Research Article

Correlation of urinary tract infection pathogens, antibiogram and age group in pregnant women

Abstract

Objective: The aim of the study is to detect urinary tract infections (UTI) pathogens, prevalence and antibiotic sensitivity among pregnant women aged 20-45 year in Amman-Jordan.

Method: Total of one hundred and twenty three pregnant women age between 18-42 years suspected of UTI were referred to the laboratories from private antenatal clinics. Voided mid-stream urine samples were collected in wide mouth sterile containers. Samples were cultured and examined microscopically. The isolate were identified based on colonial morphology, microscopic characteristics, and biochemical tests. Antibiotic sensitivity test was then followed.

Results: Out of one hundred and twenty three samples tested only fifty three urine samples showed positive growth with an incidence rate of 43.1%. Out of the positive culture 49 (92.4%) revealed single isolate while 4(7.6%) showed mixed culture. *Escherichia coli* 19(35.8%) was the most predominant organism followed by *Staphylococcus aureus* 11(20.8%), Coliforms 9(17.0%), *Klebsiella pneumoniae* 7(13.2%), *Pseudomonas aeruginosa* 1(1.9%), *Streptococcus faecalis* 1(1.9%), *Proteus mirabllis* 1(1.9%) and mixed culture of *Staphylococcus epidermis* and *Candida albicans* 4(7.5%). Microscopic examination of the positive samples (53) revealed Pus cells in 32 samples (26. 0%), red blood cells (rbc) in 12 samples (9.7%), yeast cells in 2 samples (1.6%) and *Trichomonas vaginalis* in 1 samples 1(0.8%). Age groups 38-42 show the highest incident rate of infection 66.7%. Meropenem and ipenim showed the highest activity (100%) rate.

Conclusion: The high incidence rate 19(35. 8%) for *Escherichia coli* and low efficacy rate of antibiotic in pregnant women reported in this study should be of great concern, as not only a threat to health of pregnant women and infants, but they also create an economic and social problems due to the stigma associated with these infections.

Keywords: bacteriuria, pregnant women, urine, age group

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Introduction

Urinary Tract Infections (UTIs) is an infection caused by the presence and growth of microorganism anywhere in the urinary tract and is perhaps the single commonest bacterial infection of mankind.[1,2] Many studies reported the significance of UTI during pregnancy although pregnancy does not cause UTI,[3–6] however, the complexity of urinary tract system and changes during pregnancy account for susceptibility to infection.[3-5,7,8] Urinary tract infections have been reported in all age groups and can occur in both sexes[2,9] and pregnant women are not an exception.[5,6] UTI is a serious health problem worldwide affecting millions of people each year and the leading cause of Gram-negative bacteria.[9,10] Over eight million cases of UTI annually were reported and more than one million were hospitalized, for an overall annual cost more than $1 billion,[10–12] classifying hospital and antenatal clinic in the lead as source of UTI pathogens[2,13] and responsible for 35% of the cases where bacteraemia was the most common cause in hospitalized patients[14–16] Diagnosis of UTI causing organism is the major work load in medical laboratories where *Escherichia coli* reveal the highest predominate rate although, other reports showed that the causative organism of UTI is changing over the year and other microorganism were responsible for infection.[13,14] Many reports showed that UTI is common in patients with different symptoms.[14] However, our concern in this study is to focus on pregnant women at different age group were they believed to have highest infection rate.[2,14] Due to the fact that untreated UTI in pregnancy can increases the risks of morbidity, and mortality to pregnant women and infant,[17] keeping in mind that estimated 40 percent of women reported to have UTI some time in their lives,[15] and by nature women are more susceptible to UTI because accessibility of organism to invade urethra and bladder easier than men.[18] 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.[2,19,20] Other factors reported to increase rate of infection are pregnancy and sexual intercourse,[19] due to vaginal trauma which enhance access of bacteria to urethral into bladder.[2,17,19] Other factor found to increase rate of infection is using diaphragms during intercourse forming residual urine and hence increase rate of UTI in pregnant women.[20,21] Therefore UTI in pregnant women is of great concern practically in developed countries,[22,23] where rational prescribing of drugs by member of health practitioner is difficult to control.[24,25] This study therefore focuses on prevalence and incidence of UTI among pregnant women with deferent age in term of prevalence of organisms and antibiotic sensitivity rate.

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Materials and methods

Urine samples were collected from a total of 123 pregnant women between the ages of 18 to 42 year were referred to our laboratories as outpatients attending antenatal clinics for routine examination. Suspecting patients with UTI were referred for further investigations. Clean-catch MSU samples were collected in wide open mouth sterile container as described by.[26,27] Patients were instructed to wash and clean urethro-genital organs and to pass the first void of urine then to collect midstream sample into sterile container. The study groups were also stratified by age distribution chart. Samples were labeled and analyzed within 30 minutes of collections.

Urine samples were examined microscopically according to.[17] Those showed 10 white blood cells/mm^3 were regarded as pyuric.[28] Urine culture was then performed. Identification and characterization of isolated bacteria include Gram stain followed by microscopic examination, motility test and biochemical tests as described by.[29–32]

For drug susceptibility test Mueller Hinton agar (MHA) was used and commercial antibiotic multidisc were used as described by.[4] Antibiotics discs, Amoxicillin (AMX) 25µg, Augmentin® (AUG) 10µg, Cotrimoxazole (COT), Ciprofloxacin (CIP) 10ug, Gentamycin (GEN)10ug, Imipenim (IPM)10ug, Levofloxacin (LEV) 30ug, Meropenem (MEM) 10ug, Nalidixic acid (NA 30ug), Ofloxacin (OFL) 5µg, were used. Zone of inhibition was measured to determine the level of susceptibility of isolates to the antibiotics. Data obtained in this study were analyzed using SPSS version16.0.

Results

Microscopic observation of one hundred and twenty three MSU samples collected and examined in this study only 32(26. 0%) samples were revealed to have white blood cells (pus cells), 12(9.7%) red blood cells (rbc), yeast cells 2(1.6%) and *Trichomonas vaginalis* 1(0.8%) (Table1). Out of 123 samples examined only 53(43.1%) were showed significant bacteriuria, while 70(56.9%) had no significant bacterial growth (Table 2). Culture plates with bacteria counts greater or equal than 1x10^5 cfu/consider as UTI. Bacterial isolation and identification followed by antibiotic sensitivity test was then performed. Correlation between incidence of UTI and age groups is shown in Table 2, where age groups 38-42 year and 33-37 year shows the highest incident rate of infection 66.7% and 54.5% respectively, followed by age group 28-32 year (42.2%). Meanwhile, age group 18-22 year had the lowest percentage infection rate (33.3%) as shown in Table 2. There is significant statistical variation (*P*<0.005) between UTI and age group. This is in agreement with other studies.[3,8]

Table 1 Microscopic examination of urine samples

Isolates	No. of positive samples (%)
Pus cells	32(26.0)
Red blood cells	12 (9.7)
Yeast cells	2 (1.6)
Trichomonas vaginalis	1 (0.8)
Total	47(38.2)

Table 2 Distribution of UTI in different age groups

Age Group (years)	No. Tested (%)	No. Positive (%)	No. Negative (%)
18-22	24(19.5)	8(33.3)	16(66.7)
23-27	34(27.6)	14(41.4)	20(58.8)
28-32	45(36.7)	19(42.2)	26(57.8)
33-37	11(8.9)	6(54.5)	5(45.4)
38-42	9 (7.3)	6(66.7)	3(33.3)
Total	123(100)	53(43.1)	70(56.9)

The prevalence of gram negative and gram positive obtained in this study are 37(69.8%) and 14(26.4%) respectively, *E. coli* showed the highest prevalence rate followed by *S. Aureus* 11(30.8%) and *K. pneumoniae* 7(13.2%). A mixed culture of *C. albicans* and *S. epidermis* revealed 4(7.6%). Other organism isolated showed different prevalence rate Table 3. It is noticeable that *E. coli* and *S. aureus* were the most common isolates in all age groups however; *P. aeruginosa* was isolated from age group 38-42 years exclusively.

Table 3 Frequency of isolation of organisms in pregnant women

Isolates	No. of positive samples (%)
E. coli	19(35.8)
S. aureus	11 (20.8)
Coliforms	9 (17.0)
K. pneumonia	7 (13.2)
S. faecalis	1(1.9)
P. mirabilis	1 (1.9)
P. aeruginosa	1(1.9)
Mixed culture of *C. albicans* & *S. epidermis*	4(7.5)
Total	53 (100.0)

Results of antibiotic sensitivity test revealed 100.0% activity for meropenem, imipenem and levofloxacin. They are the most active antibiotics. The rate of multidrug resistance is (>50%) (Table 4). These results are worrisome and essential care should be taken in pregnancy unit and efficient drug prescribing policy should be explored.

Table 4 Susceptibility of urine isolates to antibiotic from pregnant women

Bacteria	No.% Susceptibility	AMX 26ug	AUG 30ug	COT 25ug	CIP 10ug	GEN 10ug	IPM 30ug	MEM 10ug	NA 30ug	OFL 5ug	LEV 10ug
E. coli	19	1	9	8	19	6	19	19	12	12	19
		5.3	47.3	42.2	100	31.6	100	100	73.6	63.2	100
S. aureus	11	5	5	9	10	3	11	11	10	10	11
		45.5	45.5	81.8	91	27.2	100	100	90.9	90	100
K. pneumonia	7	1	3	6	6	3	7	7	6	6	7
		14.3	42.9	75	85.7	42.9	100	100	85.7	85.7	100
S. faecalis	1	0	0	1	1	0	1	1	0	0	1
		0	0	100	100	0	100	100	0	0..0	100
Coliforms	9	2	7	4	8	7	9	9	9	9	9
		22.2	77.7	44.4	88.9	77.7	100	100	100	100	100
P. mirabilis	1	0	0	0	1	0	1	1	1	1	1
		0	0	0	100	0	100	100	100	100	100
P. aeruginosa	1	0	0	1	1	0	1	1	0	0	1
		0	0	100	100	0	100	100	0	0	100
Total	49	9	24	29	46	19	49	49	38	38	49
		18.4	48.9	59.2	93.9	38.8	100	100	77.6	77.6	100

Discussion

The incidence of UTI in this study is 43.1%. This is similar to the figures reported in other studies indicated high prevalence rate of UTI 48.0%, 45.3%,[33–35] and 58.0% reported by.[36] Also, in agreement with other studies where female showed higher UTI prevalence than male.[37–40] However, the incident rate in this study is higher than the incidence rates reported in other studies,[3,8,12,41–45] such a difference could be due to geographic location and different in environmental conditions,[3] Other factors associated with increasing incidence rate in developing countries such as lack of proper hygiene, different environmental status, population susceptibility, low socio-economic status, sexual intercourse and pregnancy.[3,41]

Results of the microscopic observation revealed 32 samples have pus cells, 12 samples had red blood cells, 2 samples had yeast cells and 1 had *Trichomonas vaginalis*. There is no statistical significant variation ($P>0.05$) between these parameters and UTI however this results is in agreement with other study.[20]

The pattern and frequency of isolates in this study are similar to what have been previously reported, where *E. coli* was the most dominant organism.[6,41–43] Other organisms were isolated in low rate which is in agreement with other studies.[44] However, their occurrence and resistant pattern to antibiotic should be considered.

The most implicating organisms causing UTI among these pregnant women in this study was *E. coli* (35.8%), followed by *S. aureus* (20.8%), Coliform (17.0%), *K. aerogenes* (13.2%). These finding is similar to other reports which suggest that Gram-negative bacteria, particularly *E. coli* is the most common pathogen isolated in patients with UTI.[2,5,44–47] The pattern of infection by *E. coli*, *S. aureus* and *K. pneumoniae* obtained in this study is in agreement with other study reported by,[17] showing similar infection rate and pattern where *E. coli* (51.2%), *S. aureus* (27.3%), and *K. pneumoniae* (12.8%)

respectively. However, the 13.2% incidence rate of *K. pneumoniae* reported in this study is consistent with previous study,[7] also this bring *K. pneumoniae* as predominant organism in UTI which lay out different status for this organism which disagree with other studies reported by.[5,48–50] Adding to that prevalence of *S. aureus* in UTI in this study is in agreement with other reports,[8] but disagrees with earlier study by.[51] This shows that other organisms are revealing prominence in pregnant women UTI.

In this study, a total of 49 cases out of 53 show prevalence rate of 43% of single isolate however only 4(7.5%) showed mixed culture, this results agree with other studies,[8] where single isolate was dominant.[10,13] Age group 38-42 year exhibited the highest prevalence of UTI although. age group 28-32 year showed higher percentage of isolates, this indicate that UTI increase with age.[5,10] Mean while *P. aeruginosa* is one of the least common organism isolated in this study among other *S. faecalis* and *P. mirabilis* which still impressive and should be considered for future treatment. There are other factors assisting high UTI incident rate in pregnant women such as age with acute symptoms.[10,13] However, in asymptomatic UTI changing in vaginal microflora reported to have major effect in women and this is one of the reasons why women have higher incident rate of UTI than men.[52] *E. coli*, *S. aureus*, *K. pneumoniae* and *S. faecalis* also showed a resistance pattern >50% for most of drug used as first line of treatment. This is consistent with other study.[9] Ciprofloxacin and nalidixic acid revealed 85.7-100.0% and 73.6-100.0% activity range respectively. Other antibiotics showed different activity range 63.0-100.0%, 31.6-77.7% and 42.9-77.7% for ofloxacin, gentamicin and augmentin respectively Table 4. The low activity ranges are consistent with other studies.[6,7] The high activity rate of antibiotic reported in this study disagree with other studies,[5,53] that might be due to low number of isolate in the study. Amoxicillin showed very low efficacy (<30%) in this which is in agreement with other study,[5] that showed uncontrolled use of amoxicillin over the years for different infections

treatment have led to bacterial drug resistance,[5,54,55] adding to that rational use of these antibiotics as first line of treatment particularly in developing countries,[56,57] had led to MDR development organisms.[5] This is reinforcing the need for laying out control policy for prescribing antibiotics.[1–3] Although organisms such as *S. aureus* and *P. aeruginosa* and have been documented to show MDR[3–6] particularly in Hospital. The high Multidrug resistant pattern for *S. aureus* followed by *P. aeruginosa* and *E. coli* for certain drugs showed is not surprising because these organisms documented to have high resistance rate particularly *S. aureus,*[3,5,6] which is commonly found in hospital environment, antenatal clinics and community.[4,37] One of the reasons for acquisition of drug resistant phenomena among organisms is long exposure of these organisms to antibiotics leading to serious problem in health profession treatment strategy.[1,2,5,6] High drug resistant rate observed in this study will add further problem for pregnant women treatment due to the fact that bacteriuria, cystitis, vaginitis and pyelonephritis are the most common cause of urogenital infections,[8,10] and asymptomatic infection could be caused by other factors such as abortion, still birth and thrombosis.[3,5,6] Pyelonephritis reported to cause significant maternal and fetal morbidity and mortality.[3,10] It is worth mentioning that asymptomatic infection could be easily transfer to symptomatic infection if it is not treated probably,[5] and will lead to infant morbidity and mortality if poorly diagnosed.[57,58] This is in agreement with other studies showed that other physiological changes during pregnancy such as hormonal changes provide the ideal environment for UTI-causing bacteria (*E. coli)* and increase rate of infection, likewise vagina of the pregnant women work as niche for bacterial and Candida growth due to moisture habitat and rich glycogen content.[59] Also sexually active women are more susceptible to UTI.[60] Therefore, all these factors will increase rate of UTI infection in women more than men. Adding to that the remarkable resistant of these isolates in this study is of great concern for limiting availability of drugs used for treatments and further consideration for laying out base line for future treatments to avoid invention of new MDR strains.

The overall antimicrobial activity pattern showed that meropenem, Imipenem and levofloxacin is the most effective antibiotic with rate of 100.0% Table 4. This encourage prescribing these antibiotic for UTI under good surveillance system in order to increase their life spam.[24,25] Moreover, recommendation for educational policy to reduce prevalence of UTI and to improve quality of health services in term of prevention and treatment services and drug prescribing policy for pregnant is of high concern. Therefore, routine screening of pregnant women for UTI followed by culturing and sensitivity test for appropriate antimicrobial selection to render further complications.

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Conflicts of interest

Authors declare that there is no conflict of interest.

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