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Frequency Rate of Urinary Tract Infections among Pregnant and Non-pregnant Women attending Omdurman Military Teaching Hospital

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Abstract

Background: Urinary tract infections (UTIs) involve the urinary tract and are common in pregnancy and caused by microorganisms invading the urinary tract, e.g. bacteria, fungi, viruses and parasites. Bacteria are usually the most common cause of UTIs, and they are naturally present on the skin, in the lower bowel.
Objective: To determine the frequency rate of urinary tract infections among pregnant and non-pregnant women attending Omdurman Military Teaching Hospital
Materials and methods: Urine samples were collected from pregnant and non-pregnant women aged 26 to 40 years. Isolation, identification, and sensitivity tests were performed as per standard, conventional methods.
Results: A total of 120 urine specimens were investigated. Significant bacterial growth was detected in 16 specimens (13.3 %). From these, one specimen (1.7%) was collected from a non-pregnant woman and 15 specimens (25%) were collected from pregnant women. The highest frequency rate of infection (15%) was found in the age group 26-30 years. The commonest organisms isolated were *Escherichia coli* (9 / 7.5 %), *Staph. aureus* (3 / 2.5%), *Klebsiella pneumoniae* (3 / 2.5 %), and *Proteus mirabilis* (1 / 0.8%). Bacterial pathogens isolated were found to be highly sensitive (93.75%) to amikacin.
Conclusion: *Escherichia coli* was the most frequently isolated pathogen in pregnancy. Amikacin was the drug of choice for treatment of UTIs among pregnant and non-pregnant women.

Key words: Urinary tract infections, Pregnant women, *Escherichia coli*, Amikacin.

Introduction

Urinary tract infection, or UTI, is an infection that can be caused anywhere along the urinary tract. The infection most often occurs in the urethra and bladder. It can also travel from the bladder to the ureter and kidneys. A person's urine does not normally contain any bacteria. When bacteria from one of these sources enter the urinary tract system, they multiply and

cause infection. Urinary tract infections (UTIs), which are caused by the presence and growth of microorganisms in the urinary tract, are perhaps the single commonest bacterial infections of mankind[1].

UTIs in pregnancy may involve the lower urinary tract or the bladder. UTI has been reported among 20% of the pregnant women and it is the commonest cause of admission[2].

Anatomically UTI can be classified into lower urinary tract infection involving the bladder and urethra and upper urinary tract infection involving the kidney, pelvis, and ureter. The majority of the UTI occur due to ascending infection[3].

There are three common clinical manifestations of UTIs in pregnancy:

1. Asymptomatic bacteriuria, acute cystitis and acute pyelonephritis[4]
2. UTI which is the presence of at least 100,000 organisms per milliliter of urine in an asymptomatic patient, or as more than 100 organisms/mL of urine with accompanying pyuria (>5 WBCs/mL) in a symptomatic patient. Particularly in asymptomatic patients, a diagnosis of UTI should be supported by a positive culture for a uropathogen[5].
3. Untreated asymptomatic bacteriuria is a risk factor that may cause acute cystitis (40%) and pyelonephritis (25-30%) in pregnancy. These cases account for 70% of all cases of symptomatic UTI among unscreened pregnant women[6].

Symptomatic and asymptomatic bacteriuria has been reported among17.9% and 13.0% pregnant women, respectively[7].

E coli is the most common cause of urinary tract infection (UTI). It originates from fecal flora colonizing the periurethral area, causing an ascending infection. Other pathogens include: *Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa, and Candida albicans*[8].

Urinary tract infections may cause considerable morbidity in pregnant women. These infections may precipitate chronic complications, and problems of the urinary system may be increased by aging, illness, or injury. In the elderly changes in the kidney structure may make them lose some of their ability to remove wastes from the blood[9].

Also, the muscles of the ureter, bladder, and urethra may tend to lose some of their strength. Frequent urinary tract infections may make the bladder muscles fail to contract properly to empty the bladder completely. A decrease in strength of muscles of the sphincters and the pelvis can also cause incontinence of urine. Illness or injury can also prevent the kidneys from filtering the blood completely or block the passage of urine[3].

Good medical management may eliminate UTIs and prevent kidney damage. The usual approach in pregnancy is to combat the infection. This study focused on why pregnant women have UTIs and what can be done to protect them.

Materials and methods

This was a qualitative, descriptive, cross sectional, analytical study. It was carried out at Karary University, and Omdurman Military Teaching Hospital (Sudan). Population investigated was pregnant and non-pregnant women attending Omdurman Military Teaching Hospital. The study was conducted during the period from April to June 2014. Approval to conduct the study was taken from Karary University. Permission to collect the specimens was granted by the Administration of Omdurman Military Teaching Hospital. Verbal consent was obtained from

all patients enrolled in the study. The software used for analysis of data was the Statistical Package for Social Sciences (SPSS) program.
Sampling selected was a non-probability, convenience type. Sample size was 120 urine specimens: 60 were collected from pregnant women and 60 from non-pregnant women.
A structured questionnaire was used to collect socio-demographic data, i.e. age, education, occupation, residence, income, and housing conditions. Information of past and present obstetric history, parity, number of children, past history of urinary tract infections, antibiotic history and clinical picture was recorded.
After proper positioning of thighs, each patient was instructed to spread the labia with one hand and cleanse the area with soaped swabs with the other hand, then pass out a small amount of urine, and finally urinate into sterile, wide mouthed container. Patients were requested to submit about 10-20 ml, clean catch, and mid-stream urine specimens. Each specimen was properly labelled with patient's name, laboratory serial number, date, etc. The specimens were then transferred to the laboratory as quickly as possible. Urine specimens were processed in the laboratory within 2 hours of collection. If there was any delay urine specimen was preserved refrigerated. The appearance and color of urine was recorded. 5 ml of urine samples were mixed and poured into a clean, dry 15 ml centrifuge tube and centrifuged at 3000 rpm for 5 minutes. The supernatant fluid was discarded and one drop of sediment was transferred to a clean labelled glass slide, covered with a clean cover slip and then examined under a light microscope using 10X and 40X magnifications, looking for pus cells per HPF (29).
Standard laboratory techniques were employed for isolation of the pathogenic organisms. Cysteine, lactose, electrolyte-deficient (CLED) medium was used for isolation. A sterile loop (internal diameter 3.26 mm, holding 0.004 ml of urine) was used to inoculate urine specimens onto plate culture media. The plates were incubated at 37ºC for 18-24 hours. Then plates were examined for the presence of significant growth. The colonies were examined morphologically for size, consistency, convexity, and ability to ferment lactose. Smears of isolates were prepared on clean dry slides and stained by Gram stain to determine the Gram reaction. Identification of Gram positive organisms was performed using catalase test, coagulase test, mannitol salt agar test, novobiocin sensitivity test and aesculin test. Identification of Gram negative organisms was conducted by Kligler iron agar test, citrate utilization test, oxidase test, urease test, motility test, indole production, and Voges-Proskauer test.
Kirby-Bauer method was used for the antimicrobial susceptibility testing of the bacterial species isolated. Muller Hinton agar and Mc Farland turbidity standard were employed. The standard has a turbidity of approximately $(1.5x\ 10)^8$ bacteria /ml. The antibiotics chosen were those most frequently used in hospitals and health centers, i.e. amikacin, cephalexin, cefoperazone, ciprofloxacin, norfloxacin, gentamycin, and nalidixic acid. Results of inhibition zones were interpreted according to the American Clinical and Laboratory Standards Institute (CLSI) zone diameter interpretive standards. American Type Culture Collection organisms were used as sensitivity control strains, e.g. *Escherichia coli* (ATCC25922) for gram negative bacilli, and *Staphylococcus aureus* (ATCC25923) for gram positive cocci.

Results

In this study, a total of 120 urine specimens were investigated: 60 urine specimens were collected from pregnant and 60 specimens from non-pregnant women. Significant bacterial growth was

detected in 16 urine specimens (13.3 %). From these, one specimen (1.7%) was collected from a non-pregnant woman and 15 specimens (25%) were collected from pregnant women.
The highest frequency rate of infection was found in the age group 26-30 years (15%) and the lowest frequency was observed in the age range 36-40 years (1.7%).
94% of the women investigated had past history of UTIs; and about 80% of them were in the sexually active age range (21-35 years); and about 91% were in the age range 21-35 years.
The commonest organisms isolated were *Escherichia coli* (9 / 7.5 %), *Staph. aureus* (3 / 2.5%), *Klebsiella pneumoniae* (3 / 2.5 %), and *Proteus mirabilis* (1 / 0.8%).
Regarding the organisms isolated from pregnant women, three organisms were isolated from pregnant women in first trimester, five organisms were isolated from pregnant women in second trimester, and seven organisms were isolated from pregnant women in third trimester.
Bacterial pathogens isolated were found to be highly sensitive (93.75%) to amikacin. Other antibiotics effective in over 50% of cases were ciprofloxacin (75.0%) and gentamycin (56.3%) as shown in Table (I).

Table (I): Sensitivity pattern of bacterial species isolated

Bacterial species	No. of bacterial species sensitive to:						
	CEF	NOR	NA	G	AM	CX	CIP
Escherichia coli	1 11.0%	0 0%	3 33.0%	7 77.8%	8 88.8%	1 11.0%	5 55.6%
Staph. aureus	0 0%	0 0%	0 0%	2 66.0%	3 100%	3 100%	3 100%
Kleb. pneumoniae	1 50.0%	0 0%	3 100%	0 0%	3 100%	1 50.0%	3 100%
Proteus mirabilis	0 0%	0 0%	0 0%	0 0%	1 100%	0 0%	1 100%
Total	2 12.5%	0 0%	6 37.5%	9 56.3%	15 93.75%	5 31.25%	12 75.0%

NOR = Norfloxacin NA = Nalidixic acid G = Gentamicin AM = Amikacin
CIP = Ciprofloxacin CX = Cephalexin CEF = Cefoperazon

Escherichia coli was found highly sensitive to amikacin (88.8%); while *Staphylococcus aureus* was highly sensitive (100%) to amikacin, ciprofloxacin, and cephalexin. *Klebsiella pneumoniae* was found highly sensitive (100%) to amikacin, ciprofloxacin, and nalidixic acid (Table I).

Discussion:

Urinary tract infection (UTI) in pregnancy may lead to pyelonephritis, hypertensive disease of pregnancy, anaemia, chronic renal failure, premature delivery and foetal mortality.
This study aimed to identify the etiologic agents of UTI and to determine the patterns of antimicrobial drug susceptibility among pregnant and non-pregnant women attending Omdurman Military Teaching Hospital.
It was reported that only a significant risk increase of 1-2% may occur per decade of age[10]. However, in our study there was no significant difference as regard age incidence (Table I); probably due to the small sample size investigated in this study.
The highest frequency rate of UTI was found in the age group 26-30 years (15%). Previous studies had reported similar result[11]. The reason could be due to the fact that many women at this age range are likely to have had delivered a number of children; since multiparity is considered a risk factor for acquiring bacteriuria in pregnancy[12]. Sexual activity and the use of some contraceptive methods may also increase the risk factor at this age group[13].
The results of our study were also similar to that reported by Onuh *et al*[14] and Leigh[15]. Multiparity has an increased risk factor of developing bacteriuria among pregnant women. Leigh[15] and Sharma *et al*[16] had similar observation regarding the risk of urinary problems which gave an increase by 37.04%.
Also a parity of > 3 children may increase the risk factor of developing UTI as compared to the rate of 18.75% in nulliparous women. However, there was a disagreement with the findings of Onuh *et al*[14] who reported that there was no such relationship with parity. These discrepancies in results may be due to the different locations where in which these studies were carried out.
Furthermore, in this study, 16 urine specimens (13.3%) showed bacterial growth. This frequency rate was lower than that reported by Mazzulli *et al*[17] who reported a prevalence rate of 21.7 %. However our study did not agree with that of Onuh and colleagues[14], who reported a frequency rate of 32.7%.
Also the frequency of bacterial UTIs of our study does not agree with that of Onyemelukwe *et al*[18] who reported a frequency rate of 12.7%; and does not agree with the reports of Leigh[15] and Brook *et al*[19] who documented a 1-10% frequency rate. The explanation for this discrepancy may be due to including UTIs results of both symptomatic and asymptomatic pregnant women in this study; or due to the differences in socio-economic status of the pregnant women investigated.
On the other hand, the number of bacterial species isolated in this study was higher (seven organisms) in the third pregnancy trimester stage compared to the first and second trimesters. This finding was in agreement with Leigh[15] who also reported an increased frequency of isolation in the third trimester. However, this finding does not agree with Onuh *etal*[14] who reported a higher isolation rate in the second trimester. This difference may be explained either by the decreased levels of urinary progesterone and oestrogen hormones or by changes in urinary stasis and vesico-ureteral reflux during the various pregnancy trimesters.
Also in this study, past history of UTI was admitted by 94% of the women investigated. This remark reflects a significant risk factor to UTIs. In a study conducted by Haider *et al*[20] bacteriuria was detected in 100% of women who had previous bouts of UTI. Other studies acknowledged the high association of past episodes of UTI with recurrent UTIs in pregnancy[15].

Furthermore, in our study about 80% of the women investigated were in the sexually active age range (21-35 years); and about 91% of them were in the age range 21-35 years. This finding would make sexual activity to arise as a significant risk factor to UTIs. This study finding was confirmed by Haider and his colleagues[20] who reported that the prevalence of UTI increases among women who are sexually active. The anatomical neighboring of female's urethra and the vagina makes it liable to coital trauma; as well as passage of bacteria up the urethra into the bladder during pregnancy/child birth process[21].

Other risk factors of UTIs during pregnancy may include: low socio-economic status, poor hygiene, and not voiding post-coitus urine[22]. In our study the frequency rate of bacteriuria was 25%; and a similar finding (23%) was reported by Patterson and Andrriole[23].

In this context, bacterial pathogens isolated were found to be highly sensitive (93.75%) to amikacin; whereas other antibiotics effective in over 50% of cases were ciprofloxacin (75.0%) and gentamycin (56.3%). Also *Escherichia coli* was found highly sensitive to amikacin (88.8%); while *Staphylococcus aureus* was highly sensitive (100%) to amikacin, ciprofloxacin, and cephalexin. Also *Klebsiella pneumoniae* was found highly sensitive (100%) to amikacin, ciprofloxacin, and nalidixic acid (Table I).

In Bangladesh, Parvin[24] reported that all his UTIs bacterial isolates were 100 % sensitive to imipenem. He found *Escherichia coli* 60.6% sensitive to nitrofurantoin and 57.6% sensitive to gentamicin; whereas he found *Klebsiella* species 100% sensitive to gentamicin, and 66.7% sensitive to nitrofurantoin.

From this study it may be recommended that all pregnant women should be screened for significant bacteriuria, and positive cases are to be promptly treated. Also antimicrobial susceptibility should be performed to prescribe proper antimicrobial agents.

Conclusion: *Escherichia coli* is the most frequently isolated pathogen in pregnancy. Amikacin is the drug of choice for treatment of UTIs among pregnant and non-pregnant women.

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