Urinary Tract Infection in Pregnancy and its Correlation with Nitrite Test

Subedi M,[1] Basnyat SR,[2] Acharya SD[3]

[1]Department of Microbiology, Amrit Science Campus, Kathmandu, [2]Central Department of Microbiology, TU, Kirtipur, [3]Lumbini Zonal Hospital, Butwal.

ABSTRACT

Background: Urinary Tract Infection is one of the most frequently seen medical complications of pregnant women. The value of screening for bacteriuria by rapid test has to be readdressed considering methods, significance and costs. The study was done to assess the sensitivity and specificity of rapid test (nitrite test) for the confirmation of UTI and etiology of infection during pregnancy and antibiotics sensitivity pattern of the isolates.

Methods: In this observational based study, mid stream urine samples from 100 pregnant women clinically suspected of urine infection were evaluated by urine dipstick analysis, microscopic and by culture method. The isolates were identified and antibiotic sensitivity pattern was determined by standard protocol. At the end, Sensitivity, Specificities, Positive and Negative predictive values of isolates were determined from nitrite test.

Results: Out of 100 clinically suspected UTI cases, 45% were culture positive of which (55.5%) were Gram-negative bacteria of them *Escherichia coli* (n=14) was the most common pathogens and *Staphyococcus aureus* (n=11) was found to be predominant in Gram positive bacteria. Among total 45 positive cases, 17 samples were nitrite positive and also culture positive. The Sensitivity, Specificity, Positive and Negative predictive values of nitrite test in relation to *Enterobacteriaceae* were 70.8%, 100%, 100% and 91.5% respectively where as Sensitivity, Specificity, Positive and Negative predictive value of nitrite test in relation to *Escherichia coli* were 100%, 96.6%, 82.3%, and 100%, respectively. Amikacin as well as Gentamycin was found the most effective antibiotics against Gram negative and Gram positive bacteria.

Conclusions: Although, confirmatory diagnosis can be achieved by urine culture method, the combination of Nitrite test with pyuria appears to be rapid test and very useful markers for bacterial UTI in district laboratories where culture facilities are rare. On the basis of in vitro tests Amikacin and Ciprofloxacin are comparatively effective drugs for UTI.

Key words: antibiotics, nitrite test, pregnant women, urinary tract infection.

Correspondence: Mr. Munal Subedi, Department of Microbiology, Amrit Campus, Thamel, Kathmandu, Nepal. Phone: 9841593873, Email: munalsubedi@yahoo.com.

INTRODUCTION

Urinary Tract Infection (UTI) is one of the most frequently encountered problems owing to significant number of patients needing hospitalization during pregnancy. In pregnant women the incidence of UTI can be as high as 8%. Similarly, 2% of 24000 patients acquired acute pyelonephritis during pregnancy.[1] The report has shown that 6% of pregnant women had asymptomatic bacteriuria as well as 11.8% of bacteriuric women developed symptoms of infection in pregnancy; whereas only 3.2% of women with sterile urine did so.[2,3]

 The diagnosis of UTIs should be based initially on the clinical aspects presented by the patient and confirmed by urine culture. However, microscopic examination of urine for the presence of pyuria with nitrite test is another available option for the rapid screening of UTI. The nitrite test is highly sensitive and specific when properly used in first morning urines whose efficiency was found to 90 %.[4] Thus, A positive nitrite test with pyura is taken as highly reliable marker for bacterial UTI.

Escherichia coli is present in between 80 and 90% of UTIs and up to 95% of acute pyelonephritis[5,6] and Novobiocin-resistant *Staphylococcus saprophyticus* is the true gram positive pathogen of UTI.[7]

This article briefly examines the efficiency of nitrite test for UTI with culture, significant of pus cells, etiological agents for UTI in pregnant women and their antibiotic sensitivity pattern.

METHODS

An observational study was conducted in Lumbini Zonal Hospital from October 2004 to March 2005. Ethical approval was taken from institutional ethical committee. Similarly, Verbal consent was taken to all patients for fulfilling semi structured interview questionnaire. Purposive sample were selected on the basis of symptoms of increased frequency micturation, Dysurea, Uregency and Fever in clinically suspected UTI patient. All clinically suspected pregnant women of UTI, attending outpatient department and hospitalized were only included where as non pregnant women were excluded.

Mid stream urine was processed for nitrate reduction test, microscopy for pyuria, and culture. Urine culture, WBC counts and nitrite test were performed on the urine specimen. Nitrite test was performed by using two drops of two different solutions; N-1-napthylenediamine and sulphanilamide and mixed with equal amounts of urine in a kit well and observed for magenta color for positive test.

For culture, 0.001 ml of un-centrifuged, mixed mid stream urine specimen were streaked onto Mac-Conkey agar and Blood agar plates with the help of standard flame sterilized loop. Bacterial growths were observed following overnight incubation and their sensitivity pattern were determined by Kirby-Bauer disc diffusion method. Finally, correlation between nitrite test and bacterial isolates were determined.

Statistical analysis was done by in accordance with the specific objective i.e. finding sensitivity, specificity and positive and negative predictive values of nitrite and culture. For this Microsoft excel was used.

RESULTS

Out of 100 clinically suspected pregnant women of UTI cases having different ages, 45 (45%) were culture positive. Of that culture positive cases, age 20-30, were the highest number suffered from UTI (Table 1). Of the total suspected cases, the majority 59 (59%) cases were multigravidae and that was the highest number suffered from UTI, 27 (60%) in positive cases. 72% of the clinically suspected patients had increased frequency of micturition of which 22 (30.5%) were culture positive. Based on different symptoms different diagnosed cases were found (Table 2).

Table 1. Distribution of Cases according to Age			
Age (in years)	< 20 No. (%)	20-30 No. (%)	>30 No. (%)
Total suspected cases (N=100)	35 (35%)	61 (61.0%)	4 (4.0%)
Total culture positive cases (N=45)	14 (31.11%)	30 (66.67%)	1 (2.22%)

Table 2. Distribution of cases according to symptoms		
Symptoms	Total Suspected cases No. (%)	Diagnosed Culture cases No. (%)
IFM	72 (72%)	22 (30.5%)
IFM,D	22 (22%)	18 (81.8%)
IFM,U	2 (2%)	2 (100%)
IFM,D,U	2 (2%)	2 (100%)
IFM,F	1 (1%)	0 (0%)
IFM,D,U,F	1 (1%)	1 (100%)

IFM (Increase Frequency micturation),D (Dysurea),U (Urgency),F (Fever)

 Of the total suspected cases, 83.1% were urine culture positive and had pus cell counts (1-5/HPF). However,

cases which have more than 5 pus cells/HPF were all culture positives (Table 3).

Table 3. Relation with Pus cells and Positive Culture Results

Pus cell/HPF	Total Suspected cases No. (%)	Culture positive cases No. (%)
0	2 (2 %)	0 (0%)
0-1	60 (60%)	13 (21.7%)
1-5	32 (32%)	26 (81.3%)
5-10	6 (6%)	6 (100%)

Samples which showed Nitrite test positive i.e. 17 (37.7%) were all culture positives i.e. if the patient has nitrite positive result, it was sure that his urine was infected with Gram negative bacteria. This shows the positive relationship exists between the Nitrite test and culture positive for the member of enterobacteriaceae family (Table 4 and 5).

Table 4. Comparison between the results of Nitrite test and Culture

	Culture positive	Culture negative	Total
Nitrite positive	17	0	17
Nitrite negative	28	55	83
Total	45	55	100

Table 5. Nitrite test in relation to Enterobacteriaceae and *E. coli*

Organism	Sensitivity	Specificity	Predictive values Positive	Negative
Enterobac-teriaceae	70.8%	100%	100%	91.5%
E. coli	100%	96.6%	82.3%	100%

In total 45 culture cases, 11 species of Gram positive and Gram negative bacteria belonging to 10 genera were isolated from urine samples. Among that, 25 (55.5%) cases were by Gram negative bacteria including *Escherichia coli* (14), *Klebsiella oxytoca* (4). Besides, *Staphylococcus aureus* (11) and *Staphylococcus saprophyticus* (8) were the common etiological agent of UTI in pregnant women due to Gram positive bacteria.

Of nine antibiotics used in vitro sensitivity test, Amikacin was the most effective followed by others (Figure 1).
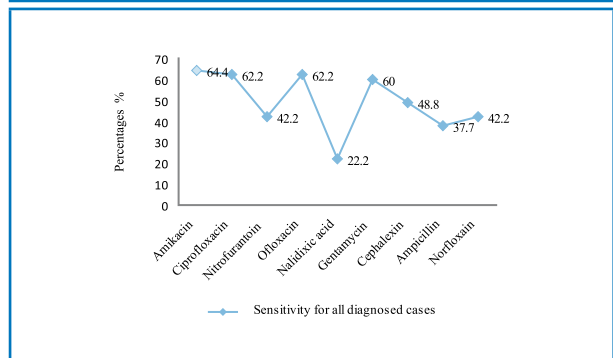

Figure 1. Antibiotics sensitivity test for all diagnosed cases

Amikacin was highly effective against Gram-negative bacteria followed by other antibiotics. Similarly, Gentamycin was highly effective against Gram positive followed by other antibiotics (Figure 2).
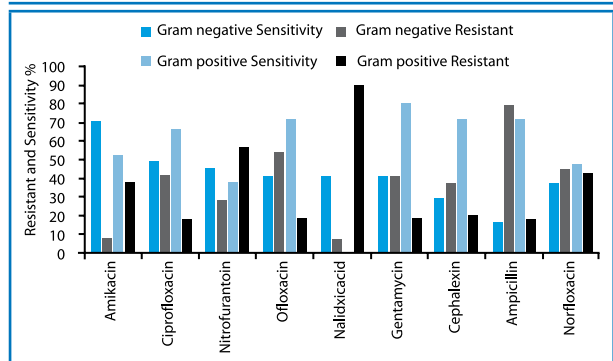

Figure 2. Antibitics sensitivity and resistant pattern of Gram negative and Gram positive bacteria

Of the *E. coli* isolates, 64.2% were effective to Amikacin, followed by other antibiotics. Similarly, Gentamycin was the most effective i.e. 20 (100%) towards *Staphylococcus aureus* followed by other antibiotics (Figure 3).
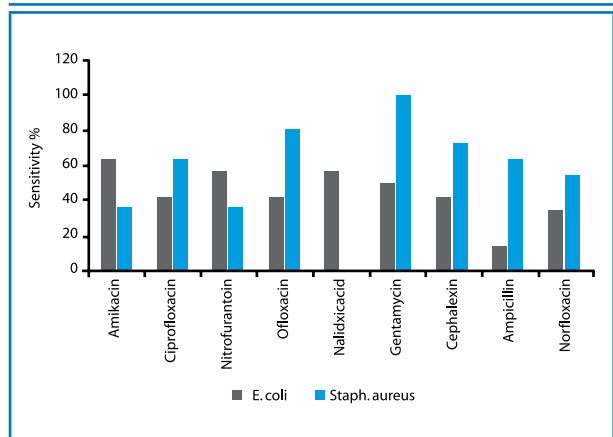

Figure 3. Antibiotics Sensitivity of E.coli and Staph. aureus

DISCUSSION

UTIs are very common during pregnancy. *Escherichia coli* is the most common pathogen isolated from pregnant women.[8] In the present study *E. coli* found as 31.1% followed by *Staphylococcus aureus, Staphylococcus saprophyticus, Klebsiella oxytica* which, however, is still the dominant organism responsible for UTI and a study conducted by Santosh JF *et al.*[9] has also stated that the microorganism frequently isolated organisms associated with first infection of UTI was always been and is coliform bacilli followed by *Staphylococcus spp.* Similar type of result was found by Latham *et al*[10] with 60% of infection by *E. coli*, 30% by *Staphylococcus saprophyticus* and 10% by *Proteus mirabilis*. Similarly, Pandey[11] has shown same type of result i.e. *E. coli* (35.4%) followed by COPS (22.3%) and CONS (*saprophyticus*) (18.8%) equal percentage of *Enterbacter spp.* and *Klebsiella oxytoca* i.e. 2.1%. He also stated that the microorganism frequently isolated organisms associated with first infection of UTI was always been and is coliform bacilli followed by *Staphylococcus spp.*

The nitrite test is highly sensitive and specific when properly used in first morning urines. Its efficiency was found 90% in 1000 women with no false positive.[4] Our finding also showed that Samples which were nitrite positive were all culture positive. The Sensitivity, Specificity, Positive and Negative predictive values of nitrite test in relation to *Enterobacteriaceae* were 70.8%, 100%, 100% and 91.5% respectively where as Sensitivity, Specificity, Positive and Negative predictive value of nitrite test in relation to *Escherichia coli* were 100%, 96.6%, 82.3%, and 100%, respectively. However, Regmi, 2003[12] reported that the Sensitivity of nitrite test in relation to *Enterobacteriaceae* and *E. coli* were 58.7% and 50.9% respectively with specificity 99.5%. From our finding we can say that the nitrite test with pus cell (>5 HPF) appears to be very useful marker for bacterial UTI and is more useful in district laboratories where culture facilities are rare.

The antibiotic sensitivity patterns of isolates were variable. None of the tested antibiotics were 100% sensitive for isolates. Amikacin was the most effective antibiotics, 29(64.4%) against Gram-negative organism followed by Ciprofloxacin and Nitrofurantoin where as Gentamycin, 16 (80%) was effective against Gram positive bacteria followed by Cephalexin and Ofloxacin. Similarly, Ampicillin, 20 (80%) was found highly resistant against Gram-negative bacteria followed by Ofloxacin and Norfloxacin.

CONCLUSIONS

Escherichia coli is common pathogen isolated form pregnant women. Although diagnosis of UTI is confirmed by culture method the combination of Nitrite test with pyuria appears to be very useful markers for bacterial UTI and is more useful in district laboratories where culture facilities are rare. Since, antibiotics resistant bacterial pathogens were isolated, it can recommend that over use, under use & misuse of antibiotics must be prohibited. On the basis of in vitro tests Ampicillin was found resistant towards bacterial isolates so it should not be used for the treatment of UTI.

ACKNOWLEDGEMENTS

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