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Bacterial Profile of Urinary Tract Infections and Antimicrobial Susceptibility Patterns among Pregnant Women at the Benghazi Medical Centre, Benghazi/Libya

Entesar S. Elmanefi[1], Ismaeel H. Bozakouk[2], Farag A. Bleiblo[3], Mohamed M. Bumadian[4 *]

[1] *Department of Medical Technologies, Faculty of Science and Technology, Qamenis, Libya.*
[2,3,4] *Department of Microbiology, Faculty of Science, University of Benghazi, Benghazi, Libya.*

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الملخص:

تعد عدوى المسالك البولية (UTI) من أكثر الأمراض شيوعًا التي تسببها البكتيريا في أثناء الحمل، ويمكن أن تؤدي إلى عواقب وخيمة لكل من الجنين والأم مما يستلزم الكشف المبكر للوقاية من الاصابة وتزايد المشاكل. هدفت هذه الدراسة إلى عزل والتعرف على بكتيريا التهابات المسالك البولية بين النساء الحوامل في مركز بنغازي الطبي لعدد 200 امرأة حامل خلال الفترة من شهر يونيو الى شهرأكتوبر 2018. نتائج هذه الدراسة أظهرت أن العدوى البكتيرية في أثناء الحمل أكثر شيوعاً في عمر السيدات من (25 إلى 35) 25 مريضة من أصل 44 (56.8%)، الثلث الثاني للحمل كان الأكثر ارتباطا بالعدوى 23 (52.3%)، كما أظهرت النتائج أن ربات البيوت أكثر عرضة للإصابة 28 (63.6%). أظهرت الإصابة البكتيرية عدة تباينات بكتيرية مرتبطة بالتهاب المسالك البولية خلال فترة الحمل بما في ذلك *E. coli* (56.8%) *كانت* وهي تمثل أكثر الممرضات المعزولة تكرارا تليها *S. aureus* (25%)، *Enterococcus* (9.1%)، *Klebsiella* (6.8%) و *Staphylococcus saprophyticus* (2.3%). إختبار حساسية البكتيريا للمضادات الحيوية أظهرت استجابة متغايرة، فقد بينت النتائج إن المضادات الحيوية Ciprofloxacin و Levofloxacin كانت فعّالة ضد جميع الميكروبات المختبرة، كما أن البكتيريا *E. coli* و *S. saprophyticus* أظهرت إستجابة حساسية لجميع المضادات الحيوية هذا بالإضافة الى أن البكتيريا أظهرت مقاومة لتأثير فعالية المضادات Amoxicillin، Azithromycin ، Erythromycin. لتجنب التهاب المسالك البولية في أثناء الحمل ومضاعفات العدوى الميكروبية التي تؤدي إلى فقدان الجنين المحتمل، يجب فحص جميع النساء الحوامل بشكل روتيني للكشف عن إحتمالية التهاب المسالك البولية مع إجراء زراعة لعينة البول ، إن تطلب الامر ومعالجتهن بالمضادات الحيوية المناسبة حسب الحاجة، كذلك زيادة مستوى الوعي الصحي للنساء قبل وأثناء بداية فترة الحمل من خلال إتباع الاساليب الصحيحة للعناية الشخصية للتقليل من خطر الإصابة بعدوى المسالك البولية.

الكلمات المفتاحية:

عدوى المسالك البولية، الحمل، بكتيريا، مقاومة مضادات البكتيريا (AMR).

Abstract

Urinary tract infection (UTI) is one of the most common diseases caused by bacteria during pregnancy, and it can create serious consequences for both the fetus and the mother, necessitating early detection and prevention of problems. The study aimed to isolate and identify urinary tract infections bacteria among pregnant women at the Benghazi Medical Centre. Initially, a sectional descriptive design was used on 200 pregnant women who attended the Obstetrics and Gynecology Clinic at the Benghazi Medical Centre from June 2018 to October 2018. A purposive sample was employed to collect data utilizing a structured interviewing questionnaire and laboratory test records. Bacterial infection during pregnancy was more frequent within the age range of 25 to 35 years with 25 out of 44 patients (56.8%). The second trimester of pregnancy was the time period most related to the infection with 23 patients (52.3%). The results also showed that housewives were more susceptible to the infection (28 patients; 63.6%). Several varieties of bacteria were related to UTIs during pregnancy including *Escherichia coli* (56.8%), which was the most frequently isolated pathogen followed by *S. aureus* (25%), *Enterococcus* (9.1%), *Klebsiella* (6.8%) and *Staphylococcus saprophyticus* (2.3%). Antibiotic sensitivity revealed that the response to antibiotics was variable; most of the isolated pathogens were sensitive to the tested antibiotics specifically to ciprofloxacin and levofloxacin. The isolated bacteria that were sensitive to all the used antibiotics included *Escherichia coli* and *S. saprophyticus*. Antibiotic resistance was increasingly seen in amoxicillin, azithromycin, and erythromycin. To avoid UTIs during pregnancy and the complications of infection, which could lead to fetal loss, all pregnant women should be routinely screened for UTIs with urine culture and treated with the appropriate antibiotics as needed as well as reducing the risk of developing a urinary tract infection by increasing the level of cultural awareness. Women confront double dangers with UTIs; the danger of the disease and the risk of anti-microbial treatment. Pre-natal connection to the baby is highlight when preparing to make this choice, weighing both the shorter-term risks from UTIs and the longer-term dangers from anti-microbial use, particularly the chance of AMR.

Keywords: urinary tract infection (UTI); pregnancy; bacteria; anti-microbial Resistance (AMR)

***Correspondence**:

Mohamed M. Bumadian
mohamed.bumadian@uob.edu.ly

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1. INTRODUCTION

Urinary tract infections (UTIs) are bacterial illnesses that affect people more frequently and are caused by bacteria known as uropathogenic. UTIs are considered a common health problem during pregnancy all over the world, particularly in developing countries[1]. Due to the load of the gravid uterus on the ureters, which causes urine flow stagnation, pregnancy is regarded as one of the predisposing reasons for increasing the risk of urinary tract infection in addition to urethral dilatation which occurs in 90% of pregnant women at 6 and 22-24 weeks gestation. Hormonal and immunological responses during normal pregnancy, sexual activity, age and the presence of genitourinary defects increase the prevalence of UTI[s] [2,3]. Enterobacteriaceae, particularly *Escherichia coli* and *Klebsiella pneumoniae* are the most common bacteria that cause urinary tract infections. *E. coli* is considered the main organism to infect the community with 80% of infections in the urinary tract. These micro-organisms increase risks for pregnant women such as premature labour as well as spontaneous abortion which requires firm vigilance because of its great prevalence[1,4]. The frequency of UTIs in pregnancy is strongly linked to women's socioeconomic position, as well as predisposing factors such as previous UTIs, diabetes mellitus, and urinary system structural anomalies. Among the pathogenic agents, *E. coli* is the most common cause of UTIs, followed by *Enterobacter* and *Klebsiella*. Inflammation of the bladder and pyelonephritis are caused by enterococci and *Proteus* species. *Candida* species are a major cause of fungal UTIs, mainly in immune-compromised patients and in patients with catheters for a long period[5]. Penicillin, amoxicillin, cefotaxime, norflaoacin, and cefoxitin are the most important and competent antibiotics for the cure and inhibition of the majority of UTI bacteria[6]. Urinary tract infections are responsible for the mortality of approximately 150 million annually, worldwide[2,7,8]. Therefore, women during pregnancy should be evaluated for predisposing factors and assessed for the causative organism and markers of infection throughout their regular scheduled follow-ups. The examination of urine for the presence of bacteria and the appropriate antibiotic treatment should be determined for maternal and fetal health safety. The sensitivity to the drugs should be taken into consideration with any adverse reactions related to pregnancy[9]. UTIs are a preventable condition that might be simply limited by providing health education to pregnant women about the disease's aetiology, its nature, the predisposing factors, and characteristics of high-risk women, as well as preventive strategies[10]. The gold standard for diagnosing UTIs is urine culture and sensitivity. Preterm delivery, intrauterine development retardation, low birth weight, maternal hypertension, pre-eclampsia, and anaemia are all linked to asymptomatic bacteriuria in pregnancy if not treated. Acute pyelonephritis can lead to maternal sepsis. Recurrent UTIs in pregnancy require prophylactic antibiotic treatment[11].

2. MATERIALS AND METHODS

Samples collection to investigate the bacterial UTIs was carried out from the 1st of June 2018 to the end of October 2018. The study sample population consisted of 200 pregnant women who attended the antenatal clinic at Benghazi Medical Center with the inclusion criteria; pregnant women at all trimesters of pregnancy with and without symptoms of urinary tract infection (UTI). Verbal informed consent was obtained from each woman before the commencement of the research. Socio-demographic data such as age, occupation and duration of gestation were obtained from the pregnant women using standard questionnaires. Early morning clean-catch midstream urine was collected from each pregnant woman into a wide-mouthed sterile screw-capped container. With a calibrated micro-loop, 10µl of urine was cultured onto blood agar, MacConkey agar and Cysteine lactose electrolyte -deficient (CLED) (Wilson, 2004) plates. After overnight incubation at 37 ºC, colony counts yielding bacterial growth of $\geq 10^5$ CFU/ml were taken as being significant in both symptomatic and asymptomatic pregnant women. The centrifuged urine deposit was examined microscopically at high magnification for pus cells, red blood cells, epithelial cells, casts, crystals, yeast-like cells. Pus cells 8-10 /HPF were also considered significant for infection (Simerville, 2005). Antibiotic susceptibility to the isolated species was performed using Kirby-Bauer Disk Diffusion Susceptibility Test and using the following antibiotics: Amikacin (AK), Augmentin (AUG), Nitrofurantoin (F), Levofloxacin (LEV), Ciprofloxacin (CIP). Trimethoprim-sulfamethoxazole (SXT), Nalidixic acid (NA), Erythromycin (E), and Azithromycin (AZM).

3. RESULTS

Two hundred urine samples were collected and analyzed during the study period (from the 1st of June 2018 to the end of October 2018**).** Prevalence of UTIs in the study population of pregnant women was at 22% positive out of 200 pregnant women, (n= 44 women) 78% (n=156 women) were negative for UTIs.

Bacterial profile of UTIs associated with pregnancy

The results showed that 25 UTI cases out of 44 had *Escherichia coli*, which was the most predominant pathogen isolated (56.8%) followed by *S. aureus* (25%), *Enterococcus* (9.1%), *Klebsiella* (6.8%) and *Staphylococcus saprophyticus* (2.3%) table (1).

Table 1. Frequency of UTI-associated microbial agents

Isolated pathogens	Number of infection cases	Percentage
Escherichia coli	25	56.8%
Staphylococcus aureus	11	25%
Enterococcus	4	9.1%
Klebsiella	3	6.8%
Staphylococcus saprophyticus	1	2.3%
Total isolates	44	

The frequency of UTI according to the age

The bacterial infection investigation and bacterial pathogenicity distribution according to the patients' age group showed that patients within the age of 25-35years had the highest incidence of infection (n=25) (20.66%) with a total infection percentage of (56.8%). The next age group in order of highest incidence of infection was the < 25 years group (n= 11) (23.4%) with a total infection percentage of (25%), while the lowest frequency was in the above 35 years age group (n= 8) (32.0%) with a total infection percentage of (18.2%), table (2).

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Table 2. The frequency of UTI according to the age

**p-value* =0.06

Age group	Number of samples	Number of positive samples	Total of Prevalence
<25	47	11 (23.4%)	25 %
25 – 35	121	25 (20.66%)	56.8%
>35	32	8 (32.0%)	18.2 %
Total	200	44	22%

Distribution of the UTIs according to pregnancy trimesters

The results showed a high incidence of bacterial infection during the second and the third trimester, with 23 patients (31.0%) and 13 patients (27.65%) respectively. Infection during the first trimester was low with 8 patients (10.1%). The comparison between the three trimesters showed that infection was higher in the second trimester (52.3%) compared to the third trimester (29.5 %) and the first trimester (18.2%), table (3).

Table 3. Distribution of the UTIs according to *p-value=0.059

Trimesters	Number of sample	Number	Total Prevalence
First trimester	79	8 (10.1%)	18.2%
Second trimester	74	23 (31.0%)	52.3%
Third trimester	47	13 (27.65%)	29.5 %
Total	200	44	22%

Distribution of UTIs among pregnant women according to occupation

The bacterial infection investigation of pregnant women showed that housewives had the highest rate of infection (n= 28) (27.7%), whereas just 16 (16.2%) of employed women in the study had urinary tract infections. The total infection percentage showed (63.6%) of the women were housewives and (n=16) (36.4%) were employed, table (4).

Table 4. Distribution of UTIs among pregnant women according to occupation

*p-value =0.048

Occupation	Number of sample	Number	Total Prevalence
Housewife	101	28 (27.7%)	63.6%
Employee	99	16 (16.2%)	36.4%
Total	200	44	22%

Sensitivity of the isolated pathogen to the antibiotics

In the current study, antibiotic sensitivity tests were carried out for the recovered bacteria isolated from UTI cases. The outcome of the sensitivity tests were shown in table (5). The study revealed that ciprofloxacin, nitrofurantoin and levofloxacin were sensitive frequency (95.5%, 77.2% and 63.6%) respectively, and are the most useful antibiotics for the treatment of UTIs followed by trimethoprim-sulfamethoxazole, amikacin and nalidixic acid and were able to inhibit the most commonly isolated UTI pathogens sensitive frequency (61.4%, 52.2% and 47.7% respectively).
On the other hand, amoxicillin, azithromycin and erythromycin, commonly used antibiotics, were poorly effective against the majority of pathogens isolated in the current study with a resistance rate of 40.9%, 18.1% and 15.9% respectively.

Table 5. Sensitivity of the isolated pathogen to the antibiotics *p-value =0.045

Isolated bacteria	No of isolates	Antimicrobial Agent								
		CIP	E	LEV	AN	SXT	AK	F	AZM	AMC
E. coli	25	100%	0%	76%	68%	76%	64%	60%	16%	36%
S. aureus	11	91%	64%	91%	18%	36%	18%	72.7%	9%	36%
Klebsiella	3	100%	0|	66.6%	33%	67%	100%	33%	0	33%
Enterococcus	4	75%	0	75%	25%	25%	50%	75%	50%	75%
S. saprophyticus	1	100%	0	0	0	100%	0	100%	100%	100%

4. DISCUSSION

Two hundred urine samples were collected and analyzed during the study period. The study indicated that the incidence of urinary tract infection was 22% among the population of the study (n=44 pregnant women) who were followed up in the antenatal care clinic. This high percentage was found to be consistent with earlier research in underdeveloped nations 8 %and 7.7%, respectively. [12] It was 30% in a study in Yemen [13], 28.5% in a Pakistani study [14], and between 22-28.8% in several studies in Egypt[15].This high incidence highlights the size of the problem which necessitates rapid intervention especially as UTIs are incriminated in various adverse outcomes of pregnancy. The prevalence of infection in relation to age is also shown in table 1; individuals of the age group 25-35 years had the highest incidence of infection with 25 patients (56.8%). Followed by the under 25 age group with 11(25%), while the lowest frequency of infection was in the over 35 years age group with 8 (18.2%). In addition, most of the pregnant women were between 25 to 35 years. This was to be expected because it is a suitable and ideal age for childbearing. This result correlates with previous findings[16]. However, the aforementioned age groups having the highest incidence of infection were also observed in previous studies[17,18]. This could be because many

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women in this age bracket are likely to have had several children prior to the current pregnancy and it has been reported that multiparty is a risk factor for acquiring bacteriuria in pregnancy. Sexual activity and certain contraceptive methods are also said to increase the risk and women are mostly sexually active at this age[19].

There was a higher rate of infection in the second trimester (52.3%) compared to the third trimester (29.5 %) and the first trimester (18.2%). The results of the current study do not agree with a previous study[17]. However, it does agree with another study, which reported a higher prevalence of urinary tract infections in the second trimester compared to the third trimester [20]. A scientific explanation of the increased risk of UTIs in the second trimester of pregnancy is because the risk of acquiring bacteriuria during pregnancy was highest between weeks 9 and 17 and that week 16 was the best time for screening so treatment at that time would provide the highest number of bacteriuria-free gestational weeks. In this study, more than half (63.6%) of the women were housewives. This is expected because during working hours women do not find the chance to visit the antenatal clinic. This result is congruent with the results of study done by Lamadah and Elsaba[21]. Additionally, more than a quarter (36.4%) of the positive culture patients were employed. Working women may not have the opportunity to drink enough water or urinate regularly during working hours.

According to these findings, the pathogens of 156 samples had no growth. 44 samples were positive for urinary pathogens. Among the significant isolates, *E. coli* had the highest percentage of isolation (56.8%), followed *by S. aureus* (25%) while the lowest was *S. saprophytic* (2.3%). These results may be attributed to rising urine pH in pregnancy to a range suitable for the growth of *E. coli*. Glycosuria gets advanced due to diminished reabsorption by the collecting loop and tubule of Henle. About 5% of the filtered glucose leaks proximal complicated tubular reabsorption [22]. These results are supported by findings of other studies results which found that *S. aureus* was the second most prevalent organism following *E. coli* [2,23,24.25] .*E. coli* has been well documented as the most common traditional causative agent of UTIs in different studies results[26,27,28,29,30]. Meanwhile, *S. aureus* infection was more prevalent among asymptomatic pregnant women in another study [3]. The antibiotic sensitivity studies conducted on the isolated UTI causative bacterial agent during the current study revealed that ciprofloxacin, nitrofurantoin and levofloxacin sensitive frequency (95.5%, 77.2% and 63.6% respectively) are the most useful antibiotics for the treatment of UTI followed by trimethoprim-sulfamethoxazol, amikacin and nalidixic acid sensitive frequency (61.4%, 52.2% and 47.7% respectively). On the other hand, amoxicillin, azithromycin and erythromycin were poorly effective against the majority of the organisms isolated in this study with a resistance rate of 40.9%, 18.1% and 15.9% respectively. This differs from the studies and findings in studies related to Caucasian women where ampicillin remain the most useful antimicrobial agent [31] and the findings of another study [32]of patients in the Military Hospital, Jos, Nigeria where the isolates were highly susceptible to nitrofurantoin. The efficacy of ciprofloxacin and levofloxacin as reported in the current study could be attributed to the fact that these drugs are relatively expensive when compared to most antibiotics frequently used. This likely limited their availability and indiscriminate usage, rendering the organisms vulnerable to them. This is similar to other reports where expensive antibiotics as quinolones are the most effective choice[32,33,34]. On the other hand, the high resistance to other drugs may be due to the practices of self-medication and the indiscriminate use of these antibiotics with the subsequent resistance acquirement.

5. CONCLUSIONS

A urinary tract infection is one of the biggest problems caused by bacterial agents in a pregnant woman and can lead to major complications for both the fetus and the mother. This makes early detection and quick prevention of problems a necessity. The study aimed to isolate and identify UTIs among pregnant women at the Benghazi Medical Center. A cross-sectional descriptive design was conducted on 200 pregnant women attending the Obstetrics and Gynecology Clinic of the Benghazi Medical Center with inclusion criteria from the beginning of June 2018 to the end of October 2018. A structured interview questionnaire and laboratory test registry were used to collect data using a purposeful sample. In this study, 22% of the women studied had positive bacteria in their urine culture. *Escherichia coli* (56.8%) had the highest percentage of isolated bacteria, followed by *Staphylococcus aureus* (25%). Frequency of urination, followed by dysuria, lower abdominal pain, urine discolouration, a painful burning sensation, and incomplete bladder evacuation were the most common maternal signs. The predisposing factors associated with UTIs during pregnancy were age, occupation, and portion of current pregnancy. The sensitivity of bacterial isolates was high when using ciprofloxacin and levofloxacin, and they were more resistant to erythromycin azithromycin.

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