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Research Article

ASYMPTOMATIC BACTERIURIA AND PYURIA IN ANTENATAL WOMEN: RISK FACTORS, SCREENING TESTS AND MICROBIOLOGICAL PROFILE

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ABSTRACT
Asymptomatic bacteriuria in antenatal women is associated with adverse maternal and fetal outcomes. The gold standard for the diagnosis of bacteriuria is urine culture. This is expensive and time consuming. Hence, it is better to resort to a screening test which is user friendly and economical, with good sensitivity and specificity. We undertook this study, to note the occurrence ofasymptomatic bacteriuria and pyuria in antenatal women, the microbiological profile of the etiological agents, to evaluate the various screening tests, to note down the associated risk factors and complications. 250 antenatal womenwere screened. The midstream clean catch urine samples were subjected to Gram's stain, pus cell count, leucocyte esterase test, nitrite test, combined nitrite and leucocyte esterase , catalase test and to culture and sensitivity. Percentage description of data was given .Culture was taken as the gold standard against which the screening tests were compared. Significant bacteriuria was noted in 30 patients (12%). Asymptomatic bacteriuria was seen in 25-29 years age group (46.66%), in the third trimester (56.66%) and in multiparous women (53.33%), in low socio-economic group (73.33%).The most common organism isolated in the present study was *Escherichia coli* (43.33%).The isolated organisms were sensitive to nitrofurantoin and gentamicin. Gram's stain of uncentrifuged urine was found to be the single, most useful test with good sensitivity (86.6%), specificity (98.6%) and NPV (98.1%). Pre-eclamptic toxaemia was observed in 3.33% of antenatal women, while 6.66% had low birth weight babies. Therefore**,** all antenatal women should be screened for asymptomatic bacteriuria and started on prompt treatment to prevent adverse maternal and fetal outcomes.

Keywords**:** *Antenatal Women**,** Asymptomatic Bacteriuria, Pyuria, Risk Factors, Screening Tests, Urinary Tract Infection (UTI)*

INTRODUCTION
The most common infection occurring during pregnancy is urinary tract infection and is associated with adverse maternal and perinatal outcomes. These infections may be symptomatic or asymptomatic (Balamurugan, 2012; Hankins, 1985; Jaylakshmi, 2008).
Asymptomatic bacteriuria is defined as the "presence of actively multiplying bacteria within the urinary tract excluding the distal urethra'', at a time when the patient has no urinary symptoms (Jaylakshmi, 2008). Asymptomatic bacteriuria occurs, as there is urinary stasis in pregnancy, due to the effect of progesterone (Kerure *et al*., 2013). There are several morphological and hormonal changes that take place in genitourinary tract during 6-24weeks of pregnancy, which put the pregnant women at an increased risk for UTI (Ansari, 2011; Hankins, 1985; Jain, 2013; Rahimkhani, 2008).
Various studies indicate that the prevalence of asymptomatic bacteriuria is higher in developing countries than in developed countries (Ajayi *et al*., 2012).
The prevalence of asymptomatic bacteriuria varies from 2-8% in the west, while in India the prevalence of asymptomatic bacteriuria is as high as 8% (Lavanya, 2002; Patel, 2005).The prevalence of asymptomatic bacteriuria is more in the rural population and in those who belong to lower socio-economic status (Ansari, 2011; Lavanya, 2002; Senthinath, 2013).
The other risk factors associated with asymptomatic bacteriuria are: increasing maternal age, gestational diabetes, past urinary tract infection, increasing period of gestation, multiparity, hypertension and anaemia (Ansari, 2011; Perera, 2012).

The commonly isolated organism is *Escherichia coli*, which accounts for 75-90% of the cases. The other gram negative bacilli isolated are Klebsiella species, Proteus species, CONS, Pseudomonas species (Celen, 2011; Gayathree, 2010; Girishbabu *et al*., 2011; Jaylakshmi, 2008).

10 % of pregnant women with asymptomatic bacteriuria develop symptomatic bacteriuria during pregnancy .The challenge with asymptomatic bacteriuria is that, it is difficult to diagnose, as there are no specific symptoms. 30 – 40% of the cases of untreated asymptomatic bacteriuria develop acute pyelonephritis in later part of pregnancy (Ahmad, 2011).

The other complications that are associated with untreated asymptomatic bacteriuria are: chronic renal failure, IUGR, hypertensive disease of pregnancy, anemia, preterm labour, low birth weight infants, and infants with mental retardation or developmental delay (Girishbabu *et al*., 2011; Jaylakshmi, 2008; Tincello, 1998). However if asymptomatic bacteriuria is detected and treated early, it reduces the risk of pyelonephritis from 20 - 35% to 1- 4%, and the risk of low birth weight baby from 15% to 5 % (Perera, 2012; Smaill, 2007).

Need for Screening

Although quantitative urine culture is the gold standard for the diagnosis of bacteriuria, it may not be feasible in many parts of developing countries, as it is time consuming and costly (Kerure *et al*., 2013; Perera, 2012). To overcome these limitations, certain screening tests are used, as they are cost-effective, easy to use and require little time when compared to quantitative urine culture (Mignini *et al*., 2009). The microbiological profile and the susceptibility pattern of the organisms isolated vary from region to region. Therefore, we undertook this present study in our teaching hospital with the below mentioned aims and objectives.

Aims and Objectives

1. To note down the occurrence of asymptomatic bacteriuria and pyuria in antenatal women attending the antenatal clinic at our teaching hospital.
2. To note down the microbiological profile and susceptibility pattern of the etiological agents.
3. To evaluate the various screening tests used to detect asymptomatic bacteriuria and pyuria,as a cost effective alternative to the standard culture method
4. To note down the associated risk factors.
5. To note down the associated complications in such cases.

MATERIALS AND METHODS

Type of Study: Prospective and descriptive study.

Study Population: All antenatal women visiting the antenatal clinic in our teaching hospital, who are in the age group18 - 45 years, of any parity, with no history of premature rupture of membrane (PROM)or preterm labour and are willing to give informed consent, were included in the study.

Those pregnant women who exhibited clinical signs and symptoms of UTI ,who were on antibiotic treatment two weeks prior to initial antenatal visit, who had history of pregnancy induced diabetes mellitus/hypertension, pyrexia (>38^0C) or who had congenital anomalies of the urinary tract, were excluded from the study.

The study was approved by the Institutional Ethics Committee.

Study duration: 1 year

Sample size: 250 antenatal women.

Methods: Antenatal women were educated to obtain a midstream, clean catch urine sample, after proper genital toileting. This sample was transported to Microbiology laboratory within half an hour of collection, for further processing. The urine specimens were processed and analyzed by the following screening methods:

1. Gram stain: A drop of uncentrifuged urine is taken on a clean slide. Gram staining is done and the smear is observed under oil immersion microscope. Presence of ≥ 1 bacteria per oil immersion field correlates with significant bacteriuria of ≥10^5CFU/ ml of urine (Ansari, 2011; Gayathree, 2010; Jaylakshmi, 2008).

2. Pus cell count of uncentrifuged urine (pyuria): Presence of ≥ 10 WBCs per high power field was considered significant (Ansari, 2011; Jaylakshmi, 2008; Lavanya, 2002; Rahimkhani, 2008).
3. Combined leukocyte esterase & nitrite test: Uncentrifuged urine specimens were tested with SD UroColor -10 multireagent test strips (Bio Standard Diagnostics PVT LTD) for the presence of nitrite & leukocyte esterase activity, following the manufacturer's instructions (Balamurugan, 2012; Gayathree, 2010; Jaylakshmi, 2008).
4. Catalase test: On addition of a few drops of hydrogen peroxide to 1 ml of urine sample, if frothing is seen, it shows the presence of catalase enzyme (Ansari, 2011; Lavanya, 2002).
5. Culture methods: Semi quantitative urine culture using the standard loop technique was done for the midstream, clean catch urine sample. The inoculation was done on nutrient agar, Mac Conkey agar and blood agar plates. After incubating these plates aerobically, for 24 hours at 37^0C, colony count $>10^5$CFU/ ml, will be as considered significant bacteriuria. These significant bacterial isolates were processed for identification, as per standard protocol. The tests included: Gram stain, motility test, catalase test, oxidase test, coagulase test and routine biochemical tests as per standard protocol (Colle *et al*., 2006).
6. Antibiotic susceptibility was done by Kirby Bauer disc diffusion method, using Muller Hinton Agar plate, as per CLSI guidelines (Wayne, 2007). Control strains of *Staphylococcus aureus* ATCC 25923 and *Escherichia coli* ATCC 25922 were run with the gram positive and gram negative organisms respectively.
Demographic data of all the study subjects like: maternal age, gravidity, parity, age of gestation, past medical and family history, education level, socio-economic status, previous history of urinary tract infection, previous history of antibiotic intake and previous obstetric history were noted down.
Those subjects, in whom there was significant bacteriuria, were counseled and started on treatment by their respective obstetrician. They were followed up for response to treatment after one week, by a repeat urine culture test. Both maternal and perinatal outcomes were noted down.

Statistical Analysis

Computerized Excel spread sheet (Microsoft Excel 2009) was used to enter the data. Percentage description of data will be given (SPSS version 20, software will be used.) Culture was taken as the gold standard against which the screening tests were compared and the sensitivity, specificity, positive predictive value and negative predictive value were derived.

RESULTS AND DISCUSSION

Results

Table 1: Asymptomatic bacteriuria in the study population

	Number	Percentage
Total no. of antenatal women tested	250	100
No. of culture positive	30	12%
No. of culture negative	220	88%

Out of 250 antenatal women included in this study, 30(12%) were culture positive, and 220(8%) were culture negative.

Table 2: Age distribution of culture positive cases

Age group in years	No. of culture positive cases(n=30)	Percentage (%)
15-19	03	10
20-24	11	36.66
25-29	14	46.66
30-34	01	3.33
>35	01	3.33
Total	30	100

The occurrence of asymptomatic bacteriuria, among the culture positive cases, was found to be high in the age group of 25 -29 years (46.66%), which was followed by the age group 20-24 years (36.66%).

Table 3: Trimester wise distribution of culture positive cases

Trimester	Total no of culture positive cases(n=30)	Percentage (%)
First	11	36.66
Second	02	6.66
Third	17	56.66
Total	30	100

The occurrence of asymptomatic bacteriuria was found to be high in the third trimester (56.66%) when compared to first (36.66%) and second trimester (6.66%).

Table 4: Occurrence of asymptomatic bacteriuria based on gravida

Gravida	Total no of culture positive cases (n=30)	Percentage (%)
Primigravida	14	46.66
Multigravida	16	53.33
Total	30	100

The occurrence of asymptomatic bacteriuria was found to be high in multigravida (53.33%) when compared to primigravida (46.66%).

Table 5: Education level of the culture positive cases

Education level	Number(n=30)	Percentage (%)
None	0	0
Primary school	0	0
Middle school	05	16.66
High school	17	56.66
Higher secondary school	02	6.66
Degree	06	20
Total	30	100

In this study, majority of the culture positive cases had attended high school (56.88%).The educational level of the study group was fairly good, with no subjects being uneducated .

Table 6: Socio-economic status of the culture positive cases

Socio-economic status	Number(n=30)	Percentage (%)
Low	22	73.33
Middle	06	20
High	02	6.66
Total	30	100

In this study, majority of the subjects (73.33%) came from a lower socio-economic status.

Table 7: Microorganisms isolated in positive cultures

Organism	Number (n=30)	Percentage%
Escherichia coli	13	43.33
Enterococcus spp.	05	16.66
CONS	05	16.66
Group D Streptococcus	03	10
Klebsiella spp.	02	6.66
Staphylococcus aureus	01	3.33
Citrobacter diversus	01	3.33
Total	30	100

The most common organism isolated in the present study was *Escherichia coli* (43.33%) which was followed by Enterococcus spp. (16.66%), *Coagulase negative staphylococcus aureus* (16.66%) ,Group D Streptococcus(10%), Klebsiella spp.(6.66%), *Staphylococcus aureus*(3.33%)and *Citrobacter diversus*(3.33%) , as shown in Table 7.

Table 8: Sensitivity pattern of Gram positive cocci cultured from cases of significant bacteriuria

Organisms	Amoxiclav	Cefoxitin	Ciprofloxacin	Erythromycin	Clindamycin	Cotrimoxazole	Doxycycline	Linezolid	Nitrofurantoin	Novobiocin	Oxacillin	Vancomycin	Gentamicin
CONS (S%)	80	80	100	20	80	60	80	100	80	80	0	100	100
CONS (R%)	20	20	0	80	20	40	20	0	20	20	100	0	0
S.aureus (S%)	0	0	100	100	100	0	100	100	100	0	0	100	100
S.aureus (R %)	100	100	0	0	0	100	0	0	0	100	100	0	0

Organisms GPC	Ampicillin	Erythromycin	Gentamicin	Linezolid	Vancomycin	Penicillin	Nitrofurantoin	Ciprofloxacin
***Enterococcus and Group D Streptococci* (S %)**	87.5	62.5	100	100	100	75	100	62.5
Enterococcus and Group D Streptococci (R %)	12.5	37.5	0	0	0	25	0	37.5

Coagulase Negative Staphylococcus (5/30) showed 100% sensitivity to ciprofloxacin, gentamicin, linezolid and vancomycin. It showed good sensitivity pattern against amoxiclav and nitrofurantoin. It was less sensitive to erythromycin and cotrimoxazole.

The sensitivity pattern of *Staphylococcus aureus* (1/30) showed 100% sensitivity to ciprofloxacin, erythromycin, clindamycin, doxycycline, nitrofurantoin, gentamicin, vancomycin and linezolid. It was resistant to amoxiclav, cefoxitin, oxacillin, norfloxacin and cotrimoxazole. It was found to be a MRSA strain, as it was resistant to both oxacillin and cefoxitin, as per CLSI guidelines.The Enterococcus spp. (5/30) and Group D Streptococci (3/30) showed 100% sensitivity to gentamicin, linezolid, nitrofurantoin and vancomycin. It was less sensitive ampicillin, erythromycin and penicillin as shown in Table 8.

Table 9: Sensitivity pattern of Gram negative bacilli cultured from cases of significant bacteriuria

Organisms	Amikacin	Amoxiclav	Ampicillin	Ceftazidime	Ceftazidime Clavulinic acid	Ceftriaxone	Cefoperazone	Ciprofloxacin	Cefuroxime	Cotrimoxazole	Gentamicin	Imipenem	Meropenem	Nitrofurantoin	Norfloxacin	Nalidixic acid
E.coli(S %)	84.62	76.92	76.92	76.92	84.62	69.23	61.54	61.54	61.54	53.85	100.00	92.31	92.31	100.00	61.54	61.54
E.coli(R %)	15.38	23.08	23.08	23.08	15.38	30.77	38.46	38.46	38.46	46.15	0.00	7.69	7.69	0.00	38.46	38.46
Klebsiella spp. (S%)	100	100	50	100	100	50	100	50	50	50	100	100	100	100	50	100
Klebsiella spp. (R%)	0	0	50	0	0	50	0	50	50	50	0	0	0	0	50	00
Citrobacter spp. (S%)	100	100	100	100	100	0	100	100	0	0	100	100	100	100	0	0
Citrobacter spp. (R%)	0	0	0	0	0	100	0	0	100	100	0	0	0	0	100	100

Escherichia coli were 100% sensitive to nitrofurantoin and gentamicin, followed by amikacin, ceftazidime-clavulinic acid, amoxiclav and ampicillin. It showed resistance to ampicillin, cefuroxime, cotrimoxazole, ciprofloxacin, nalidixic acid and norfloxacin.
Klebsiella species were 100% sensitive to amikacin, amoxiclav, ceftazidime, gentamicin, nitrofurantoin, imipenem and meropenem. Variable resistance was seen to other commonly used antibiotics. *Citrobacter diversus* was 100% sensitive to amikacin, amoxiclav, ceftazidime, gentamicin, nitrofurantoin, imipenem and meropenem. It was resistant to cefuroxime, cefuroxime and cotrimoxazole as shown in Table 9.

Table 10: Statistical values of various screening tests

Tests	True Positives	True Negatives	False Positives	False Negatives
Gram's stain	26	217	3	4
Pus cell count	12	210	10	18
Leukocyte esterase	22	202	18	8
Nitrite	15	219	1	15
Combined Leukocyte esterase & Nitrite	15	220	0	15
Either Leukocyte esterase & Nitrite	22	202	18	8
Catalase	21	214	6	9

Table 11: Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of various screening tests

Screening tests	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Gram's stain	86.6	98.6	89.6	98.1
Pus cell count	40	95.4	54.5	92.1
Leukocyte esterase	73.3	91.8	55	96.7
Nitrite	50	99.54	93.7	93.5
Combined leukocyte esterase & nitrate reductase	50	100	100	93.6
Either leukocyte esterase or nitrate reductase	73.3	91.81	55	96.1
Catalase	70	97.27	77.77	96.83

The test which identified the maximum number of true positives in the uncentrifuged urine samples was Gram's stain (26/30), therefore its sensitivity increased to 86.6%. The pus cell count, identified the least amount of positives (12/30), thereby bringing down its sensitivity (40%). In case of LE esterase test, the specificity was decreased (91.81%), as high number of false positives were seen with this test (18/30).In the nitrate test, it was observed that the specificity was increased (99.54%), as the least number of false

positives were seen with this test(1/30).When compared to the other screening tests, the sensitivity (86.6%) and NPV(98.1%) of Gram's stain were found to be superior. Higher PPV (93.7%) and specificity (99.54%) were observed in the nitrite test. Combined LE & Nitrite test were performed on a single dipstick, and the statistical values were derived considering both test results. The sensitivity and NPV increased to (73.3%) and (96.1%) respectively when either nitrite or leucocyte esterase positive and both tests positives were considered, instead of single test values.

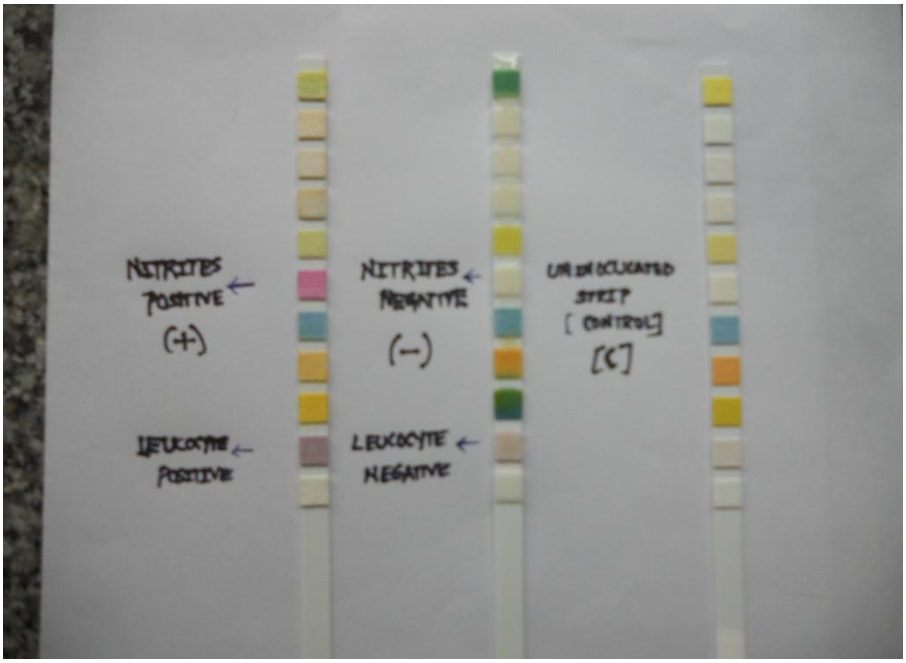

Figure 1: Combined leucocyte and nitrite test on the reagent strip

In the case of Combined LE & Nitrite test, only 22 cases were positive for both tests, therefore this test gave low sensitivity (50%).However; no false positives were wrongly identified by the combined LE & nitrite test. Therefore it gave a 100% PPV and specificity. With regards to the catalase test, it has the third highest sensitivity (70%) and specificity (97.27%), when compared to the other screening tests. Refer Tables 10 and 11.

10 out of the 250 urine samples were positive for pus cell counts with more than 10 pus cell per microliter of urine with culture being negative; this constituted 4% of sterile pyuria. Only 40% (12/30) asymptomatic bacteriuria patients had pyuria associated with bacteriuria.

On follow up of these cases, we observed that one antenatal woman (1/30, 3.33%) developed pre-eclamptic toxaemia and two antenatal women (2/30, 6.66%) had given birth to low birth weight babies.

Discussion

Asymptomatic bacteriuria in pregnant women is associated adverse maternal and fetal outcomes. Such pregnant women deliver premature or low birth weight infants and are at the risk of developing acute cystitis and pyelonephritis (Smaill, 2007; Tincello, 1998). It also leads to perinatal mortality (Jain *et al.*, 2013). Hence there is a need to screen all antenatal women for asymptomatic bacteriuria to prevent these adverse maternal and fetal outcomes. Various Indian studies have shown an incidence of 4 to 23.9 % (Jain *et al*., 2013). In the present study, out of 250 pregnant women, 30 of them had asymptomatic bacteriuria, showing 12% occurrence of asymptomatic bacteriuria. This is similar to the studies done by Balamurugan (2012) and Sentinath (2013). Another study by Jain *et al.*, (2013), shows a prevalence rate of 11 %.

The various factors that contribute to the acquisition of asymptomatic bacteriuria in antenatal women include: hormonal changes during pregnancy, the gravid uterus sits directly on the top of the bladder and displaces it and leads to urinary stasis (Lavanya, 2002). In the present study, it was observed that pregnant

women in the age group 25-29 years had highest percentage of asymptomatic bacteriuria. This results correlates with studies of Ajayi *et al*., (2012); Girishbabu *et al*., (2011) and Kerure *et al.*, (2013).

One of the identified risk factor for asymptomatic bacteriuria in pregnancy is advanced maternal age (Ansari, 2011). Women with advanced maternal age would have given birth to many children, prior to the present pregnancy. Multiparity is also identified as a risk factor for asymptomatic bacteriuria (Ajayi, 2012; Girishbabu *et al*., 2011; Kerure *et al*., 2013). This correlates with our study, in which we observed that the occurrence of asymptomatic bacteriuria was high among multigravida (53.33%), when compared to primigravida (46.66%), (Table 4). Most cases of asymptomatic bacteriuria were found during the third trimester of pregnancy (56.66%) when compared to the first (36.66%) and second trimester (6.66%) (Table 3). The result of this study correlates with other studies done by Gayathree (2010); Girishbabu *et al.*, (2011) and Sentinath *et al*., (2013). The occurrence of asymptomatic bacteriuria is more in lower socio-economic group, which is comparable to other studies (Ajayi, 2012; Ansari, 2011; Gayathree, 2010; Smaill, 2007). In this study, we found that 73.33% of asymptomatic bacteriuria occurred in antenatal women belonging to the lower socio-economic group (Table 6). This finding is very similar to the study done by Gayathree (2010).

The most common organism causing asymptomatic bacteriuria in the present study was *Escherichia coli* which correlate with the studies of Gayathree (2010); Girishbabu *et al.*, (2011) and Lavanya (2002). Other organisms isolated were*Enterococcus spp.*, CONS, Klebsiella spp., Citrobacter diversus, Group D Streptococcus (Table 7).

With regards to the antimicrobial susceptibility pattern, the most effective in-vitro agents were gentamicin among injectables and nitrofurantoin among orally administered ones. The organisms were resistant to ciprofloxacin, cotrimoxazole, norfloxacin and cotrimoxazole. These findings are in agreement with various other studies (Ahmed, 2011). Oral cephalosporin and ampicillin are considered safe alternatives, but there was variable resistance noted with these two drugs.Various studies have observed that oral nitrofurantoin is a good choice to treat asymptomatic bacteriuria in antenatal women (Perera, 2012). In our study, both the gram positive cocci and gram negative bacilli showed good sensitivity to nitrofurantoin (Table 8 and Table 9).

There is an increased incidence of low birth weight babies (50%) and prematurity (75%) in antenatal women who are not treated for asymptomatic bacteriuria (Kerure *et al*., 2013; Lavanya, 2002). The incidence of pre-eclamptic toxaemia is more in antenatal women with bacteriuria (9.1%) when compared to the antenatal women without bacteriuria (6%) (Kerure *et al*., (2013). In our study, one antenatal woman (1/30, 3.33%) developed pre-eclamptic toxaemia and two antenatal women (2/30, 6.66%) had low birth weight babies. This could be because these antenatal women were promptly started on antibiotic treatment. These findings reiterate the need to screen and treat antenatal women with asymptomatic bacteriuria at the earliest.In pregnancy, urinary stasis is common. *Escherichia coli* grows well in this environment and causes UTI. Pregnant women, after defecating, find it difficult to clean their anus. They also find it difficult to clean their genitalia after urinating. This contributes to poor genital hygiene (Girishbabu *et al.*, 2011; Kerure *et al*., 2013). Hence, in the present study all the pregnant women included in the study were counseled, before the test and they were educated regarding proper genital hygiene. Although urine culture is considered to be the gold standard for detection of asymptomatic bacteriuria, it is time consuming and requires trained personnel and good laboratory facilities. This may be a constraint in a developing country like India. Therefore, we need to evaluate and identify screening tests which are user friendly, economical, with good sensitivity and reasonable specificity, which can detect asymptomatic bacteriuria rapidly and accurately. Only those cases which have been reported positive with these screening tests can be taken up for culture. By doing so, we can optimize the laboratory resources (Balamurugan, 2012; Jaylakshmi, 2008). In this study we evaluated Gram's stain of uncentrifuged urine, Pus cell count, nitrite test, leukocyte esterase, combined nitrite and leukocyte esterase test (Figure 1), and either nitrite or leukocyte esterase test. In this study, it was observed that Gram's stain of uncentrifuged urine was found to be the single, most useful test with good sensitivity (86.6%), specificity (98.6%) and NPV (98.1%).

Pus cell count (pyuria) showed the least sensitivity (40%). The prevalence ofsterile pyuria may be attributed to infections due to organisms like Chlamydiae species, which do not grow on the routine culture media that we use in our laboratory. In the present study we found two cases of *Trichomonas vaginalis* (2/30, 6.66%), while screening for pus cells in wet mount, which may be attributed to sterile pyuria. Pyuria may suggest only bladder colonization and not actual infection (Jaylakshmi, 2008). The low sensitivity of this test, does not qualify it to be used as a screening test for detecting asymptomatic bacteriuria.

The nitrite test gives an indirect measure of nitrite reducing bacteria in urine. Nitrate reducing bacteria include Gram negative cocci, non-fermenters and Gram negative bacilli belonging to Enterobacteriaceae. The urine should have been retained in the bladder ≥ 4hours and should contain dietary nitrates in adequate amounts (Jaylakshmi, 2008). In our study, nitrite test gave lesser sensitivity (50%) as 15 positive cases were missed as false negatives. This included all infections caused by Gram positive cocci.

Leukocyte esterase is an enzyme produced by neutrophils. A positive leukocyte esterase test may suggest pyuria but not necessarily bacteriuria. Therefore a negative leukocyte esterase test does not exclude infection (Balamurugan, 2012). In the present study, leukocyte esterase test (LE test) gave a lower sensitivity (73.3%) and NPV (96.7%) because of 18 false positives, which included patients with sterile pyuria, identified, the specificity was lower (91.81%) than other tests. High levels of ascorbic acid, phenazopyridine and albumin in the urine can lead to false positive findings with the LE test.Even if the pus cells were disintegrated in the urine sample, the LE test could identify asymptomatic bacteriuria (Jaylakshmi, 2008). When the combined nitrite and leukocyte esterase test was evaluated, it showed less sensitivity (50%) but 100% specificity. Since none of the screening tests were 100% sensitive, urine culture is considered to be the gold standard. Among the screening tests evaluated, Gram's staining of uncentrifuged urine was the best screening test and pus cell count was not found to be useful. Nitrite test and combined nitrite and leukocyte esterase showed high specificity of 99.54 and 100% respectively, but both were least sensitive (50%) (Table 10 and 11). All antenatal women with asymptomatic bacteriuria were started on appropriate antibiotics based on the sensitivity report. Repeat urine cultures, which were done after the completion of the course of antibiotics, came negative.

Conclusion

The present study showed that 12% of the antenatal women examined, had a positive urine culture, without any symptoms of UTI (asymptomatic bacteriuria). Antenatal women in third trimester had the highest occurrence of asymptomatic bacteriuria. Hence it is important to screen for asymptomatic bacteriuria in pregnancy, not only in first trimester but in all the trimesters. It is important to screen the antenatal women using a good screening test, so that it is economical and there is no burden on the laboratory resources.

All the pregnant women should be educated about proper personal hygiene as it is one of the risk factor leading to asymptomatic bacteriuria especially in lower socio-economic group. The antenatal women who are detected to have asymptomatic bacteriuria should be counseled and treated with proper antibiotics in order to avoid adverse maternal and fetal outcomes associated with untreated asymptomatic bacteriuria.

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REFERENCES

Ahmad Shamweel, ShakoohShehla, Salati Ahmad Sajad and Muniem Abdul (2011). Prevalence of asymptomatic bacteriuria among pregnant women in Kashmir. *Sri Lanka Journal of Obstetrics and Gynaecology* **33** 158-162.

Ajayi AB, Nwabuisi C, Aboyeji AP, Ajayi NS, Fowotade A and Fakeye OO (2012). Asymptomatic Bacteriuria in Antenatal Patients in Ilorin, Nigeria. *Oman Medical Journal* **27**(1) 31-35.

Ansari HQ and Rajkumari Aruna (2011). Prevalence of asymptomatic bacteriuria and associated risk factors among antenatal women attending a tertiary care hospital. *Journal of Medical and Allied Sciences* **1**(2) 74-78.

Balamurugan S, Shah Chaitanya, Jayapriya S, Jeya M and Ramesh Rao K (2012). Reagent strip testing (RST) in pregnant women: A cost effective screening tool in under resourced settings. *J of Clinical and Diagnostic Research* **6**(4) 671-673.

CelenSevki, OrucSarginAyla, KarayalcinRana, SayganSibel, UnluSerpil and PolatBelgin *et al.*, (2011). Asymptomatic bacteriuria and antibacterial susceptibility patterns in an obstetric population. *ISRN Obstetrics and Gynecology* 1-5.

Colle JG, Duguid JP, Fraser AG, Marmion BP and Simmons A (2006). Laboratory strategy in the diagnosis of infective syndromes. In: *Mackie and McCartney, Practical Medical Microbiology*, 14th edition, edited by Colle JG, Fraser AG, Marmion BP and Simmons A (New Delhi: Elsevier, a division of Reed Elsevier India Pvt.Ltd.) 53-94.

Gayathree L, Shetty S, Deshpande SR and Venkatesha DT (2010). Screening for asymptomatic bacteriruria in pregnancy: An evaluation of various screening tests at Hassan District Hospital, India. *Journal of Clinical and Diagnostic Research* **4** 2702-2706.

Girishbabu RJ, Srikrishna R and Ramesh ST (2011). Asymptomatic bacteriruria in pregnancy. *International Journal of Biological and Medical Research* **2**(3) 740-742.

Hankins GD and Whalley P (1985). Acute urinary tract infections in pregnancy. *Clinical Obstetrics and Gynecology* **28** 266-78.

Jain SA, Pandya JM, Mehta SJ, Jain AG, Kikani KM and Pandya MR (2013). Evaluation of Asymptomatic Bacteriuria in Antenatal women at CU Shah Medical College and Hospital, Surendranagar, Gujarat. *International Journal of Medical Science and Public Health* **2**(4) 1022-24.

Jaylakshmi J and Jayaram VS (2008). Evaluation of various screening tests to detect asymptomatic bacteriuria in pregnant women. *Indian Journal of Pathology and Microbiology* **34**(6) 699-707.

Perera Jennifer, Cyril Randeniya, PiyumiPerera, NimeshaGamhewage and JayalathaarachchiRenuka (2012). Asymptomatic bacteriruria in pregnancy: Prevalence, risk factors and causative organisms. *Sri Lankan Journal of Infectious Diseases* **1**(2) 42 – 46.

Kerure SB, Surpur R, Sagarad SS and Hegadi S (2013).Asymptomatic bacteriuria in pregnant women. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology* **2**(2) 213-216.

Lavanya SV and Jogalakshmi D (**2002).** Asymptomatic bacteriuria in antenatal women. *Indian Journal of Medical Microbiology* **20** 105-6.

Mignini Luciano, Carroli Guillermo, Abalos Edgardo, Widmer Mariana, Amigot Susana and Nardin Manuel Juan *et al*., (**2009).** Accuracy of diagnostic tests to detect Asymptomatic bacteriuria during pregnancy. *Obstetrics & Gynecology* **113**(2) 346-352.

Patel HD, Livsey SA, Swann RA and Bukhari SS (2005). Can urine dipstick testing for urinary tract infection at the point of care reduce the laboratory workload? *Journal of Clinical Pathology* **6**(4) 671-673.

Rahimkhani M, Daneshvar HK and Sharifian R (2008). Asymptomatic bacteriuria and pyuria in pregnancy. *Acta Medica Iranica* **46**(5) 409-412.

SenthinathJayaseelan T, RajalakshmiChitra P, Vigneshwari RS, Revathi P, Prabhu N and Susethira AR (2013). Prevalence of asymptomatic bacteriuria among antenatal women in rural tertiary care hospital, Tamilnadu, India. *International Journal of Current Microbiology and Applied Sciences* **2**(1) 80-85.

Smaill F and Vazquez JC (2007). Antibiotics for asymptomatic bacteriuria in pregnancy. *The Cochrane Database of Systemic Reviews* (2), Art. No.: CD000490, DOI 10.1002/14651858, CD000490, pub 2.

Tincello G Douglas and Richmond H David (1998). Evaluation of reagent strips in detecting asymptomatic bacteriuria in early pregnancy: prospective case series. *British Medical Journal* **316** 435-37.

Wayne PA (2007). Clinical and Laboratory Standards Institute. Performance standards for antimicrobial susceptibility testing; *17th Informational Supplement,* CLSI/NCCLS document M100-S17 **27**(1).