Assessment of Asymptomatic Bacteriuria in Pregnant Women in Port Harcourt, South Southern Nigeria

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Abstract: This study investigated the prevalence and the causative organisms of asymptomatic bacteriuria among pregnant women attending their first prenatal visit at University of Port Harcourt Teaching Hospital (UPTH) and Braithwaite Memorial Hospital (BMH), both in Port Harcourt, South Southern Nigeria. A retrospective analysis was performed on the routine prenatal screening (urine culture tests) of 9,698 women attending their first prenatal clinic visit between 1 January 2011 to 31 July 2012. They were reviewed, analyzed, and correlated with data on patients' age, nationality, gravidity, and number of previous abortions. Of 9,698 women, only 166 (1.7%) showed significant bacterial growth, and 1,918 patients (19.8%) were reported as heavy mixed growth. The most common bacterium isolated was *Escherichia coli* on 88 patients (53%). In this study, low prevalence of bacteriuria among pregnant women was compared to published studies conducted in other countries. In view of the paucity of information regarding asymptomatic bacteriuria in pregnancy, and the findings of this study, there is need to conduct a nation-wide survey to guide the revision of medical practice on a national scale in Nigeria.
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1. Introduction

Urinary tract infections (UTIs) are the most common bacterial infections during pregnancy (Cunningham and Lucas, 1994; Lee et al., 2004). The incidence of UTI varies depending on the local prevalence of asymptomatic bacteriuria and whether it is treatable. Asymptomatic bacteriuria (ASB) is a major risk factor for the development of urinary tract infections (UTIs) during pregnancy. Thus, accounting for 70% of all cases of symptomatic UTI among unscreened pregnant women (Jones et al., 2009). It is generally defined as true bacteriuria in the absence of specific symptoms of an acute UTI (Smaill and Vazquez, 2007). Although, the original criterion for diagnosing it was the presence of more than 100,000 bacteria/ml on two consecutive clean catch urine samples, a more practical alternative is the detection of more than 100,000 bacterial/ml in a single voided midstream urine sample (Smaill and Vazquez, 2007; Kass, 1960). Furthermore, ASB occurs in 2% to 10% of all pregnancies (Whalley, 1967). It does not occur more frequently with pregnancy. However, it is more likely to result in a symptomatic UTI in pregnant women (Jones et al., 2009) because of stasis of urine, and the bacteria in the urinary tract from relative obstruction, that is caused by the physiological changes during pregnancy that predispose women to bacteriuria. These physiological changes include the dilatation of the ureters secondary to progesterone, and to the mechanical obstruction from the gravid uterus later in pregnancy. Glycosuria, proteinuria, and aminoaciduria were found in pregnancy and also facilitate bacterial growth (Jones et al., 2009).

As many as 20-40% of pregnant patients with ASB, if left untreated, will eventually develop pyelonephritis later in their pregnancy compared with < 1% of pregnant women without ASB (Lee et al., 2004). Pyelonephritis is the most common severe bacterial infection that can lead to prenatal and maternal complications, including premature delivery, infants with low birth weight, fetal mortality, preeclampsia, pregnancy-induced hypertension, anemia, thrombocytopenia, and transient renal insufficiency (Cunningham and Lucas, 1994; Foxman, 2002). Proper antibiotic treatment of ASB is effective in reducing the incidence of pyelonephritis and low birth weight, but there was no evidence of a reduction in preterm delivery (Smaill and Vazquez, 2007).

Screening for ASB in pregnant women has been shown to be cost effective when compared with treating UTI and pyelonephritis without screening (Rouse et al., 1995; Wedland and Plante, 1989). The various screening techniques used to detect bacteriuria include urinalysis, leukocyte esterase activity, a nitrite test, and urine cultures. A midstream urine culture is still considered the best diagnostic test (Tolosa, 2008). Because ASB is clinically significant in pregnancy, it should be aggressively sought, diagnosed, and treated in all stages. Screening is an essential component of prenatal care (Tolosa, 2008). The American College of Obstetrics and Gynecology advocates routine screening for

bacteriuria with a urine culture at the first prenatal visit and during the third trimester (ACOG, 1998). The US Preventive Services Task Force recommends screening for bacteriuria with urine culture for pregnant women at 12-16 weeks of gestation, hoping to identify 80% of women, who will eventually develop ASB (USPSTF, 2007).

Using a decision analysis, screening for and treating of ASB to prevent pyelonephritis have been shown to be cost effective over a wide range of estimates. Although, the cost benefit diminish if the rate of ASB is less than 2% (Rouse et al., 1995; Wedland and Plante, 1989). Estimates from mathematical modeling to evaluate the cost–effectiveness or cost–benefit of different diagnostic strategies vary significantly, with an approximate incidence rate of 9%, when pyelonephritis is considered as an outcome (Tolosa, 2008). The low prevalence of infection in certain populations, the cost of different screening tests, and the uncertainty about the benefits of treatment in decreasing adverse outcomes of pregnancy have, however, been used to argue against universal screening and treatment (Smaill and Vazquez, 2007).

In Nigeria, there is insufficient old data and scanty recent data about the prevalence of bacteriuria (asymptomatic or symptomatic) during pregnancy. While there are no new data to indicate that women should not be screened for ASB, it is difficult to estimate accurately cost-effectiveness of screening it without up-to-date information on the prevalence.

The primary purpose of this study was to determine the prevalence and the causative organisms of ASB among pregnant women attending their first prenatal visit at two hospitals in Port Harcourt, South Southern, Nigeria; and, Secondly, to evaluate the value of the current policy of universal screening of pregnant women among our local population.

2. Materials and methods

2.1 Study Design and Setting

This is a retrospective descriptive cross-sectional hospital-based study (prevalence study) where the results of the routine prenatal screening urine culture tests of 9,698 women attending first prenatal clinic from 1 January 2011 to 31 November 2012. They were reviewed based on their age, nationality, gravidity, and history of abortions. The data was obtained from two hospitals; University of Port Harcourt Teaching Hospital (UPTH), and Braithwaite Memorial Hospital (BMH). Both hospitals provide tertiary medical care for the regional population of Southern Nigeria.

The screened women were divided into groups according to their nationality: Nigerian and Non Nigerian, age: < 20 years, 20-34 years, > 35-44 years and > 45 years), gravidity: nulliparous/primigravida (G1), multiparous (G2-G5), and grandmultiparous (> G5). In addition to history of previous abortion: Women with and without history of abortion.

A quantitative urine culture was obtained with blood and MacConkey agar plates. Significant growth means; the presence of > 100,000 organisms/ml urine of a single bacterium, while heavy mixed growth means; presence of > 100,000 organisms/ml urine of more than one type of bacteria.

2.2 Ethical Consideraation

Ethical approval was obtained from the Departments of Pathology and Community Medicine, University of Port Harcourt Teaching Hospital Institutional Review Board, Port Harcourt, Nigeria. All information about persons screened was kept confidential. This study did not interfere with the normal management of the patients.

2.3 Data Analyses

Statistical analyses were performed using the Statistical Package for the Social Science (SPSS), Version 16 for Windows. Continuous variables were summarized using descriptive statistics in terms of means±standard deviations; 95% confidence intervals (95% CI), minimums and maximums, while a Chi-square test was used to compare categorical variables. A p-value less than 0.05 were considered significant.

3. RESULTS

3.1 Demographics of Study Population

Of a total of 9,698 pregnant women 6,082 (62.7%) were Nigerian, aged between 15 and 48 years; mean, 27.6 (95% CI = 27.52 - 27.76). Their gravidity range was between 1 - 17; mean 3.53 (95% CI = 3.48 - 3.58). Their parity was between 0 - 14; mean 2.07 (95% CI = 2.03 - 2.12). Their history of abortions range was from 0-11; mean 0.48 (95% CI = 0.46 - 0.5) and were screened for bacteriuria by mid stream urine culture.

3.2 Prevalence of Urine Culture Results and Demographic

Of the 9,698 culture results, 7,614 (78.5%, 95% CI = 77.7 - 79%) yielded no growth; 1,918 (19.8%, 95% CI = 19 - 20.6%) yielded heavy mixed/mixed growth, and only 166 (1.7%, 95% CI = 1.45 - 1.97%) showed significant growth. Figure 1 shows that the most common bacterium isolated was *Escherichia coli*, 88 (53%). Other bacteria included *Candida albicans*, 33 (19.9%); Group B *Streptococcus* (GBS), 18 (10.8%), *Staphylococcus*, 8 (4.8%); *Actinobacter*, 8 (4.8%); *Diphtheroids*, 5 (3%), *Proteus*, 1 (0.6%); and *Klebsiella* 1 (0.6%) species,

Table 1 shows that nationality had significant relationship with the significant growth urine result (χ^2; 32.19; df, 2, p = 0.0005). Most of the significant growth was among Nigerian nationality group, 139 (2.3%). Age groups had considerable relationship with the significant growth urine culture result (χ^2;

48.8; df, 6, p = 0.0005). Most of the significant growth occurred in the 35-45 age group; 43 (2.8%), followed by age group 20-34 years; 123 (1.7%). There was no significant growth among age group < 20 years and > 45 years.

Gravidity/parity groups also had considerable relationship with the significant growth urine result (χ^2; 35.17; df, 6, p = 0.0005). Most of the significant growth was observed in the multiparous (G2-G5) group, 112 (2.2%), followed by grandmultiparous (> G5); 30 (1.5%). The primigravida/nulliparous group showed significant growth only in 24 women (0.9%). History of previous abortion had no relationship with the urine culture result (χ^2; 0.258; df, 2, p = 0.879). The results of this study showed that the most significant growth was found among Nigerian women, in 35-45 years age group and in the multiparous (G2-G5) group.

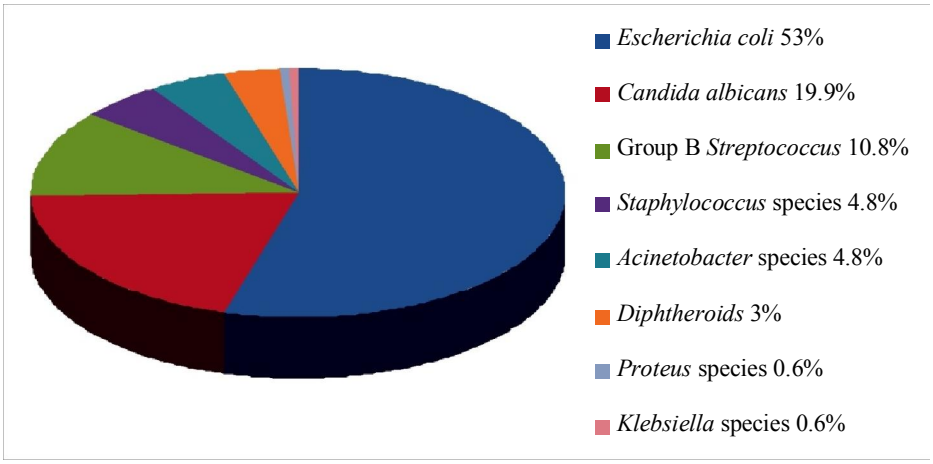

Figure 1: Percentage occurrence of isolated pathogens.

Table 1: Summary of 9,698 Urine Culture Results and Patient Demographic Characteristics.

Characteristics / Urine results	NO Growth N (%)	Mixed Growth N (%)	Significant Growth N (%)	Total N (%)	χ^2 (P-value)
N (%)	7614 (78.5%)	1918 (19.8%)	166 (1.7%)	9698 (100%)	
NATIONALITY					
Nigerian	4737 (77.9)	1206 (19.8%)	139 (2.3%)	6082 (100%)	32.19 [a],
Non Nigerian	2876 (79.6%)	711 (19.7%)	27 (0.7%)	3614 (100%)	(0.0005)
Total	7613 (78.5%)	1917 (19.8%)	166 (1.7%)	9696 (100%)	
AGE (years)					
< 20	531 (76.2%)	166 (23.8%)	0 (0.0%)	697 (100%)	
20 – 34	5809 (78.1%)	1504 (20.2%)	123 (1.7%)	7436 (100%)	48.8 [b],
35 – 45	1227 (81.0%)	245(16.2%)	43 (2.8%)	1515 (100%)	(0.0005)
> 45	47 (94.0%)	3(6.0%)	0 (0.0%)	50 (100%)	
Total	7614 (78.8%)	1918 (19.9%)	166 (1.7%)	9698 (100%)	
GRAVIDITY					
G1	2018 (77.6%)	557 (21.4%)	24 (0.9%)	2599 (100%)	
G2-G5	3970 (77.6%)	1032 (20.2%)	112 (2.2%)	5114 (100%)	35.2 [c],
>G5	1620 (81.9%)	327 (16.5%)	30 (1.5%)	1977 (100%)	(0.0005)
Total	7614 (78.8%)	1918 (19.9%)	166 (1.7%)	9698 (100%)	
History of previous Abortions					
NO	5362(78.4%)	1354(19.8%)	120 (1.8%)	6836 (100%)	
YES	2235(78.7%)	558(19.7%)	46 (1.6%)	2839 (100%)	0.258 [d]
Missed	17	6	0	23	(0.879)
Total	7597 (78.3%)	1918 (19.9%)	166 (1.7%)	9698(100%)	

[a] df,2; [b] df,6 ; [c] df,6; [d] df,2

Abbreviations: $\chi^{2=}$ Chi-square test; G1=primigravida/nulliparous, G2-G5=multiparous, >G5=grandmultiparous.

4. Discussion

ASB occurs in 2-10% of all pregnancies (Whalley, 1967). The majority of the most recent studies, including observational studies from developing countries, found the prevalence range between 4-10% (McNair et al., 2007; Mohammad et al., 2002; McIsaac et al., 2005; Tugrul et al., 2005). This range during pregnancy was reported to be as high as 78.7% in a population from Nigeria that included *Staphylococcus aureus* as an uropathogen (Amadi et al., 2007). This variation in studies can be attributed to several factors such as the geographical variation, socio-economic status, ethnicity of the subjects, setting of the study (primary care, community based, or hospitals), and the variation in the screening tests (urine dipstick, microscopy, and culture).

Race-specific rates show significant variation, as well as there is variation within same race living in different geographical areas or with socio-economic status. Reported prevalence of ASB among Bangladesh pregnant women living in London was 2.0% and 12% in rural areas in Bangladesh (Ullah et al., 2007). Thus, it is important to evaluate the prevalence of ASB in a specific population. This study reported that the prevalence of ASB among pregnant women attending their first prenatal visit in two tertiary health centers in Port Harcourt, South Southern Nigeria was 1.7% (95% CI: 1.45-1.97%). This rate is much lower than that reported in a study from Saudi Arabia; 14.2% bacteriuria in pregnant women from the eastern region of Saudi, where only 25% of the women were symptomatic (i.e., the prevalence of ASB was 10.5%). 15.8% bacteriuria was reported in 1991 from the Western region of Saudi, where the ASB was 7.1% (Al-Sibai et al., 1989). Furthermore, the prevalence rate in this study was much lower than the recent reports from other Middle Eastern countries. For example, the reported prevalence of ASB is 30%, 9.9%, 3.3-6.1% and 4.8% among pregnant women in Yemen (Al-Haddad, 2005), Iran (Hazhir, 2007; Aseel et al., 2009) and United Arab Emirates (UAE) (Abdullah and Al-Moslih, 2005), respectively. However, the prevalence in this study was the same as what has been reported in Malaysian pregnant women (1.9%) (Mohammad et al., 2002) and Bangladesh women (2%) living in London (Versi et al., 1997). The explanation for the low prevalence could have been due to the improved socio-economic status. Particularly, in the study that was reported from the Asian countries where bacteriuria was significantly more common among the low socio-economic group. The higher prevalence was in Qatar, Iran, and UAE; perhaps it's because their patients were recruited from primary heath care centers while patients were from tertiary centers in this study.

E. coli has been identified as the most common pathogen isolated among the pregnant women in this study (Figure 1), which was consistent with the majority of the reported studies in literature (Jones et al., 2009; Smaill and Vazquez, 2007; Wedland and Plante, 1989; Whalley, 1967; Tugrul et al., 2005; Fatima and Ishrat, 2006). However, *E. coli* formed 53% of the isolated organisms, which is lower than what have been reported in countries such as Pakistan, 2006 (78.6%) (Fatimat and Ishrat, 2006); Turkey, 2005 (77%) (Tugrul et al., 2005); Iran, 2009 (70%) (Aseel et al., 2009) and in UAE, 2005 (66.7%) (Abdullah and Al-Moslih, 2005). Moreover, higher than Qatar, 2009 (31%) (USPSTF, 2007); Malaysia, 2002 (40%) (Jones et al., 2009); Yemen 2005 (41.5%) (Foxman, 2002; and Nigeria, 2006 (11.1%) (Akinloye et al., 2006). *E. coli* is the most common microorganism in the vaginal and rectal area. Because of the anatomical and the functional changes that occur during pregnancy, the risk of acquiring UTI from *E. coli* is high (Mohammad et al., 2002).

The prevalence of *Candida albicans* in this present study (19.9%) is higher than other studies (Mohammad et al., 2002; Akinloye et al., 2006) . Western Nigeria, 2006 (7.9%) and Malaysia (2 out of 32 cultures; 6.25%). The physiological alterations during pregnancy that affects immunity and high prevalence of diabetes, including gestational diabetes, among our population may account for this high prevalence of *C. albicans*.

Group B streptococcus (GBS), which is occasionally isolated in urine (10%) (Kennedy, 2005), had a prevalence of 10.8% in this study, less than that reported from Malaysia (15%). GBS bacteriuria may be associated with preterm rupture of membranes, premature delivery, and early onset neonatal sepsis. Thus, all pregnant women with these bacteria during gestation should receive treatment at the time of diagnosis, as well as intrapartum antibiotic prophylaxis (Lee et al., 2009; Smaill, 2010). The 19.9% of mixed bacterial growth reported in this study was similar to that reported from Malaysia (17.2%) (Mohammad et al., 2002) and less than 25.5% previously reported in Nigeria (Amadi et al., 2007) It likely indicates that contamination of urine specimens still happens, despite the strict instructions given to patients about the collection of a midstream urine specimen. Proper collection, appropriate transport, and the early processing of urine specimens remain essential.

During pregnancy, bacteriuria/UTIs are more common in women who are older and of higher parity (Foxman, 2002; Dwyer and Reilly, 2002). However, closer scrutiny of the published literature reveals that the age and parity effects are poorly

characterized. For example, some studies showed that the prevalence of ASB increased with age (Tugrul et al., 2005; Amadi et al., 2007), while others found it more with a younger age group (Hazhir, 2007; Ullah et al., 2007; Al-Sibai et al., 1989). This study showed the age groups had a significant relationship with the urine culture result, and there was no positive growth among age group < 20 years and > 45 years. This observation among these groups was similar to recent data from Iran (Fatima and Ishrat, 2006). Nevertheless, in contrast to previously published data by Al-Sibai *et al.*(1989) bacteriuria was more common (23.2%) among women below the age of 20 years. The reason for this observation was not obvious.

With regard to gravidity/parity, some previous studies found that the prevalence of ASB was highly associated with multiparity (Tugrul et al., 2005; Akinloye et al., 2006). In the present study, gravidity had a significant relationship with urine culture results, and primigravida (nulliparous) women had lower rate of bacteriuria than those who had babies. This rate was consistent with previously published data in Saudi Arabia (Al-Sibai et al., 1989). However, the rate of ASB among primigravida/nulliparous women was 10 times (9.6%) more than our current rate (0.9%) (Al-Sibai et al., 1989). Multiparous groups (G2-G5) in the present study had higher bacteriuria than nulliparous/ primigravida, and grand multiparous women (> G5). Though, no meaningful trends were observed with increasing parity. Versi and colleagues (1997) found that grand multiparous white women had a higher bacteriuria rate than white women of lower parity. This trend with parity was not observed in the Bangladesh women. He hypothesized that the effect of parity was not global, but rather dependent on race and/or geography. This hypothesis was not true as even in the same ethnic group the pattern of the prevalence of bacteriuria with age and parity was not consistent over time. For example, studies on Nigerian women (Olusanya et al., 1993) showed higher bacteriuria rates among nulliparous women in 1993. A 2006 study confirmed it was higher in multiparous women, and that the multiparity was associated with increased bacteriuria in pregnancy (Amadi et al., 2007).

In conclusion, the result of this study updates information on the prevalence of ASB among pregnant women attending their first prenatal visit in two tertiary centers in Port Harcourt, South Southern Nigeria. The prevalence was low (1.7%), and the predominant organism, *E. coli*, was 53%. A large scale national study that includes primary health care centers should be conducted to determine the actual prevalence of ASB in the obstetric population in Nigeria, and to identify the group that is vulnerable for developing a UTI. If low prevalence is confirmed at the national level and vulnerable groups are identified, it is more cost effective to recommend selective rather than universal screening for ASB in pregnancy. Predominantly, because the cost benefit of screening for, and the treatment of ASB, to prevent pyelonephritis, have shown to be diminished if the rate of ASB is less than 2%. However, the uncertainty of the benefits of treatment in decreasing adverse outcomes of pregnancy is not clear.

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References

1. Cunningham FG, Lucas MJ. Urinary tract infections complicating pregnancy. Baillieres Clinical Obstetrics and Gynaecology 1994; 8(2): 353-373.
2. Lee J, Briggs GG, McKeown A, Bustillo G. Urinary tract infections during pregnancy. Annals of Pharmacotherapy 2004;38(10):1692-701.
3. Jones LA, Woodman PJ, Ruiz HE, Urinary tract infections in pregnancy. eMedicine 9 December 2009. <http://emedicine.medscape.com/article/452604-overview>.
4. Smaill F, Vazquez JC. Antibiotics for asymptomatic bacteriuria in pregnancy. System Review 2007; 18(2): CD000490.
5. Kass EH. The role of asymptomatic bacteriuria in the pathogenesis of pyelonephritis. In: Quinn EL, Kass EH, (eds.) Biology of Pyelonephritis. Boston: Little Brown Co, 1960. 399-412.
6. Whalley P. Bacteriuria of pregnancy. American Journal of Obstetrics and Gynecology 1967; 97(5): 723-738.
7. Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. American Journal of Medicine 2002; 113(1): 5-13.
8. Rouse DJ, Andrews WW, Goldenberg RL, Owen J. Screening and treatment of asymptomatic bacteriuria of pregnancy to prevent pyelonephritis: a cost-effectiveness and cost-benefit analysis. Obstetrics and Gynecology 1995; 86(1): 119-123.
9. Wadland WC, Plante DA. Screening for asymptomatic bacteriuria in pregnancy. A decision and cost analysis. Journal of Family Practice 1989; 29(4): 372-376.
10. Tolosa JE. Antibiotics for Asymptomatic

Bacteriuria in Pregnancy: RHL commentary (last revised: 14 January 2008). The WHO Reproductive Health Library; Geneva: World Health Organization.
11. ACOG. Antimicrobial therapy for obstetric patients. ACOG Educational Bulletin, Washington, DC: American College of Obstetricians and Gynecologists 1998;245:8-10.
12. US Preventive Services Task Force. Guide to Clinical Preventive Services, 2007: Recommendations of the U.S. Preventive Services Task Force. Section Recommendations for Adults, Infectious Diseases. <http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=hscps2007&part=A5008>
13. 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(5):1076-1079.
14. Mohammad M, Mahdy ZA, Omar J, Maan N, Jamil MA. Laboratory aspects of asymptomatic bacteriuria in pregnancy. Southeast Asian Journal of Tropical Medicine and Public Health 2002; 33(3): 575–580.
15. McIsaac W, Carroll JC, Biringer A, Bernstein P, Lyons E, Low DE, et al. Screening for asymptomatic bacteriuria in pregnancy. Journal of Obstetrics Gynaecology of Canada 2005; 27(1): 20-24.
16. Tugrul S, Oral O, Kumru P, Kose D, Alkan A, Yildirim G. Evaluation and importance of asymptomatic bacteriuria in pregnancy. Clinical Obstetrics and Gynecology 2005;32(4):237-240.
17. Abdullah AA, Al-Moslih MI. Prevalence of asymptomatic bacteruria in pregnant women in Sharjah, United Arab Emirates. East Mediterrenian Health Journal 2005; 11(5-6): 1045-1052.
18. Al-Haddad AM. Urinary tract infection among pregnant women in Al-Mukalla district, Yemen. East Mediterrenian Health Journal 2005; 11(3): 505-510.
19. Fatima N, Ishrat S. Frequency and risk factors of asymptomatic bacteriuria during pregnancy. Journal of the College of Physicians and Surgeons of Pakistan 2006; 16(4): 273-275.
20. Akinloye O, Ogbolu DO, Akinloye OM, Terry Alli OA. Asymptomatic bacteriuria of pregnancy in Ibadan, Nigeria: a re-assessment. British Journal of Biomedical Sciences 2006; 63(3): 109-112.
21. Hazhir S. Asymptomatic bacteriuria in pregnant women. Urology Journal 2007; 4(1): 24-27.
22. Ullah MA, Barman A, Siddique MA, Haque AK. Prevalence of asymptomatic bacteriuria and its consequences in pregnancy in a rural community of Bangladesh. Bangladesh Medical Research Council Bullettin 2007; 33(2): 60-64.
23. Aseel M, Al-Meer F, Al-Kuwari, Ismail M. Prevalence and predictors of asymptomatic bacteriuria among pregnant women attending primary health care in Qatar. Middle East J Fam Med 2009; 7(4): 10-13. Moghadas AJ, Irajian G. Asymptomatic urinary tract infection in pregnant women. Iranian Journal of Pathology 2009; 4(3): 105-108.
24. Amadi ES, Enemuo OB, Nwosu OK, Onyeagba RA, Ugbogu OC. Asymptomatic bacteriuria among pregnant women in Nigerian. Journal of Medical Science 2007; 7(4): 698-700.
25. Versi E, Chia P, Griffiths DJ, Harlow BL. Bacteriuria in pregnancy: a comparison of Bangladeshi and Caucasian women. International Urogynecological Journal 1997; 8(1): 8-12.
26. Al-Sibai MH, Saha A, Rasheed P. Socio-biological correlates of bacteriuria in Saudi pregnant women. Public Health 1989; 1103(2): 113-121.
27. Abduljabbar H, Moumena RA, Mosli HA, Khan AS, Warda A. Urinary tract infection in pregnancy. Annal of Saudi Medicine 1991; 11(3): 322-324.
28. Kennedy E. Pregnancy, urinary tract infections. eMedicine <http://www.emedicine.com/emerg/topic485.htm>(available 10 October 2005).
29. Smaill F. Intrapartum antibiotics for group B streptococcal colonization. System Reviews 2010; 20(1): CD000115
30. Dwyer PL, O'Reilly M. Recurrent urinary tract infection in the female. Current Opinion in Obstetrics and Gynecology 2002;5(14):537–543.
31. Olusanya O, Ogunledun A, Fakoya TA. Asymptomatic significant bacteriuria among pregnant and non-pregnant women in Sagamu, Nigeria. West African Journal of Medicine 1993; 12(1): 27-33.

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