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Prevalence of Urinary Tract Infections Caused by Some Gram-Negative Bacteria Among Pregnant Women in Kirkuk Province – Iraq

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ABSTRACT

The increased risk of urinary tract infection (UTI) among pregnant women, coupled with the increase in the incidence of type various uropathogens worldwide in recent years, may impose a substantial burden on medical costs. This study was designed to evaluate the prevalence of UTIs caused by some gram-negative bacteria among pregnant women in Kirkuk province. 217 women (aged between 16-65 years old-117 pregnant and 100 non-pregnant women) with urinary tract infections were subjected to this study. Their ages were ranged between ages 16 & 65 years. A sufficient amount of (10-20 ml) of Mid-stream, clean catch specimens were collected in a sterilized container for urine culture and Bacterial Susceptibility Test to Antimicrobial Agents. The results revealed a significant (p,0.05) incidence of UTI in pregnant than in non-pregnant women and the highest percentage of patients was within the age group 36-45 years old. Regarding isolated gram-negative bacteria among pregnant women, there were E. coli which constituted 40.8% followed by K. pneumonia which constituted 26.7%. Most of the gram-negative bacteria showed high sensitivity to ceftazidime, amoxiclav, cefotaxime, and nitrofurantoin. It is concluded that the high prevalence of UTI among pregnant women and urine culture are very necessary for diagnosis along with antibiotic sensitivity tests.

Keywords

UTI, Pregnant women, Antibiotic sensitivity, Gram-negative bacteria.

Introduction

Urinary tract infection (UTI), in pregnancy, is one of the major risk factors for morbidity and pregnancy complications [1]. This may be due to the physiological and physical changes which lead to an increase in the risk for the onset, for example; glycosuria and alkaline urine pH; kidney enlargement, and an increase in glomerular filtration rate [2,3].

The most common organism causing UTIs in the community include Escherichia coli derived from the gastrointestinal tract, in addition to *Proteus, Pseudomonas species, Streptococcus*, and *Staphylococcus*. Other pathogens might be also causing UTIs.

In fact, *E. coli* accounts for more than 90% of acute infections in patients with normal urinary tracts, the factors responsible for this extraordinary monopoly are incompletely understood, but the relative resistance of *E. coli* to the inhibitory effects of vaginal fluids, its possession of pili that aid its attachment to the epithelial cells of the urinary tract, its motility appears to contribute to its effectiveness as a uropathogen [4].

Hospitalized patients are particularly susceptible to cross-infection with nosocomial strains of *Proteus, Pseudomonas, Klebsiella, Enterobacter, Serratia, coagulase-negative staphylococci*, and *Enterococci* many of which are passed directly from catheterized patient to another on hands of medical personnel [4-5]. UTIs are one of the most common complications among women, especially during pregnancy [6]. which is mostly due to physiological and anatomical changes in the urinary tract.

Bacterial contamination in the area that surrounds the rectum is the most important pathway for UTI infection through the urethra and migrating to the bladder [7].

The increased risk of UTI among pregnant women, coupled with the increase in the incidence of type various uropathogens worldwide in recent years, may impose a substantial burden on medical costs. In addition, the increased rates of antibiotic prescription, for UTIs in women may further lead to the development of antibiotic-resistant urinary pathogens.

The present study aimed to evaluate the prevalence of UTIs caused by some gram-negative bacteria among pregnant women in Kirkuk province -Iraq.

Materials and Methods

Subjects

Two hundred and seventeen women (117 pregnant and 100 non-pregnant women) with urinary tract infections were subjected to this study. Their ages were ranged between ages 16 & 65 years. They were from different geographical areas in Kirkuk city. They were seen in Kirkuk General Hospital and primary health care centers in Kirkuk within a period From November 2019 to April 2020. Throughout the duration of the study, all women in the study areas were under routine monthly community-based pregnancy inspection.

Collection of Urine

A sufficient amount of (10-20 ml) of Mid-stream, clean catch specimens were collected in a sterilized container. All the antibiotics were discontinued 72 hours before sending the urine for culture and sensitivity. The urine specimen was delivered to the laboratory and immediately placed in a refrigerator at 4°C and analyzed within 6 hours of the collection. The urine samples were cultured in blood agar and MacConkey agar for 24 hours.

Microscopic Examination of Urine

Microscopic examination of the urine was done as the first step in the laboratory diagnosis of urinary tract infection. Detection of pyuria was more readily determined by finding >10kocytes of centrifuged urine. Gram staining: gram stain of one drop of unspun freshly voided urine was done. Any bacteria under the oil immersion field (at least 20 oil immersion fields ought to be examined before saying negative) suggested the presence of more than 105 bacteria/ml of urine.

Culture of Urine Specimens

Media were prepared and sterilized according to the manufacturer's instructions. The prepared media used for isolation, determination of the viable count, identification, and susceptibility testing was carried out after being solidified. Semiquantitative urine culture by using calibrated platinum loop was employed. Quantitative bacterial culture of a urine specimen is done by inoculating appropriate media with a measured amount of urine, most commonly with a plastic or wire calibrated loop designed to deliver a known volume. The inoculated plates were incubated at 37°C. Colonies were counted in each plate and these represented the number of microorganisms /ml in the original specimen.

Bacterial Susceptibility Test to Antimicrobial Agents

Disk diffusion tests were employed in the present study. Maximum 7 antibiotic discs were selected and placed onto each plate using flamed forceps for application of the discs on the plate and each disc was pressed down gently to ensure even contact with the medium. After overnight incubation at 37°C, the diameter of each zone including the diameter of zone inhibition was measured and recorded in mm and compared with the standard inhibition zone.

Statistical analysis

The prevalence of UTI was estimated based on the proportion of pregnant women with a UTI diagnosis report in their medical records and on the result of the urine culture test.

Statistical analysis was performed using the Excel version 2013. A comparison was carried out using; Chi-square (X^2), and probability (P-value). The P-value $\geq$ 0.05 was considered statistically significant.

Results

In the present study, 217urine specimens from married women were tested for detection of UTI, out of 117 specimens from pregnant women 71(61%) were positive for gram-negative species, while out of 100 specimens from non-pregnant women (control) included in the present study, only 41 (31%) were positive for bacterial culture as shown in figure 1.

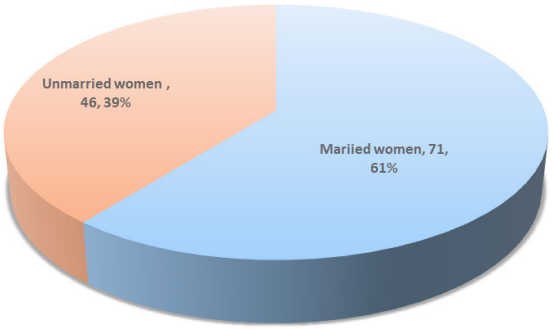

Figure 1: Results of urine culture among study groups.

In the present study, the ages of the patients ranged between 16 and 65 years old. Among the pregnant women, the highest percentage of patients was within the age group 36-45 years old, which constituted 69.23%.

According to the distribution of the isolated bacteria among the study groups, as shown in Table 1, the commonly isolated gram-

negative bacteria among pregnant women was *E. coli* which constituted 40.8% followed by *K. pneumonia* which constituted 26.7%. Both microorganisms showed significant prevalence ($p<0.05$) among pregnant women when compared with non-pregnant women. *Proteus mirabilis,* and *P. vulgaris* constituted 19.8% and the lowest percentage was *Pseudomonas aeruginosa* for 11.3%.

Table 1: Distribution of isolated bacteria among study groups.

	Pregnant women		Non-pregnant women	
	Number	Percentage	Number	Percentage
Escherichia coli	29	40.8 *	14	30.4
Klebsiella pneumoniae	19	26.7 *	8	17.4
Proteus mirabilis	9	12.7	9	19.6
Proteus vulgaris	6	8.5	8	17.4
Pseudomonas aeruginosa	8	11.3	7	15.2
Total	71	100	46	100

*Means significant $p > 0.05$

Regarding the distribution of Antibiotics Sensitivity of Gram-Negative Bacteria Isolated From Married Women with UTI. *Escherichia coli* showed a high rate of sensitivity (93.02%) to ceftazidime and it was 100% resistant to oxacillin and lincomycin. *Klebsiella pneumonia* showed a high rate of sensitivity (81.48 %) to amoxiclav and it was resistant to ampicillin, tetracycline, erythromycin, oxacillin, and lincomycin (100%) *Proteus mirabilis* showed a high sensitivity rate to cefotaxime (94.44%) and it was resistant to erythromycin, ampicillin, oxacillin, and lincomycin (100%). *Proteus vulgaris* showed a high sensitivity rate to nirtrofurontoin, cefotaxim (92.85%), and a low rate of sensitivity to erythromycin. Finally, *Pseudomonas aeroginosae* showed a high sensitivity rate to cefotaxim (86.66%) and a low rate of sensitivity (20%) to ampicillin.

Discussion

UTI infection, in pregnancy, is one of the major risk factors for morbidity and pregnancy complications [1]. This may be due to the physiological and physical changes which lead to an increase in the risk for the onset, for example; glycosuria and alkaline urine pH; kidney enlargement, and an increase in glomerular filtration rate [2,8]. An additional cause is the anatomical differences in female's short urethra and easily contaminated since its very close proximity to the vulvuler and perineal region. Furthermore, perineal flora and gastrointestinal consider the most recurrent microorganisms related to UTIs [9].

The increased risk of UTI among pregnant women, coupled with the increase in the incidence of type various uropathogens worldwide in recent years, may impose a substantial burden on medical costs [10]. In addition, the increased rates of antibiotic prescription, for UTIs in women may further lead to the development of antibiotic-resistant urinary pathogens [11], urinary tract infections are diagnosed depending on clinical manifestations including asymptomatic bacteriuria and acute pyelonephritis [12].

Urine culture is being typical method among several methods available to diagnose UTI. UTI is a bacterial invasion, colonization, and proliferation of the urinary tract; they may migrate from the urinary bladder to the kidney and affect the parenchyma. Diagnosis of this infection depends on the urine culture results with specific parameters for each type of UTI and clinical manifestations [13].

During the pregnancy period, UTI is one of the bleeding causes of miscarriage, premature births. These and other complications of UTI can be reduced by early treatment of infection [14].

The definition of specific antibiotics for treatment is one of the most important guides to reduce complications. In this study, *Escherichia coli* showed a high rate of sensitivity (93.02%) to ceftazidime and it was 100% resistant to oxacillin and lincomycin. *Klebsiella pneumonia* showed a high rate of sensitivity (81.48 %) to amoxiclav These findings agree with the conclusion of many researchers [15].

In a study finding that *Klebsiella spp*, *Proteus mirabilis*, and *E. coli* cause 95% of the cases, 7 Resistance of these microorganisms to antibiotics varies depending on the population included in and the kind of antibiotic used for treatment, with ampicillin resistance occurring in 97% of *E. coli* infections and in up to 100% of *Klebsiella spp* and *Proteus spp* infections. These results are nearly compatible with the results of some studies [16,17].

Regarding the age of patients with UTI infections, we noticed that the highest percentage of patients was within the age group 36-45 years old, which constituted 69.23% followed by the age group 26-35 years. These findings may confirm the fact that the incidence of UTI among pregnant women dropped by 6% each year which is consistent with López-Martínez et al. [18], who recorded a significant correlation between UTI and the age of the patient.

The present study in clarifying a significant relationship between pregnancy and the incidence of UTIs among women. This study is supported by other studies, which showed that a higher percentage of UTIs 43% was found among pregnant women [19].

In addition to abuse of prophylactic antibiotics, without taking suitable treatment, or incomplete treatment, result in recurrent infection [4]. The most common organism causing UTIs in the community include *Escherichia coli* derived from the gastrointestinal tract, in addition to *Proteus*, *Pseudomonas species*, *Streptococcus*, and *Staphylococcus*.

Gram-negative organisms, *E. coli,* and *Klebsiella species* were common etiologies of UTI in Sylhet, accounting for half (38 and 12%, respectively) of cases of significant bacteriuria. In this study, *E. coli* comprised 40.8% of isolates, and Klebsiella species 26.7% the remainder bacteria ranged from 8 to 12.7% of isolates. Also agrees with Gessese et al., [20] and Almuhtar [20]. Findings of a study conducted on an Ethiopian population with characteristics similar to findings of 56 positive urine cultures, *E. coli* was the most causative agent of UTI among pregnant women (46.4%).

Both species showed a significant ($p<0.05$) prevalence in pregnant women than in non-pregnant. Several findings have been consistent with our findings, such as findings of an effort done on 1,000 pregnant women which revealed that the gram-negative bacteria had an effect on the incidence of UTIs, and recorded the third abundant in the total of bacteria [21].

Conclusion

From our results, we concluded a high prevalence of UTI among pregnant women, and urine culture is a defined method for diagnosis along with clinical manifestation. The definition of specific antibiotics for treatment is one of the most important guides to reduce complications.

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