Study of bacteriuria in pregnant women and determination of their antibiotic susceptibility patterns

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Abstract

Aim: Urinary Tract Infection (UTI) is one of the most frequently encountered problems owing to significant number of patients needing hospitalization during pregnancy. In pregnant women the incidence of UTI can be as high as 8%. The aims of this study were isolation of pathogenic bacteria from urine culture of pregnant women and determination of their antibiotic sensitivity patterns.

Methods: In this study, midstream urine samples from 139 pregnant women with gestation age ranging between 6 to 38 weeks referred to Obstetrics and Gynecology clinic of Sina hospital, Ahvaz, Iran, were collected. The samples were cultured on Macconkey and Blood agar by calibrated loop method and after overnight incubation at 37°C, standard colony count were performed, which the colony count of 100,000 CFU/ml or more were considered as serious bacteriuria. The isolates were simultaneously identified using conventional biochemical tests. The antibiotic susceptibility pattern was determined as recommendation of CLSI.

Results: From 139 urine samples, 29(20.9%) were culture positive and colony count of more than 100,000 CFU/ml. Among them 23 (79.3%) were gram negative and 6 (20.7%) were gram positive bacteria. The most predominant isolate was Escherichia coli 19 (65.5%), followed by Staphylococcus aureus 4 (13.8%), and the lowest rate was belong to Enterobacter with one case (3.4%). Based on the results of microscopic urine examination, 7 (24.1%) of samples revealed the presence of pus cells, and leukocyturia were observed in 11 cases (37.9%). The highest antibiotics sensitivity among gram negative isolates were seen against ceftazidime, ceftriaxone and cefotaxime, while they showed high resistance to amoxicillin and amoxicillin-clavulonic acid.

Conclusion: Based on overall results, the rate of bacteriuria in examined pregnant women were 20.9% with the common causes of E.coli and Staphylococcus aureus. The most effective antibiotics for most bacterial isolates were cefotaxime, ceftazidime, ciprofloxacin and nitrofurantoin respectively. So it is recommended that routine microbiological analysis and antibiotic sensitivity test of urine samples of pregnant women be carried out before the administration of the drugs for the treatment and management of UTIs to avoid antibiotics resistance.

Key words: Bacteriuria, pregnant women, colony count, antibiotic susceptibility, E. coli.

Introduction

Urinary Tract Infection (UTI) is caused by the presence and growth of microorganisms anywhere in the urinary tract. It is perhaps the single most common bacterial infection of mankind and is an extremely common clinical problem [1].

The urine that stays in the bladder is more likely to allow growth of bacteria and cause infections [2-3]. The importance of UTI is that because it may involve the urethra, bladder, uterus, and kidney [1,2]. The infection affects all age groups, but women are more susceptible than men, because bacteria can reach the bladder more easily in women. This is partially due to the short and wider female urethra and its proximity to anus. Bacteria from the rectum can easily travel up the urethra and cause infections [4, 5]. Approximately
10-15% of women will have a UTI at some time during their life. It is the most common bacterial infections during pregnancy and is one of the most frequently encountered problems owing to significant number of patients needing hospitalization during pregnancy, beginning in week 6 and peaking during weeks 22 to 24. Approximately 90% of pregnant women develop urethral dilatation, which will remain until delivery (hydronephrosis of pregnancy). [8]. In pregnant women the incidence of UTI can be as high as 8% [6].

Additionally, the physiological increase in plasma volume during pregnancy decreases urine concentration and up to 70% pregnant women develop glucosuria, which encourages bacterial growth in the urine [7]. UTIs can be asymptomatic, particularly in pregnancy and in the elderly [1, 7]. Women with asymptomatic bacteriuria during pregnancy, are more likely to deliver premature or low-birth-weight infants and have a 20- to 30-fold increased risk of developing pyelonephritis during pregnancy compared with women without bacteriuria. The presence of a significant quantity of bacteria in a properly collected urine specimen from a person without symptoms or signs of UTI characterizes as asymptomatic bacteriuria [8].

Several anatomical and hormonal changes in pregnant women lead to ureteral dilatation and urinary stasis, which contribute to the increased risk of developing UTI [9]. Untreated UTIs can lead to complications, such as pyelonephritis, low-birth-weight infants, premature delivery, and occasionally, still birth [10]. Therefore, prompt treatment of symptomatic UTI and asymptomatic bacteriuria is required in pregnant women. The importance of coliform bacilli in UTI among pregnant women has long been known in developed countries, and roughly in 80-90% of cases, the most common isolated pathogen is Escherichia coli [3, 11-14]. Other responsible microorganisms include other Enterobacteria (Klebsiella, Enterobacter, Proteus), Staphylococcus epidermidis or Staphylococcus saprophyticus, Enterococcus faecalis and group B Streptococcus [10].

The prevalent pathogens of UTIs have been found to be resistant to most chemotherapeutic agents [15, 16]. Antibacterial agents are among the most commonly used medications during pregnancy because treatment of infections is critical to both maternal and fetal well-being [17]. Since screening for and treating asymptomatic bacteriuria is recommended during pregnancy to prevent pyelonephritis and increased maternal and fetal morbidity [18], in present study the prevalence of bacteriuria is investigated in pregnant women.

**Methods**

This study was performed on 138 pregnant women with gestation age ranging between 6 to 38 weeks referred to Obstetrics and Gynecology clinic of Sina hospital, Ahvaz, south western Iran from 2009 to 2010. Guidelines for proper specimen collection were given to all patients on a printed card [19]. Clean-Catch midstream urine samples were collected in sterile disposable universal bottles (4-5ml) and immediately transferred to the microbiology laboratory for examination or refrigerated at 4°C when the immediate examination was not possible not more than 6 hours after collection. A measured amount of urine, using calibrated loop method was inoculated to nutrient agar medium (Merck, Germany) for colony count. Equal or more than 104 CFU/ml of a single potential pathogen or for each of two potential pathogens interpreted as positive UTI and a result of 102-104 CFU/ml was repeated. A less than 102 CFU/ml was interpreted as negative UTI [20].

The urine specimens were cultured on blood and MacConky agar media (Hi-media, Mumbai, India & Merck, Germany) simultaneously for isolation of causative pathogenic organism and incubated at 37°C for 18-24 hours. All the bacteria isolated from urine were identified using conventional biochemical tests [19]. The urine samples was centrifuged for urinalysis test as well. The smear preparation from the precipitate was examined under the microscope for the presence of yeast cells, parasites, leucocytes, erythrocytes, pus cells and granular casts. For those positive cultures showing the UTI as per colony count results, the antibiotic susceptibility testing of disc diffusion method was performed according to CLSI instructions [21], using common in-use antibiotics for such infections.

**Results**

From 139 urine samples, 29 (20.9%) were culture positive for UTI with colony count of more than 104 CFU/ml.
than 100,000 CFU/ml, of which 23 (79.3%) were gram negative and 6 (20.7%) were gram positive bacteria. The most predominant bacterium was Escherichia coli 19 (65.5%), followed by Staphylococcus aureus 4 (13.8%), Klebsiella aerogenes 3 (10.3%), Staphylococcus epidermidis 2 (6.9%) and the least common was Enterobacter spp. with 1 case (3.4%) [Table 1]. The patients were divided into 6 age groups, that the highest frequency of isolated bacteria and confirmed UTI were seen in pregnant women in age group of 21-25 [Figure 1]. Microscopic urine examination was performed for all samples. Seven samples (24.1%) revealed the presence of pus cells, and leukocyturia was observed in 11 samples (37.9%). The burning during urination was the most common complaint in 12 patients (41.3%). Other symptoms were as lower abdominal pain in 9 cases (31%), Urine retention 8 (27.6%), flank pain 5 (17.2%), and hematuria 10 (34.5%) [Figure 2]. Asymptomatic infections were discovered in 7 patients (24.1%). Among total 29 positive cases, 18 samples were taken from hospitalized pregnant women and 11 samples from outpatients. The highest rate of UTI was seen in those patients with gestational age of 10 -19 weeks (37.93%) and more than 30 weeks (31%) [Table 2]. According to results from antibiotics susceptibility testing, the highest resistance

![Figure 1. Incidence of UTI in relation to age distributions of pregnant women](image1)

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![Figure 2. The distribution of clinical symptoms among pregnant women with symptomatic UTI](image2)

Figure 2. The distribution of clinical symptoms among pregnant women with symptomatic UTI

![Figure 3. Antibiotic resistance pattern among isolated bacteria from UTIs of pregnant women](image3)

Figure 3. Antibiotic resistance pattern among isolated bacteria from UTIs of pregnant women

<table>
<thead>
<tr>
<th>Isolated bacteria</th>
<th>No. (%)</th>
<th>Hospitalized ≤10</th>
<th>Hospitalized 50000-100000</th>
<th>Outpatients ≤10</th>
<th>Outpatients 50000-100000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escherichia coli</td>
<td>19 (65.6%)</td>
<td>13</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Klebsiella</td>
<td>3 (10.3%)</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Enterobacter spp.</td>
<td>1 (3.4%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>4 (13.8%)</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Staphylococcus epidermidis</td>
<td>2 (6.9%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>29 (100)</td>
<td>15</td>
<td>3</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 1. The frequency of isolated bacteria from UTI of hospitalized and outpatient pregnant women

<table>
<thead>
<tr>
<th>Positive culture No. (%)</th>
<th>Patients No (%)</th>
<th>Gestation age</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 (20.68)</td>
<td>18 (12.94)</td>
<td>Less than 10 weeks</td>
</tr>
<tr>
<td>11 (37.93)</td>
<td>34 (24.46)</td>
<td>10-19 weeks</td>
</tr>
<tr>
<td>3 (10.34)</td>
<td>52 (37.41)</td>
<td>20-29 weeks</td>
</tr>
<tr>
<td>9 (31)</td>
<td>35 (25.18)</td>
<td>More than 30 weeks</td>
</tr>
<tr>
<td>29</td>
<td>139</td>
<td>Total</td>
</tr>
</tbody>
</table>

Table 2. The frequency of UTI in relation to gestational age grouping in present study
were seen against amoxicillin and amoxicillin-clavulanic acid, while the isolates showed the lowest resistance to ceftazidime, ceftriaxone and cefotaxime [Figure 3].

Discussion

UTIs are one of the most common bacterial infections during pregnancy which are associated with risks to both the fetus and the mother, including pyelonephritis, preterm birth, low birth weight, and increased perinatal mortality [16]. Remarkable changes occur in the structure and function of the urinary tract during pregnancy that totally results in urinary stasis the condition that along with the presence of vesico-ureteral reflux predispose some women to upper UTIs and acute pyelonephritis. Also hormonal change of progesteron and estrogen may lead to a decreased ability of the lower urinary tract to resist invading bacteria. Moreover, up to 70% of pregnant women develop glycosuria, which encourages bacterial growth in the urine [2].

In this study the prevalence of UTI among tested pregnant women was 20.9%. This finding was in agreement to the study of Ah-Haddad who reported a prevalence of 30% in a similar work [22]. However our UTI rate was lower than the incidence of 58% reported by Onifade et al. [23], 47.5% reported by Okonko et al. [15] and 45% reported by Subedi et al. [24]. The differences between the incidence rate of UTI in these studies could be due to differences in the environment, social habits of the community, the standard of personal hygiene and differences in education as stated elsewhere[22]. In our study E. coli (65.5%) and S. aureus (13.8%) were the most common bacteria isolated from the tested samples. This was in agreement with similar studies isolated E. coli and S. aureus from UTI in pregnant women as the most prevalent bacteria [15, 22], and studies reported E. coli as the most common organism in UTI [24-26]. Asymptomatic bacteriuria was noticed in 24.9% of pregnant women in this study. The rate of asymptomatic UTI reported vary in different similar studies. Hamdan et al. [27] and Obirikorang et al. [28], reported rates of 14.7% and 9.5% bacteriuria among the tested pregnant women respectively. The lower incidence of UTI was reported in the study of Jazayeri Moghadas and Irajian as 3.3% [25]. This rate is belonged to the cases of asymptomatic UTI that are normally underestimated in the certain populations of community due to lack of a regular screening program.

Based on the results from antibiotics susceptibility testing, the resistance of the isolates to used antibiotics were high in this study. The American College of Obstetricians and Gynecology stated that antibiotic resistance in uropathogens is increasing worldwide. It varies according to geographic locates and is directly proportional to the use and misuse of antibiotics. Understanding the impact of drug resistance is of the critical importance as the changing rate of antibiotic resistance has a large influence on the empirical therapy of UTIs [29].

In present study E. coli as the most prevalent isolate, showed the high sensitivity to ceftazidime which was in agreement with other works presented the similar findings[22, 25]. The isolated gram negative bacteria in this study showed the high to moderate sensitivities to nitrofurantoin (70%) and nalidixic acid (54.2%). This rate of sensitivity was lower compared to what previously reported by Okonko et al. [15]. In their study E. coli as the most common isolate, showed full sensitivity to nitrofurantoin and 75% sensitivity to nalidixic acid [15]. In conclusion, the findings of this study revealed that the prevalence of bacteriuria was 20.9% among tested pregnant women with important infecting organisms were found to be E. coli and S. aureus. This study has highlighted the need to raise awareness of UTIs and to expand services for prevention and treatment for pregnant women. We found 24.1% asymptomatic bacteriuria among our tested patients, so it is therefore recommended that routine microbiological analysis and antibiotic sensitivity test of mid stream urine samples of pregnant women be carried out before the administration of the drugs for the treatment and management of UTIs since resistance to these drugs are developing in the community.

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References


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