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ORIGINAL ARTICLE

The Value of Screening Pregnant Women for Asymptomatic Bacteriuria and Its Impact on Maternal and Neonatal Outcome

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ABSTRACT

Background: *Asymptomatic bacteriuria (ASB) is defined as significant growth of pathogenic bacteria of more than 10^5 CFU/ ml in urine culture without any symptoms suggesting of urinary tract infection. It has many complications on the health of a pregnant woman, her pregnancy and the fetus.* ***Objectives:*** *The present study was conducted to determine the prevalence, risk factors, pathogenic organisms of ASB in pregnant women, to assess antimicrobial susceptibility pattern of uropathogens and to assess maternal and fetal complications.* ***Methodology:*** *Urine samples were collected from 256 asymptomatic pregnant women. All samples were subjected to microscopic examination and cultivation on CLED. Colonies were identified by Gram stain and biochemical reactions. In vitro susceptibility pattern was measured by disk diffusion method.* ***Results:*** *ASB prevalence rate was 7.8% among the studied group. E. coli was the most common uropathogen isolated (35%). This study revealed that nitrofurantoin (90%) sensitivity, imipenem (85%), norfloxacin (75%) and amikacin (75%) were very effective against most of the urinary isolates, while most of the urinary isolates were resistant to cephalexin, cefuroxime and cefotaxime.* ***Conclusion:*** *Early screening, detection and proper treatment were of considerable importance to reduce maternal and fetal complications. More systematic study covering larger population is recommended to give better insights about risk factors and complications.*

INTRODUCTION

Asymptomatic bacteriuria (ASB) is a common health problem in women especially during pregnancy due to urinary stasis caused by progesterone, different morphological and physiological changes occurring during pregnancy.[1,2] Screening of ASB during pregnancy is important, as untreated ASB may progress to symptomatic urinary tract infection (UTI) during pregnancy or in the postpartum period, acute pyelonephritis, anemia, hypertension in pregnant women, intrauterine growth retardation, preterm labour, and perinatal death of the fetus.[3, 4]

The aim of the present study was to assess the prevalence, risk factors, pathogenic organisms of ASB in pregnant women, antimicrobial susceptibility pattern of the uropathogens and to assess maternal and fetal complications.

METHODOLOGY

The study has been approved by the Research and Ethical Committee of Medical Microbiology and Immunology Department, Faculty of Medicine, Cairo University. Informed consent was obtained from all participants included in the study.

Specimen collection:

Urine samples were collected by mid-stream "clean catch" method from 256 asymptomatic pregnant women (with 37 pregnant women in the first trimester, 86 pregnant women in the second trimester and 133 pregnant women in the third trimester) attending prenatal visits at the Obstetrics and Gynecology outpatient clinics, Kasr Al Ainy Hospital, Egypt, during the period from May to July 2014. Pregnant women who received antibiotics in the last two weeks, had UTI symptoms, urinary catheterization, hemodialysis, or suspected urinary tract abnormalities, were excluded from the study.

Specimen processing:

Urine samples were subjected to:

- Microscopic examination of a wet film of centrifuged urine to detect the presence of the pus cells. Pus cells count more than 10/ HPF was considered significant.
- Quantitative urine culture was performed on cysteine-lysine electrolyte deficient (CLED agar) **(Oxoid, UK)**, urine samples showed colony count more than10^5 CFU/ml was considered significant for ASB.[5] Culture plates incubated at 37°C for 24-48 h.

Identification of bacterial species

Colonies were identified by colony morphology, Gram stain.

- Gam-negative bacilli were identified by: oxidase, triple sugar iron, lysine decarboxylase, motility-indole-ornithine decarboxylase, urease and citrate utilization tests. Two *E. coli* isolates cannot be identified by conventional biochemical reactions, API20 E was used for their identification.
- Gram-positive cocci, were identified by catalase and coagulase tests, subculture on mannitol salt (Oxoid, UK) and bile esculin agars (Oxoid, UK).

Antimicrobial susceptibility (Kirby Bauer Disk Diffusion method):

Bacterial isolates were tested by disk diffusion method using Muller-Hinton agar **(Oxoid, UK)**. The agar surface was inoculated by using a swab dipped in a cell suspension adjusted to the turbidity of 0.5 McFarland standard. The following antibiotic disks **(Oxoid, UK)** were used: augmentin (AUG 30), imipenem (IPM 10), ceftazidime (CAZ 30), ceftriaxone (CRO 30), cefotaxime (CTX 30), cefuroxime (CXM 30), cephalexin (CL 30), norfloxacin (NOR 10), ciprofloxacin (CIP 5), nitrofurantoin (F 300), amikacin (AK 30), sulfamethoxazole-trimethoprime (SXT 25), vancomycin (VA 30) and cefoxitin (FOX 30 µgm). Inhibition zones were interpreted using validated CLSI interpretive break points.[6]

Statistical analysis

Data were statistically described in terms of frequencies and percentages. Comparison between the study groups was done using Chi square (v2) test. Exact test was used instead when the expected frequency is less than 5. Accuracy was represented using the terms sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and overall accuracy. P-value was considered statistically significant if less than 0.05. All statistical calculations were done using computer program.Statistical Package for the Social Science (SPSS; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

RESULTS

In the current study, the age of the participants ranged from 15-40 years with a mean of 27.52± 5.48 years. ASB was predominated in pregnant women aged between 15-20 years, while, the least prevalence was seen in women aged between 36-40 years. ASB predominated in the first trimester (13.5%) more than other trimesters. There was no statistically significant relation between the gestational age and ASB.

Urine culture was the gold standard method for detection of ASB during pregnancy.[7] Accordingly, out of the 256 pregnant women included in the present study, 20 (7.8%) of them had significant bacteriuria. *E. coli* 7 (35%) was the most common isolated uropathogen, followed by Enterococci 5 (25%), Klebsiella 3 (15%); with 2 *K. pneumoniae* and one *K. oxytoca*, *S. aureus* and Acinetobacter 2 (10%) for each and finally Coagulase negative- Staphylococci (CoNS) which was the least isolated organism 1 (5%). Figure (1).

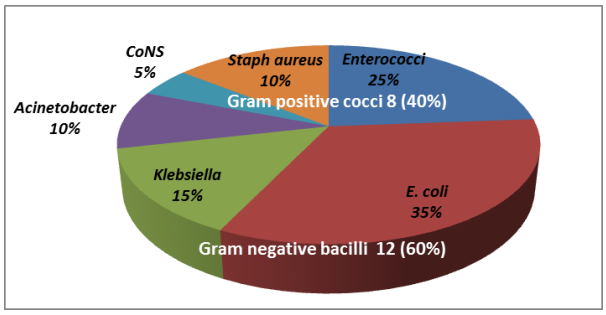

Fig. 1: Distribution of uropathogens in culture positive cases

Antimicrobial susceptibility

Nitrofurantoin was the most effective antibiotic against most of the urinary isolates with sensitivity 90%, followed by imipenem (85%), norfloxacin (75%) and amikacin (75%), respectively, while most of the urinary isolates were resistant to cephalexin, cefuroxime and cefotaxime. Susceptibility of uropathogens to different antibiotics was summarized in table (1).

Table 1: Susceptibility of isolated uropathogens to different antibiotics using disk diffusion method:

Organism % sensitivity / Antibiotic	*E.coli* % (7)	*Klebsiella* % (3)	*Acinetobacter* % (2)	*Enterococci*% (5)	*S.aureus* % (2)	*CoNs*% (1)	No. of total Sensitive organisms	% Sensitivity
AUG	2(28.6%)	3(100%)	0(0%)	5(100%)	1(50%)	0(0%)	11	55
CAZ	6(85.7%)	3(100%)	2(100%)	2(40%)	0(0%)	0(0%)	13	65
CRO	5(71.4%)	3(100%)	2(100%)	0(0%)	0(0%)	0(0%)	10	50
CTX	3(42.9%)	3(100%)	2(100%)	0(0%)	0(0%)	0(0%)	8	40
CXM	3(42.9%)	2(66.7%)	0(0%)	2(40%)	0(0%)	0(0%)	7	35
F	7(100%)	3(100%)	2(100%)	3(60%)	2(100%)	1(100%)	18	90
NOR	6(85.7%)	3(100%)	2(100%)	1(20%)	2(100%)	1(100%)	15	75
CIP	6(85.7%)	3(100%)	2(100%)	0(0%)	2(100%)	1(100%)	14	70
AK	7(100%)	3(100%)	2(100%)	0(0%)	2(100%)	1(100%)	15	75
SXT	6(85.7%)	3(100%)	1(50%)	0(0%)	1(50%)	1(100%)	12	60
IPM	7(100%)	3(100%)	1(50%)	3(60%)	2(100%)	1(100%)	17	85
FOX	ND	ND	ND	ND	1(50%)	0(0%)	1	5
VA	ND	ND	ND	4(80%)	ND	ND	4	20
CL	1(14.3%)	0(0%)	0(0%)	2(40%)	0(0%)	0(0%)	3	15

ND: not done

ASB positive cases were followed up until delivery to detect maternal and fetal complications, follow up revealed that: 8 cases dropped out, 7 cases ended their pregnancy in full-term normal deliveries, 4 cases presented with post-partum UTI, one case presented with premature rupture of membranes. Regarding fetal complications; one infant was premature and incubated for 10 days the remaining 11 women had normal full term babies.

DISCUSSION

ASB is a microbiologic diagnosis based on the isolation of a specified quantitative count of bacteria in a properly collected specimen of urine from pregnant women without signs or symptoms of UTI. Urine culture is considered the gold standard method for diagnosis of ASB during pregnancy.[7] ASB is associated with serious complications for the mother and the fetus.[8]

The current study was designed to determine the prevalence, risk factors, pathogenic organisms of ASB in a group of 256 asymptomatic pregnant women, to assess antimicrobial susceptibility pattern of the uropathogens and to assess maternal and fetal complications.

In this study, only one urine sample was collected from each patient as it was not possible to collect a second urine sample from the same patient to confirm ASB due to the inability to track patients. ASB prevalence rate was 7.8% among the studied group. These results were in accordance with other studies which reported nearly similar prevalence rates.[2, 8, 9, 10] Higher prevalence rates of 45.3% and 26% were obtained by other studies.[11, 12] In a study conducted in Egypt, ASB prevalence rate was found to be 23.5% among pregnant women with premature uterine contractions attending prenatal visits in a tertiary center in Cairo.[13] ASB prevalence rate varying from 2-10% in studies conducted in different countries.[14, 15, 16, 17]

There is a wide fluctuation in the prevalence of asymptomatic bacteriuria in different countries which can be explained by different demographic characteristics with different gestational age, sexual activity, personal hygiene, parity and cultural level of patients, geographical difference , socioeconomic level and different diagnostic techniques used (urine dipstick, microscopy, and culture).[8]

In the current study, ASB predominated in women aged 15-20 years (12%), followed by those 26-30 years of age (9.8%) rather than other age groups. These results were similar to another study which recorded that the highest prevalence of ASB was observed in women aged 15-20 years.[18] The vulnerability of these age groups may be attributed to early and intensive sexual intercourse which may cause minor urethral trauma facilitating migration of bacteria from the perineum into the urethra[19]. On contrary to our results, other studies reported high prevalence of ASB in pregnant women aged between 21-30 years and 35-39 years.[10, 20] Advanced maternal age of ≥35years was reported as a risk factor for ASB in another study.[21]

In the present study, higher infection rates were found among those who were in the first trimester (13.5%) followed by second trimester. The higher incidence of ASB in first trimester could be explained by hormonal changes occurring prior to occurrence of anatomical changes,[10] and also may be explained by a relatively small number who attend antenatal visits in first trimester. Our results were similar to studies done by other authors.[10, 22] On the other hand, another study

recorded increased incidence of ASB in the third trimester and explained that by increased urinary stasis and more frequent antenatal visits.[23]

Risk factors of ASB during pregnancy which can be identified in this study include; young maternal age and sexual activity, first trimester and low socioeconomic level, however other parameters like anemia could not be assessed. Risk factors of ASB during pregnancy identified in other studies include; advanced maternal age, multiparity, third trimester, sexual activity and the presence of genitourinary abnormalities.[24] The prevalence is higher among individuals in lower socioeconomic classes, anemia and those with a past history of UTI.[20] Diabetes mellitus and grand multiparity have been reported.[4]

In the present study, bacterial isolates were identified by colony morphology, gram stain and biochemical reactions. *E. coli* was the most common uropathogen isolated (35%), followed by Enterococci (25%), Klebsiella (15%), *S. aureus* (10%), *Acinetobacter* (10%) and CoNS (5%). Similar results were reported another study; where *E. coli*, Klebsiella, *S. aureus*, CoNS, Proteus and Enterococci were isolated.[25]

Numerous studies were conducted in many countries showed that *E. coli* is the predominant organism isolated from ASB cases.[4, 10, 11, 17, 26, 32] On the other hand, a study conducted in Nigeria revealed that *S. aureus* was the most prevalent uropathogen.[28] Another study found that *K. oxytoca* was the most prevalent organism.[27] Variation in geographical location can account for these differences.

The predominance of bacteria from fecal origin in cases of ASB may be attributed to poor personal hygienic measures by pregnant women that facilitate transmission of fecal bacteria from perineum to urethra.[11]

I*n vitro* susceptibility pattern of 20 isolates to different antibiotics was measured by disk diffusion method. This study revealed that nitrofurantoin (90% sensitivity), imipenem (85%), norfloxacin (75%) and amikacin (75%) were very effective against most of the urinary isolates. Ceftazidime (65%), co-trimoxazole (60%), augmentin (55%), and ceftriaxone (50%) were moderately effective against the urinary isolates, while most of the urinary isolates were resistant to cephalexin, cefuroxime and cefotaxime.

Our antibiogram pattern correlates with another study which reported that most uropathogens were sensitive to nitrofurantoin and imipenem, followed by ceftazidime, amikacin, cefotaxime, co-trimoxazole and augmentin.[29]

ASB is associated with multiple maternal and fetal complications including intrauterine growth retardation, preterm labour and maternal septicemia, and post-partum endometritis, pre-eclampsia and chorioamnionitis.[29]

In our study, by following up ASB positive cases, maternal complications was observed in 5 cases (4 women presented with post-partum UTI, one woman presented with premature rupture of membranes), regarding fetal complications; one infant only was premature and incubated for 10 days.

Other studies showed that the incidence of low birth weight babies and prematurity was higher in untreated ASB patients.[30, 31] So early diagnosis of ASB followed by immediate and adequate therapy during gestation is essential to avoid adverse effects on maternal and neonatal health.

CONCLUSION

Risk factors of ASB during pregnancy identified in this study include; young maternal age and increased sexual activity, first trimester and low socioeconomic level. Urine culture was the standard method for diagnosing of ASB. *E. coli* was the most predominant organism. Nitrofurantoin was the most effective antimicrobial against most of uropathogens. Early screening, detection and proper treatment were of considerable importance to reduce maternal and fetal complications. More systematic study covering larger population is recommended to give better insights about risk factors and complications.

Conflict of Interest: The authors declare no conflicts of interest

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