant pathogens. Agarwal P et al have stated high degree of resistance to ampicillin in all the isolates, 70-80% resistance to fluoroquinolones in gram negative bacilli and 50% in gram positive cocci. Sensitivity was observed towards aminoglycoside, nitrofurantoin and imipenem. 25% *S. aureus* were found to be methicillin resistant (MRSA) and sensitivity to vancomycin was 100%.[4] In the study of Nithyalaxmi J et al, *E. coli* isolates exhibited resistance rates of 92.85% gentamicin, 78.57% amikacin, 57.14% ampicillin, 7.14% norfloxacin. *K. pneurnoniae* isolates were resistant to amikacin, ampicillin and cotrimoxazole mainly and the enterobacteriaceae isolates were found resistant to gentamicin, amikacin and ampicillin predominantly.[6] Meher R. et al observed in their study that the antimicrobial resistance rates of enterobacteriaceae isolates were 75% to ofloxacin, 40% to nitrofurantoin, 35.6% to gentamicin, 19% to amikacin. The *Pseudomonas* isolates were resistant to gentamicin (57.2%) and amikacin (35.8%).[10] The injectable nature of aminoglycosides and toxic potential, they are considered unsafe in pregnancy. Their use is restricted to treat acute pyelonephritis in last trimester of pregnancy. The adverse effects of fluoroquinolones limits their use in pregnancy for treatment of UTI. *S. saprophyticus* shows high sensitivity to cefoxitin (91.7%), gentamicin (91.7%), oxacillin (83.3%) and netilmicin (83.3%) while high resistance towards cotrimoxazole and penicillin-G. Vancomycin and linezolid show 100% sensitivity. The management of UTIs is usually empirical, without the use of a urine culture or susceptibility testing to guide therapy initially. Considering overall susceptibility pattern in the present study, it can be said that, nitrofurantoin and norfloxacin can be prescribed as empirical therapy with medical advice with due consideration to safety in pregnancy and use of cephalosporins should be restricted only to sensitive isolates. 22.22% *E. coli* isolates and 42.86% *K. pneumoniae* isolates were detected as ESBL producers on confirmation with phenotypic test. Community acquired urinary tract infections are increasingly associated with muiti-drug resistant organisms such as extended spectrum beta lactamase resistant *E.coli*. These organisms tend to be resistant not only to all generations of cephalosporins but also to the fluoroquinolones and beta lactam/beta lactamase inhibitor combinations, possibly leaving the carbapenems as the only current alternatives for therapy of UTIs. Among *S. saprophyticus* isolates, 58.3% were penicillinase producers and 8.3% were carrying mec-A mediated Oxacillin resistance. All the *S. aureus* isolates were found to be penicillinase producers however no isolates displayed mec-A mediated Oxacillin resistance (MRSA). Beta lactamase producer strain is reported resistant to all penicillinases labile penicillins, that is, amino, caboxy and uriedopenicillins. mec-A positive strain is reported resistant to oxacillin, other beta lactam agents [except those with anti MRSA activity]. This further limits the treatment options available for UTI in pregnancy. Although in our study, no MRSA can be isolated, probably due to only two *S. aureus* isolates.

CONCLUSION

The association of preventable materno-foetal complications with UTIs in pregnancy has made screening for and treatment of UTI in pregnancy as a standard care in many countries worldwide. These findings underscore the importance of screening all pregnant women for significant bacteriuria, so that positive cases should be treated in time. The choice of antibiotics is restricted with the risk for the foetus and potential to develop bacterial resistance. The issue of multidrug resistance by various mechanisms is increasingly encountered. Hence, treatment strategy should be based on the known or suspected local

susceptibility pattern to maintain efficacy and limit the emergence of the resistance. Chennai declaration had also emphasised on preparing hospital antibiogram by Microbiology labs in order to control antibiotic resistance.[11] The changing spectrum of microorganisms involved in UTIs necessitates the need for continuous and regular antimicrobial resistance surveillance in these organisms in order to guide empirical therapy in UTIs. As the prevalence of resistance in a population increases, the likelihood of treatment failure outweighs its benefits in the empirical treatment which is often practised in the outpatient settings.

REFERENCES

1. Ramesh H, Aggarwal KK. Urinary Tract Infections in Women. Indian Journal Of Clinical Practice 2012;23 (4): 187-92
2. Fiona S. Asymptomatic bacteriuria in pregnancy. Best Practice & Research Clinical Obstetrics and Gynaecology 2007;21(3): 439-50
3. Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Susceptibility Testing; Twenty-sixth informational supplement. M100S, Jan 2016.
4. Agarwal P, Maheshwari M, Arora DR. Profile Of Bacterial Uropathogens And Their Antibiotic Susceptibility Patterns Among Pregnant Women In A Rural Setup Of North India. Asian J Med Clin. Sci. 2014: 3(2)
5. Sabharwal ER. Antibiotic susceptibility patterns of uropathogens in obstetric patients. North Am. J. Med. Sci. 2012;4(7): 316-9
6. Nithyalakshmi J, Vijayalakshmi. Bacterial Profile and Antibiogram Pattern of UTI in Pregnant Women at Tertiary Care Teaching Hospital. Int J Pharm Bio Sci 2014; 5(4): (B) 201-7
7. R.Sujatha, Manju Nawani. Prevalence of Asymptomatic Bacteriuria and its Antibacterial Susceptibility Pattern among Pregnant Women Attending the Antenatal Clinic at Kanpur, India. Journal of Clinical and Diagnostic Research 2014;8(4): DC01-DC03
8. El-Sokkary M. Prevalence of Asymptomatic Bacteriuria in Antenatal Women with Preterm Labor at an Egyptian Tertiary Center. Journal of American Science, 2011;7(4)
9. Schnarr J, Smaill F. Asymptomatic bacteriuria and symptomatic urinary tract infections in pregnancy. European Journal of Clinical Investigation 2008;38: 50-7
10. Rizvi M, Khan F, Shukla I, Malik A, S. Rising prevalence of antimicrobial resistance in urinary tract infections during pregnancy: Necessity for exploring newer treatment options. J. Lab Physicians. 2011; 3(2): 98-103.
11. Ghafur A, Mathai D, Muruganathan A, Jayalal JA, Kant R, Choudhary D, Prabhash K, Abraham OC, Gopalkrishnan R, Ramasubramanian V, Shah SN, Pardeshi R, Huilgol A, Kapil A, Gill J, Singh S, Rissam HS, Todi S, Hegde BM, Parikh P. The Chennai declaration: A roadmap to tackle the challenge of antimicrobial resistance. Indian J Cancer 2013; 50:71-3.

Source of Support: None Declared
Conflict of Interest: None Declared