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Prevalence of urinary tract infection among pregnant women at IMS and SUM hospital, a tertiary care teaching hospital, Bhubaneswar

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Abstract

Urinary tract contaminations (UTI) are the most widely recognized bacterial diseases amid pregnancy and these contaminations. Untreated UTI can be related with genuine obstetric inconveniences. This cross-sectional investigation was completed to decide the commonness of UTI among symptomatic and asymptomatic pregnant ladies going to at bureau of Obstetrics and Gynecology, IMS and SUM doctor's facility, Bhubaneswar. An aggregate of 247 pregnant ladies were enlisted, of these 78 (31.5%) were symptomatic and 169 (68.4%) asymptomatic. UTI was analyzed utilizing mid stream pee (MSU) culture on standard culture media and urinalysis was finished utilizing fast plunge stick. The commonness of bacteriuria among symptomatic and asymptomatic pregnant ladies were 17.9% and 13.0% separately, with no noteworthy distinction between the two gatherings ($P=0.307$). Utilizing univariate investigation there was no relationship of equality ($P=0.825$), gestational age ($P=0.173$), instruction ($P=0.615$), age ($P=0.211$) and conjugal status ($P=0.949$) with bacteriuria. The affectability and particularity of pee dipstick was 38.9% and 86.7% individually. *Escherichia coli* (47.2%) and *Enterococcus* spp (22.2%) were the most usually recuperated pathogens. The rate of obstruction of *Escherichia coli* to ampicillin, antibiotic medication, sulfamethaxazole/trimethoprim, gentamicin, ciprofloxacin, nitrofurantoin, ceftriaxone, and imipenem were 53%, 58.8%, 64.7%, 5.9%, 11.8%, 5.9%, 29.4% and 0%, individually. All in all, asymptomatic bacteriuria among pregnant ladies is pervasive in our setting and larger part of *Escherichia coli* are impervious to ampicillin, antibiotic medication, SXT and ceftriaxone. Because of low affectability of quick plunge stick, routine pee culture and defenselessness testing is prescribed to every pregnant lady at booking.

Keywords: Urinary tract infection, pregnancy, bacteriuria, *Escherichia coli*

Introduction

Urinary tract contaminations are the most well-known bacterial diseases amid pregnancy representing roughly 10% of doctor's facility visits by ladies (Millar *et al.* 1997) [16]. These contaminations can be asymptomatic or symptomatic bacteriuria happening in 5–10% and 1–3% among pregnant ladies, separately (Gilstrap *et al.* 2001) [11]. In an investigation in Hanang in northern Tanzania a commonness of UTI of 16.4% among pregnant ladies has been accounted for by Olsen *et al.* (2000) [18]. Urinary tract disease can be related with expanded hazard to the embryo and the mother (Macejko *et al.* 2007) [14]. The physiological changes that happen in urinary affability amid pregnancy can make generally sound ladies be progressively powerless to genuine inconveniences due to UTI. Around 90% of pregnant ladies create ureteral dilatation (hydronephrosis of pregnancy), which holds on until conveyance (Santos *et al.*, 2002) [20]. Some 30% of patients with untreated asymptomatic bacteriuria create symptomatic cystitis and up to 30–40% create pyelonephritis (Barnick *et al.*, 1991) [2]. Pyelonephritis in pregnancy has been related with expanded dismalness and mortality for mother and kid (Blomberg *et al.*, 2005a) [3]. Just a couple (1%) ladies without bacteriuria create symptomatic cystitis (Patterson and Audriole, 1987) [19]. Urinary tract contaminations have been ascribed to cause preterm conveyances (Haram *et al.*, 2003) [12]. *Escherichia coli* has been observed to be the commonest (80-90%) reason for UTI among pregnant ladies. *Klebsiella*, *Enterobacter*, *Proteus* species and gram positive microorganisms represent the rest of the cases (Millar *et al.*, 1997; Gilstrap *et al.*, 2001; Delzell *et al.*, 2000) [5, 11]. Among gram-positive segregates, *Staphylococcus saprophyticus* and *Enterococcus* are the commonest species.

The defenselessness to anti-toxins of these creatures can change geologically and anti-microbial treatment ought to be endorsed dependent on built up examples of antimicrobial sensitivities in the particular establishment (Jamie *et al.*, 2002) [13].

Routine screening of pregnant ladies for UTI has been related with a decline in related difficulties (Millar *et al.* 1997) [16]. Pee culture is the best quality level by which other screening tests are assessed, however it is the most costly and requires 24– 48 hours for definite understanding (Eigbefoh *et al.* 2008; Shelton *et al.* 2001) [9, 22]. Different choices have been proposed yet every has its impediments. Tiny assessment of pee for pyuria, the nearness of white platelets, has a poor affectability of 22– 29% (Shelton *et al.*, 2001) [22]. Pee dipstick testing for nitrite or leukocyte esterase has variable sensitivities (50– 92%) and specificities (83– 97%) (McNair, 2002) [15].

The size of UTI among pregnant ladies in IMS and SUM Hospital, Bhubaneswar isn't known. The examination was in this way, did to decide the commonness of UTI among pregnant ladies went to at IMS and SUM Hospital, Bhubaneswar and the defenselessness examples of the basic disengages.

Material and methods

Study area

This examination was completed in the Department of Obstetrics and Gynecology of the IMS and SUM healing center, Bhubaneswar. This healing facility is a referral clinic in the Lake zone and serves at Odisha. It has a bed limit of 850 with 5,435 conveyances every year, 16 beds in antenatal ward, and a normal number of 10 patients conceded in the ward day by day. Antenatal facility serves around 150 pregnant moms in a month (<http://www.bugandomedicalcenter.go.tz>)

Study population and sampling

The investigation populace included pregnant ladies going to Bugando Medical Center. There was no gestational age limits. This was an expository cross-sectional investigation directed from July to October 2008. A recipe of Kish and Lisle (1965) was utilized to figure the example size. $n = z^2 p(1-p)/d^2$. Where: $z = Z$ score for 95% certainty interim = 1.96, $p =$ pervasiveness, $d =$ middle of the road blunder = 5%. An extent of 20% was utilized as p (Akinloye *et al.*, 2006) [1] A sequential examining technique was utilized; somewhere around 5 pregnant ladies were selected day by day until the point that the example measure was come to. An institutionalized survey was filled for every patient to acquire socio-statistic data.

Urine collection and analysis

Mid-stream pee were gathered around the same time of enrolment utilizing sterile holder (Himedia research centers Pvt. Constrained, Mumbai, India). Examples were sent to the research facility for examination around the same time. A large portion of the examples were broke down inside a

hour of accumulation. Urinalysis utilizing pee dipstick (Mannheim GmbH, Germany) was finished adhering to producer's directions.

A 1 μ and 10 μ l were utilized to immunize pee tests on CLED, MacConkey and Blood agar plates (OXOID-England). Plates were brooded for 24hr at 37oC. A finding of UTI was made when there were at any rate 10⁵ colony framing unit (CFU)/ml of pee. High province tallies with more than one types of microscopic organisms were considered as pollutions. For tainted examples, rehash culture was requested. Recognizable proof was finished utilizing in-house biochemical testing (Murray *et al.*, 1995) [17]. Circle dissemination strategy was utilized to decide weakness of the disconnects. Singular settlements were suspended in typical saline to 0.5 McFarland and utilizing sterile swabs the suspensions were vaccinated on Muller Hinton agar for 18-24hr. All techniques were done as suggested by Clinical Laboratory Standard Institute (CLSI). For quality control, E. coli ATCC 25922 was utilized as control strains (CLSI, 2000) [6].

For gram-negative microbes the accompanying circles were tried: Ampicillin (10 μ l), sulfamethazole-trimethoprim (SXT) (1.25/23.75 μ g), antibiotic medication (30 μ g), Nitrofurantoin (300mcg), Ceftriaxone (30 μ g), Gentamycin (10 μ g), Ciprofloxacin (5 μ l) and Imipenem (30 μ g). Penicillin (10 IU), Erythromycin (15 μ l), and Clindamycin (2 μ l) were utilized for gram-positive microorganisms as it were. Symptomatic patients were given treatment observationally before culture results. All patients were approached to return for results following 2 days.

Data analysis

Information were entered in the PC, utilizing Epi-information and broke down utilizing SPSS 10.0. The Chi-square-test and Fisher correct tests were utilized to perform and set up any measurable distinction. Univariate examination was utilized to decide the affiliation. Likelihood estimations of < 0.05 were considered as measurably critical.

Results

Study population and prevalence of bacteriuria

A sum of 247 pregnant ladies were enrolled in this investigation. Of these 89.4% were 15-34 years of age. The mean development age was 34.05 \pm 7.44 and 85% of the ladies were in the third trimester. Among 247 pregnant ladies, 36 (14.6%) were found to have critical bacteriuria (Table 1). Pervasiveness of symptomatic and asymptomatic bacteriuria was 17.9% and 13%, separately. High rate of bacteriuria was seen in the third trimester with 85.8% and 90.9% of symptomatic and asymptomatic bacteriuria, separately. There was no relationship between maternal age, equality, gestational age, occupation, conjugal status and instruction with bacteriuria (Table 1). An aggregate of 78 subjects detailed urological side effects including expanded recurrence of micturition (67.9%) and dysuria (64.1%); (Table 2).

Table 1: Prevalence of bacteriuria and demographic characteristic of study population (N=247)

Variables	Response	No. subjects	No. (%) Bacteriuria	95% CI ¹	P-value ²
Maternal age	<15	2	0 (0)	--	
	15-24	112	24 (21.4)	13.83;29.03	
	25-34	109	11 (10.1)	4.44;15.74	0.211
	35-44	23	1 (4.3)	-3.99;12.69	

	>45	1	0 (0)	--	
Parity	0-1	88	15 (17.0)	9.19;24.91	
	2-3	101	16 (15.8)	8.72;22.96	0.825
	>4	58	5 (8.6)	1.4;15.84	
Gestation age	1 st Trimester	8	1 (12.5)	-10.42; 35.42	
	2 nd Trimester	29	3 (10.3)	-0.74;21.42	0.173
	3 rd Trimester	210	32(15.2)	10.38;20.1	
Occupation	None	9	2(22.2)	-4.94;49.38	
	Housewife	128	19(14.8)	8.68;21.0	
	Employed	24	4(16.7)	1.76;31.58	--
	Business	56	9(16.1)	6.45;25.69	
Marital status	Peasant	30	2(6.7)	-2.26;15.6	
	Single	16	3(18.8)	-0.38;37.88	
	Married	223	32(14.3)	9.75;18.95	0.949
Education	Separated	4	1(25.0)	-17.44; 67.44	
	Divorced/widowed	4	0(0)	--	
	Illiterate	15	1(6.7)	-5.96;19.3	
Total	Primary	158	22(13.9)	8.52;19.3	0.615
	Secondary	68	13(19.1)	9.77;28.47	
	Higher learning	6	0(0)	--	
		247	36(14.6)	10.17; 18.97	

¹Confidence interval for proportion in percentages; ²Univariate analysis

Bacterial isolates and their susceptibility

Thirty six pee tests had noteworthy bacteriuria of single seclude. E. coli (42.7%) was the most transcendent living being recouped. The rate of protection from ampicillin, co-trimoxazole, ceftriaxone, gentamicin and nitrofurantoin among E. coli were 52.9%, 64%, 29.4% 5.9% and 5.9%, separately (Table 3). All E. coli detaches were touchy to imipenem. Klebsiella pneumoniae represented 5.5% of detaches. Other Gram negative microbes (*Acinetobacter* spp, *Pseudomonas* spp, *Morganella* spp, and *Enterobacter* spp) contributed 16.7% of the segregates, and they were impervious to various anti-infection agents (Table 3).

Table 2: Common symptoms of urinary tract infections N=78

Symptoms	Number of subjects	% of subjects
Vomiting	19	24.4
Dysuria	50	64.1
Suprapubic pain	45	57.7
Fever	34	43.6
Flank pain	27	34.6
Chills	11	14.1
Frequency of micturition	53	67.9
Nausea	26	33.3

Enterococcus spp (22.2%) was the second common isolate. It was found to be resistant to co-trimoxazole in 75%, penicillin in 50 % and ampicillin in 12.5%. *Staphylococcus aureus* and Group B *Streptococci* were isolated in 5.6% and 2.8%, respectively. They were all resistant to erythromycin.

Table 3: Rate of resistance to antibiotic among Gram negative bacteria

Bacteria	SXT	TE	CIP	AMP	CRO	NF	G	IMP
<i>E. coli</i> (N=17)	64.7	58.8	11.8	52.9	29.4	5.9	5.9	0
<i>K. pneumoniae</i> (N=2)	50.0	50.0	0	100.0	100.0	0	50.0	0
Other GNB (N=6)	66.7	83.3	50.0	66.7	50.0	50.0	16.6	16.6

Key: SXT=Co-trimoxazole; TE=Tetracycline, CIP=ciprofloxacin, AMP=Ampicillin, CRO=Ceftriaxone; NF=Nitrofurantoin; G=Gentamicin, IMP=Imipenem

Table 4: Rate of resistance to antibiotics among Gram positive bacteria

Bacteria	AMP	TE	CIP	ER	DA	NF	PEN	SXT
<i>Enterococcus</i> (N=8)	12.5	75.0	0	-	-	0	50.0	75.0
Other GPB (n=3)	33.3	33.3	33.3	100.0	33.3	33.3	33.3	100.0

Key: AMP=Ampicillin; TE=Tetracycline; CIP=ciprofloxacin; E=Erythromycin; DA=Clindamycin; NF=Nitrofurantoin; PEN=Penicillin,

Sensitivity and specificity of Urine dip stick

The prevalence of UTI among pregnant women by dipstick and culture was 17% and 14.5%, respectively. The sensitivity and specificity of urine dipstick was 38.9 % and 86.7%, respectively. Positive predictive value and negative predictive value were 33.3% and 89.3%, respectively (Table 4).

Table 5: Sensitivity and specificity of rapid screening test using culture as gold standard

Rapid screening test	Culture			
		Positive (%)	Negative (%)	Total
	Positive	14(33.3)	28(66.7)	42(100)
Negative	22(10.7)	183(89.3)	205(100)	
Total	36(14.5)	211(85.5)	247(100)	

Sensitivity = 38.9 %; Specificity = 86.7 %; Positive predictive value = 33.3 %; Negative predictive value = 89.3%; False positive = 66.7 %; False negative = 10.7 %

Discussion

The general pervasiveness of bacteriuria among pregnant ladies in this investigation was 14.6 %. This is like the pervasiveness of UTI (16.4%) among pregnant ladies in northern Tanzania (Olsen *et al.*, 2000) [3]. The pervasiveness of symptomatic and asymptomatic bacteriuria was seen to be 17.9% and 13%, separately. An examination in Enugu, Nigeria announced comparative discoveries (Ezeome *et al.* 2006) [10]. Nonetheless, the commonness of asymptomatic bacteriuria saw in our examination is fundamentally high contrasted with those announced in created nations and this is probably going to be credited to low financial status (Gilstrap *et al.*, 2001, Santos *et al.*, 2002; Sheik *et al.*, 2000) [11, 20, 21].

Diverse variables have been recorded to add to UTI among pregnant ladies. These incorporate age, equality, incubation age, dimension of training (Gilstrap *et al.*, 2001; Smaill *et al.*, 2007; Santos *et al.*, 2002; Dimetry *et al.*, 2007) [11, 20, 21]. In this investigation there was no critical relationship between these variables and bacteriuria. Comparable discoveries have been accounted for somewhere else (Sheik *et al.*, 2000) [21].

E. coli strains were the most well-known disconnect. Comparable discoveries have been accounted for in northern Tanzania (Blomberg *et al.*, 2005a) [3] and somewhere else (Millar *et al.*, 1997; Gilstrap *et al.*, 2001; Dalzell *et al.*, 2000; Eigbefoh *et al.*, 2008) [16, 9, 7]. The majority of the confines were observed to be touchy to nitrofurantoin, ciprofloxacin and gentamicin. Comparable perceptions have been accounted for by different specialists (Blomberg *et al.*, 2005a; Ezesh *et al.*, 2003) [3]. Since ciprofloxacin is related with fetal arthropathy it isn't prescribed in pregnancy (Briggs *et al.* 2001) [5]. Then again, gentamicin is held for intense pyelonephritis (Macejko *et al.* 2007) [14]. Nitrofurantoin, thusly, remains medication of decision as it is protected to use in pregnancy. The medication is suggested for both asymptomatic and symptomatic bacteriuria (Briggs *et al.*, 2001; Jamie *et al.*, 2002) [5, 13].

In the present examination among *E. coli*, 94% of separates were delicate to nitrofurantoin. In comparative investigation in northern Tanzania, 96% of *E. coli* disconnects were observed to be touchy to nitrofurantoin (Blomberg *et al.*, 2005a) [3]. This medication can subsequently, be utilized in our setting for the treatment of suspected UTI in pregnant ladies. In this examination the vast majority of Gram negative microbes (GNB) were impervious to ampicillin with more than half of *E. coli* being impervious to this medication. *E. coli* protection from ampicillin in an investigation in northern Tanzania was lower (17%) than in our examination (Blomberg *et al.*, 2005a) [3]. The utilization of this medication in the treatment of suspected GNB disease in our setting ought not be suggested. Somewhat more than 33% of *E. coli* separates were protection from ceftriaxone, like what was seen at Muhimbili National Hospital in Dar es Salaam (Blomberg *et al.* 2005b) [4].

A critical distinction between the two tests in deciding bacteriuria among pregnant ladies was seen in this examination. The affectability dipstick in our examination was like discoveries by Tincello *et al.* (1995) [25] however marginally lower than what was seen in an investigation in Nigeria (Eigbefoh *et al.* 2008) [9]. The positive prescient incentive in this investigation was 33.3%; different examinations have discovered it to shift from 16% to 62% (Shelton *et al.*, 2001) [22]. Leucocyte esterase has a discovery limit of 5– 15 cells/ml of pee with the darkest shading square identical to 500 cells/ml. The nearness of leucocyte esterase is demonstrative of pyuria. It might accordingly, be questionable in patients with low pyuria (Eigbefoh *et al.*, 2008; Tincello *et al.*, 1995) [9, 25]. The dipstick test was found to have high false positive which shows that treatment dependent on the nearness of leukocyte esterase would uncover around 67% of the moms and their babies to superfluous anti-microbials (Shelton *et al.*, 2001; Olsen *et al.* 2000) [22, 3].

Taking everything into account, asymptomatic bacteriuria among pregnant ladies is predominant in our setting and lion's share of *E. coli* are impervious to ampicillin, cotrimoxazole and ceftriaxone. The dipstick test has restricted

use in screening for asymptomatic bacteriuria on account of its low affectability, contrasted and the pee culture. The examination suggests the utilization of nitrofurantoin in overseeing asymptomatic bacteriuria and intense cystitis. Routine culture in the conclusion of UTI among pregnant ladies at booking is vital to anticipate unfavorable result for the mother and tyke.

References

- 1 Akinloye O, Ogbolu DO, Akinloye OM, Terry OA. Asymptomatic bacteriuria of pregnancy in Ibadan, Nigeria: a re-assessment. *British Journal of Biomedical Science*. 2006; 63:109-112.
- 2 Barnick CGW, Cardozo LD. The lower urinary tract in pregnancy, labour and puerperium. In: Studd J, editor. *Progress in Obstetrics and Gynaecology*. London: Churchill Livingstone. 1991; 9:195-204.
- 3 Blomberg B, Olsen BE, Hinderaker SG, Langeland N, Gasheka P, Jureen R, Kvale G, Midtvedt T. Antimicrobial resistance in urinary bacterial isolates from pregnant women in rural Tanzania. *Scandinavian Journal of Infectious Diseases*. 2005a; 37:262-268.
- 4 Blomberg B, Jureen R, Manji KP, Tamim BS, Mwakagile DSM, Urassa WK *et al.* High rate of fatal cases of pediatric septicemia caused by Gram-negative bacteria with extended-spectrum beta-lactamases in Dar es Salaam, Tanzania. *Journal of Clinical Microbiology*. 2005b; 43:745-749.
- 5 Briggs GG, Freeman RK, Yaffe SJ. *Drugs in Pregnancy and Lactation*, 6th edition: Lippincott Williams & Wilkins Publishers, 2001.
- 6 CLSI. Performance standards for antimicrobial disk susceptibility tests. Approved standard. 9th Edition Document M2-A9. Clinical and Laboratory Standards Institute, Wayne, PA, 2006.
- 7 Dalzell JE, Lefevre ML. Urinary tract infection of pregnancy. *American Academy of Family Physicians*. 2000; 61:713-21.
- 8 Dimetry SR, El-Tokhy HM, Abdo NM, Ebrahim MA, Eissa M. Urinary tract infection and adverse outcome of pregnancy. *Journal of Egypt Public Health Association*. 2007; 82:203-218.
- 9 Eigbefoh JO, Isabu P, Okpere E, Abebe J. The diagnostic accuracy of the rapid dipstick test to predict asymptomatic urinary tract infection of pregnancy. *Journal of Obstetrics and Gynaecology*. 2008; 28:490-495
- 10 Ezeome IV, Ikeme AC, Okezie OA, Onyebueke EA. Asymptomatic bacteriuria in pregnant women in Enugu, Nigeria. *Tropical Journal of Obstetrics and Gynaecology*. 2006; 23:12-13.
- 11 Gilstrap LC, Ramin SM. Urinary tract infections during pregnancy. *Obstetrics and Gynaecology Clinics North America*. 2001; 28(3):581-91.
- 12 Haram K, Mortensen JH, Wollen AL. Preterm delivery: an overview. *Acta Obstetrica Gynecologica Scandinavica*. 2003; 82:687-704.
- 13 Jamie WE, Edwards RK, Duff P. Antimicrobial susceptibility of Gram-negative uropathogens. Isolated from obstetric patients. *Infectious Diseases Obstetric Gynecology*. 2002; 10:123-126.
- 14 Macejko AM, Schaeffer AJ. Asymptomatic Bacteriuria and Symptomatic Urinary Tract Infections during

- Pregnancy. *Urologic Clinics of North America*. 2007; 34:35-42.
- 15 McNair RD, MacDonald SR, Dooley SL, Peterson LR. Evaluation of the centrifuged and Gram-stained smear, urinalysis, and reagent strip testing to detect asymptomatic bacteriuria in obstetric patients. *American Journal of Obstetrics and Gynecology*. 2000; 182:1076-1079.
 - 16 Millar LK, Cox SM. Urinary tract infections complicating pregnancy. *Infectious Diseases Clinics of North America*. 1997; 11:13-26.
 - 17 Murray PR, Baron EJ, Pfaller MA, Tenover FC, Tenover RH. *Manual of Clinical Microbiology*, 6th edition. American Society of Microbiology Press, Washington DC, 1995, 1482.
 - 18 Olsen BE, Hinderaker SG, Lie RT, Gasheka P, Baerheim A, Bergsjø P, Kvale G. The diagnosis of urinary tract infections among pregnant women in rural Tanzania; Prevalences and correspondence between different diagnostic methods. *Acta Obstetrica Gynecologica Scandinavica*. 2000; 79:729-736.
 - 19 Patterson TF, Audriole VT. Bacteriuria in pregnancy. *Infectious Disease Clinics of North America*. 1987; 1:807-822.
 - 20 Santos JF, Ribeiro RM, Rossi P, Haddad JM, Guidi HG, Pacetta AM *et al.* Urinary Tract Infections in Pregnant Women. *International Urogynecology Journal and Pelvic Floor Dysfunction*. 2002; 13:204-209.
 - 21 Sheikh MA, Khan MS, Khatoon A, Arain GM. Incidence of urinary tract infection during pregnancy. *Eastern Mediterranean Health Journal*. 2000; 2/3:265-271.
 - 22 Shelton DS, Boggess K, Kirvan K, Frank S, Herbert W. Urinary interleukin-8 with asymptomatic bacteriuria in pregnancy. *Obstetrics & Gynecology*. 2001; 97:583-586.
 - 23 Smaill F, Vazquez JC. Antibiotics for asymptomatic bacteriuria in pregnancy. *Cochrane Database of Systematic Reviews*. 2007; 2:CD000490.
 - 24 Tincello DG, Richmond DH. Evaluation of reagent strips in detecting asymptomatic bacteriuria in early pregnancy: prospective case series. *British Medical Journal*. 1998; 316:435-437.