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Asymptomatic Bacteriuria in Pregnant Women in Jeddah, Western Region of Saudi Arabia: Call for Assessment

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Abstract. To determine the prevalence and the causative organisms of asymptomatic bacteriuria among pregnant women attending their first prenatal visit at King Abdulaziz University Hospital and in a private clinic at Dr. Erfan and Bagedo Hospital, Jeddah, Saudi Arabia. A retrospective analysis was performed of the routine prenatal screening (urine culture tests) of 9,698 women attending their first prenatal clinic visit between 1 January 2004 to 31 December 2007. 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 the only two available published studies conducted in the 80's in Saudi Arabia. In view of the lack of information regarding asymptomatic bacteriuria in pregnancy, and the findings of this study, the importance of a conducting a nation-wide survey to guide the revision of practice on a national scale in Saudi Arabia has increased.

Keywords: Asymptomatic bacteria, Prenatal screening, Saudi pregnant.

Introduction

Urinary tract infections (UTIs) are the most common bacterial infections during pregnancy[1-2]. The incidence of UTI varies depending on the

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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[3]. Thus, accounting for 70% of all cases of symptomatic UTI among unscreened pregnant women[3]. It is generally defined as true bacteriuria in the absence of specific symptoms of an acute UTI[4]. 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[4,5].

Furthermore, ASB occurs in 2% to 10% of all pregnancies[6]. It does not occur more frequently with pregnancy. However, it is more likely to result in a symptomatic UTI in pregnant women[3] 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, also facilitate bacterial growth[3].

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[2]. 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[1-4, 7].

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[4].

Screening for ASB in pregnant women has been shown to be cost effective when compared with treating UTI and pyelonephritis without screening[3,8-9]. 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[10].

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[10]. The American College of Obstetrics and Gynecology (ACOG) advocates routine screening for bacteriuria with a urine culture at the first prenatal visit and during the third trimester[11]. 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[12].

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 is diminish if the rate of ASB is less than 2%[8,9]. 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[10].

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[4].

In Saudi Arabia, there is insufficient old data and no 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 the cost-effectiveness of screening it without up-to-date information on the prevalence.

The primary purpose of this study is to determine the prevalence and the causative organisms of ASB among pregnant women attending their first prenatal visit at two hospitals in Jeddah, Western region of Saudi Arabia. Secondly, the purpose is to evaluate the value of the current policy of universal screening of pregnant women among our local population.

Patients and Methods

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 2004 to 31 December 2007. They were reviewed based on their age, nationality, gravidity, and history of abortions. The data was obtained from two hospitals; King Abdulaziz University Hospital (KAUH) which is a teaching hospital, and a private clinic in a private hospital, both in Jeddah, the Western region of Saudi Arabia. KAUH is the main teaching hospital of the Western region, with a total of 4,000-4,500 deliveries per year. The private clinic has an average of 100-150 pregnant women attending per month. Both are providing tertiary medical care for the regional population of Western Saudi Arabia.

The screened women were divided into groups according to their nationality: Saudi and Non Saudi, 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 plate. 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.

Data Analysis

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.

Results

Demographics of Study Population

A total of 9,698 pregnant women 6,082 (62.7%) were Saudi, aged between 15 and 48 years; mean, 27.6 (95% CI = 27.52 - 27.76). Their gravidity ranged 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 ranged was from 0-11; mean 0.48 (95% CI = 0.46 - 0.5) and were screened for bacteriuria by mid stream urine culture.

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 the most common bacterium isolated was *Escherichia coli (E. 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,

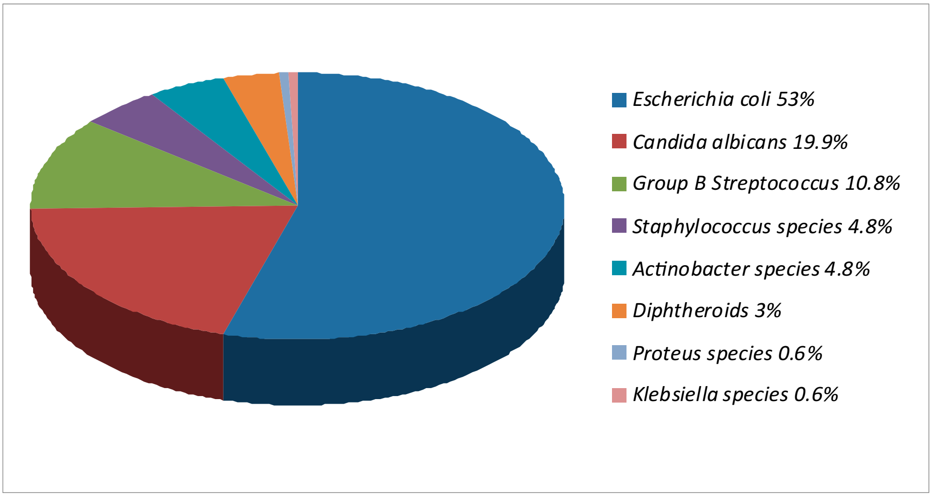

Fig. 1. Percent of isolated pathogens.

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 Saudi 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

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					
Saudi	4737 (77.9)	1206 (19.8%)	139 (2.3%)	6082 (100%)	32.19 [a],
Non Saudi	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%)	
Hx 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: χ^{2}= Chi-square test; G1 = primigravida/nulliparous, G2-G5 = multiparous, >G5 = grandmultiparous.

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 Saudi women, in 35-45 years age group and in the multiparous (G2-G5) group.

Discussion

ASB occurs in 2-10% of all pregnancies[6]. The majority of the most recent studies[13-24], including observational studies from developing countries, found the prevalence ranged between 4-10%. 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[25].

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 Bangladeshi pregnant women living in London was 2.0% and 12% in rural areas in Bangladesh[22,26]. 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 centers in Jeddah, Western region of Saudi Arabia was 1.7% (95% CI: 1.45-1.97%). This rate is much lower than the previously reported from Saudi Arabia; 14.2% bacteriuria in pregnant women from the eastern region (in 1989), 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, where the ASB was 7.1%[27-28]. Furthermore, our prevalence rate was much lower than the recent reports from other Middle Eastern countries.

In Table 2, for example, the reported prevalence of ASB is 30%, 9.9%, 3.3-6.1% and 4.8% among pregnant women in Yemen[18], Qatar[23], Iran[21, 24] and United Arab Emirates (UAE)[17], respectively. However, the prevalence in this study was the same as what has been reported in Malaysian pregnant women (1.9%)[14] and Bangladeshi women (2%) living in London[26]. The explanation for low prevalence compared to the previous local studies could have been due to the improved socio-economic status. Particularly, in the study that was reported from the Eastern region 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 ours from tertiary centers.

Table 2. Summary of reported prevalence of ASB in pregnant women and percentage (%) of *E. coli* isolated from some countries.

COUNTRY	Prevalence (%)	*E. coli* (%)
Middle East		
Saudi Arabia		
Eastern region (Al-Sibai et al., 1989)[27]	10.5%	-
Western region (Abduljabber et al., 1991)[28]	7.1%	89%
Yemen (Al-Haddad, 2005)[18]	30%	41.5%
Qatar (Aseel et al., 2009)[23]	9.9%	31%
Iran		
(Hazhir, 2007)[21]	6.1%	-
(Moghadas and Irajian, 2009)[24]	3.3%	70%
United Arab Emirates (Abdullah and Al Moslih, 2005)[17]	4.8%	66.7%
Asia		
Bangladesh (Ullah et al., 2007)[22]	12%	75.9%
Pakistan (Fatima and Ishrat, 2006)[19]	9.9%	78.6%
Malaysia (Mohammad et al., 2002)[14]	1.9%	40%
Africa		
Nigeria (Akinolye et al., 2006)[20]	21.0%.	11.1%
Nigeria (Amadi et al., 2007)[25]	78.7%	25.4%
Europe		
Turkey (Tugrul et al., 2005)[16]	8.1%.	77.77%

E. coli has been identified as the most common pathogen isolated among the pregnant women in this study (Fig. 1), which was consistent with the majority of the reported studies in literature[13-19,22-24,27,28]. However, *E. coli* formed 53% of the isolated organisms, which is lower than what have been reported in countries (Table 2) such as Pakistan, 2006 (78.6%)[19]; Turkey, 2005 (77%)[16]; Iran, 2009 (70%)[24] and in UAE, 2005 (66.7%)[17]. Moreover, higher than Qatar, 2009 (31%)[12]; Malaysia, 2002 (40%)[3]; Yemen 2005 (41.5%)[7]; and Nigeria, 2006 (11.1%)[20].

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[14].

The presence of Candida albicans in this present study (19.9%) is higher than other studies[14,20]: 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. GBS, which is occasionally isolated in urine (10%)[29] 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[2, 30].

The 19.9% of mixed bacterial growth reported in this study was similar to that reported from Malaysia (17.2%)[14] and less than 25.5% reported by Amadi *et al.* from Nigeria[25]. 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[7,31]. 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[16,20], while others found it more with a younger age group[21,23,24,27]. 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[20]. Nevertheless, in contrast to previously published local data by Al-Sibai *et al.*[27], when 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[16,20]. 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 local data[27] , however, in 1989, the rate of ASB among primigravida/nulliparous women was 10 times (9.6%) more than our current rate (0.9%). Multiparous groups (G2 - G5) in 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)[26] found grand multiparous white women had a higher bacteriuria rate than white women of lower parity. This trend with parity was not observed in the Bangladeshi 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[20,32] 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.

In conclusion, the result of this study updates information on the prevalence of ASB among pregnant women. Plus, attending their first prenatal visit in two tertiary centers in Jeddah, Saudi Arabia was low (1.7%), and the predominant organism of *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 Saudi Arabia, 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. To the best of author knowledge this the only recent paper reporting prevalence of ASB among pregnant women in Saudi Arabia.

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البولية الجرثومية اللاّأعراضية بين النساء الحوامل في جدة ، المنطقة الغربية من المملكة العربية السعودية: دعوة للتقييم

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جدة – المملكة العربية السعودية

المستخلص. هذه دراسة لتحديد مدى انتشار البولية الجرثومية اللاأعراضية، والكائنات المسببة لها بين النساء الحوامل، اللواتي يترددن على عيادة قبل الولادة، عند الكشف العيادي الأول في عيادة ما قبل الولادة بمستشفى جامعة الملك عبدالعزيز، وبمستشفى باقدو والدكتور عرفان، جدة، المملكة العربية السعودية. عن طريق عمل تحليل استعادي، لنتائج التحليل الروتيني للبول، للنساء الحوامل اللواتي ترددن على العيادة، في الفترة ما بين الأول من يناير٢٠٠٤ وحتى آخر ديسمبر٢٠٠٧م، حيث تمت مراجعة نتائج اختبار مزرعة البول لكل المشاركات، ودراسة مدى الارتباط بين نتائج الاختبار مع العمر/الجنسية/مرات الحمل/عدد الولادات/ومرات الإجهاض. تألفت العينة من ٩٦٩٨ من المشاركات، وأظهرت مزرعة لعينة البول نموًّا ذا أهمية كبيرة في ١٦٦ حالة فقط (١,٧٪) ونموًّا متباين الأهمية في ١٩١٨ (١٩,٨٪) من الحالات. وكانت بكتيريا معزولة كولاي في ٨٨ (٥٣٪) الأكثر شيوعا. استنتجنا انخفاض معدل البولية الجرثومية اللاأعراضية بين المشاركات بصورة ملحوظة في هذه الدراسة الحديثة مقارنة بدراستين أجريتا في الثمانينيات. زادت نتائج هذه الدراسة في ضوء

القصور الحاد في الأبحاث في هذا الموضوع، من أهمية عمل دراسة استقصائية وطنية، لمعرفة النسبة الوطنية للبولية الجرثومية اللاأعراضية عند النساء الحوامل، ولتحديد من هن النساء الأكثر عرضة لالتهابات البول، وذلك لوضع التوصيات الوطنية الملائمة لذلك.