

Etiology and antibiotic resistance patterns of urinary tract infections in Thi –Qar Governorate

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Abstract

Urinary tract infections (UTI) remain the common infection diagnosed in outpatients and in hospitalized patients and the current knowledge on antibiotic susceptibility pattern is essential for appropriate therapy.

Fiftieth urine samples from symptomatic UTI patients (4 males and 46 females) attending to different health cares and general hospitals in Thi – Qar Governorate were accumulated and identify 45 cases (90%) as infected with single bacterial isolate.

E. coli was the most common bacteria with 17 isolates (37.7%) followed by *Staphylococcus saprophyticus* with 14 isolates (31.1%).

Antimicrobial susceptibility testing was performed by Kirby Bauer's disc diffusion method and the result explain that Ciprofloxacin and Tetracycline have highly effective on the urinary isolates with different percentage of sensitivity, while Amoxicillin, penicillin, Trimethoprim/sulfamethoxazol and Cefotaxim have low effectiveness against the urinary isolates with different percentage of resistance.

Introduction:

Urinary tract infection (UTI) is the second most common infectious presentation in community practice, especially among women, where the urinary tract is the one of the most common sites of bacterial infection, particularly in females (Hooton T. M., 2001).

The urinary system consists of the kidneys, ureters, bladder, and urethra. The key elements in the system are the kidneys “organs located below the ribs toward the middle of the back”. The kidneys remove excess liquid and wastes from the blood in the form of urine, keep a stable balance of salts and other substances in the blood, and produce a hormone that aids the formation of red blood cells. ureters carry

urine from the kidneys to the bladder, a sack-like organ in the lower abdomen. Urine is stored in the bladder and emptied through the urethra (Biswas *et al.*, 2006).

Any thing that disrupts normal urine flow or complete emptying of the bladder or facilitates access of organisms to the bladder will predispose an individual to infection. The infection of urinary tract were classified according to the site of infection to the lower UTI or Cystitis that characterized by dysuria, urgency and frequency of micturition. However, the urine in this case is cloudy due to the presence of pus cells (pyuria) and bacteria (bacteriuria) and may contain blood (hematuria). Other type of UTI is the upper UTI or Pyelonephritis that present with the lower urinary tract symptoms and usually with fever. Infections associated with stone formation can result in obstruction of the renal tract and septicemia (Ronald A., 2002).

Normally, urine is sterile. It is usually free of bacteria, viruses, and fungi but does contain fluids, salts, and waste products. An infection occurs when tiny organisms, usually bacteria from the digestive tract, cling to the opening of the urethra and begin to multiply. The urethra is the tube that carries urine from the bladder to outside the body.

Most infections arise from one type of bacteria, *Escherichia coli*, which normally lives in the colon. In many cases, bacteria first travel to the urethra. When bacteria multiply, an infection can occur. An infection limited to the urethra is called urethritis. If bacteria move to the bladder and multiply, a bladder infection, called cystitis, results. If the infection is not treated promptly, bacteria may then travel further up the ureters to multiply and infect the kidneys. A kidney infection is called pyelonephritis (Mulvey M. A., 2002). UTIs are treated with antibacterial drugs, the choice of drug and length of treatment depend on the patient's history and the urine tests that identify the offending bacteria. The sensitivity test is especially useful in helping the doctor select the most effective drug. The drugs most often used to treat routine, uncomplicated UTIs are trimethoprim, trimethoprim/sulfamethoxazole, amoxicillin, nitrofurantoin, and ampicillin. A class of drugs called quinolones includes four drugs approved in recent years for treating UTI. These drugs include ofloxacin, norfloxacin, ciprofloxacin, and trovafloxin (Biswas *et al.*, 2006).

The extensive uses of antimicrobial agents have invariably resulted in the development of antibiotic resistance, which, in recent years, has become a major problem worldwide (Manges *et al.*, 2001). The resistance pattern of community acquired UTI pathogens has not been studied extensively. This study is important for clinician in order to facilitate the empiric treatment of patients and management of patients with symptoms of UTIs.

Materials and Methods:

Fiftieth urine samples had been accumulated from the patients (4 males and 46 females) those were visited different health cares and general hospitals in Thi - Qar Governorate, between September 2006 and May 2007 where those patients have signs and symptoms of UTI like dysuria, painful, burning feeling in the area of the bladder or urethra during urination and back pain, by using urine cap the samples had been accumulated. Then the urine samples sent to the laboratory of Biology Department in the College of Science of Thi - Qar University.

General urine examination had been done on these samples to diagnose the signs of UTI like the presence of pus cells, RBCs, pathological cells and the presence of bacteria. Semi quantitative urine culture using calibrated loop was used to inoculate blood agar and MacConkey agar plates and incubated at 37 ° C for 24 hrs.

To distinguishing genuine infection from contamination, significant monomicrobial bacteriuria was defined as culture of a single bacterial species from the urine sample at a concentration of >10⁵ cfu/ml.

Depending on the colonies features, the characteristic properties of the bacteria and by using Gram stain with some of biochemical tests (indol test, methyl red test, Voges – Proskaur test, motility test and oxidase test) the identification had been did. However, dry smear had been made on clean, dry slide then fixed on the flame and stained with Gram stain.

E. coli one of the most important bacteria in UTI characterized by opaque and convex colonies with entire edges on the blood agar, rose pink colonies due to lactose fermentation on the MacConkey agar and has the property of pleomorphic, gram negative rods in direct examination with gram stain.

Pseudomonas aeruginosa as serious infectious agent of UTI have convex and entire edge colonies with sweet musty odor and green coloration diffuse in to the medium and also it is gram negative tiny rods with gram stain examination.

Klebsiella pneumonia have large, high convex and mucoid colonies with pink color due to lactose fermentation and also appear as gram negative rods in microscope examination.

Staphylococcus saprophyticus have an entire edge and convex elevation with white color colonies on blood agar and rose pink colonies on mannitol salt agar due to mannitol non fermentation and microscopically appear as gram positive cocci as clusters.

Streptococcus agalactia have gamma hemolytic property on blood agar and can grow on MacConkey agar as minute colonies also have gram positive cocci chain when examined microscopically.

The gram negative bacteria confirmed in diagnosis by use the some of the biochemical tests as show in the table:

Biochemical test	Bacterial species		
	<i>E. coli</i>	<i>Klebsiella pneumonia</i>	<i>Pseudomonas auroginosa</i>
Indol test	+	-	N. P.
Methyl red test	+	-	N. P.
Voges-Proskaur test	-	+	N. P.
Motility test	+	-	N. P.
Oxidase test	N. P	N. P.	+

****Where (+) mean Positive result, (-) mean Negative result, (N. P.) mean not performed.**

Antimicrobial susceptibility testing was performed using the disk diffusion method on the nutrient agar and by use the most useful antimicrobial agent of UTI that directed by the physicians in the Governorate. These antibiotics were Amoxicillin (AX), Penicillin (P), Ampicillin (Am), Amoxiclave (AMC), Trimethoprim/sulfamethoxazol (SXT), Cefotaxim (CTX), Ciprofloxacin (CIP), Gentamicin (GN), Streptomycin (S), Tetracycline (TET) and Chloromphenicol (C).

Statistical analysis:

To analyze the data it was reported in the form of diameter of inhibition zone during susceptibility testing of all bacterial isolates by disc diffusion test against different classes of antimicrobial agents. One-way ANOVA test was performed to check the significant difference among the different groups. A difference was considered significant if the probability was ($p \leq 0.05$).

The Results:

Of 50 urine samples processed 45 (90 %) gave single bacterial growth while other samples (10%) exclude from the results because either the contamination with multiple pathogens or because no growth was detected as showed in table (1).

More cases of UTI recorded among females with about 41 cases (91%) while the males record just 4 cases (9%) and the table (2) showed the incidence of UTI according to gender.

The survey of this study revealed that *E. coli* was the most common bacteria that cause UTI among other isolated bacteria, where recorded 17 isolates from 45 (37.7%), followed by *Staphylococcus saprophyticus* with 14 isolates (31.1%) then *Pseudomonas aeruginosa* that recorded 7 isolates (15.5%) while the *Klebsiella pneumonia* recorded 4 isolates (8.8%) and finally *Streptococcus agalactia* with 3 isolates (6.6%).

The sensitivity profile of these isolates shown in table (3), this table explain that Ciprofloxacin was the most effective antibiotic that gave high percentage of sensitivity with all bacterial isolates in this study where recorded 70% of sensitivity with *E. coli*, 50% with *S. saprophyticus*, 71% with *Pseudomonas aeruginosa*, 75% with *K. pneumonia* and 66% with *S. agalactia*. Other type of antibiotic with less effectiveness on all isolates was Tetracycline (29, 57, 14, 50 and 33%) with (*E. coli*, *S. saprophyticus*, *Pseudomonas aeruginosa*, *K. pneumonia* and *S. agalactia*) respectively. In this study all isolates were resistant to Penicillin.

Table (3) explains the profile of bacterial isolates and sensitivity to each antibiotic used in this study.

Table (1): Positivity of samples for UTI patients

Samples of Urine	Number of Samples	Percentage
Positive samples for single bacterial isolates	45	90%
Contaminated samples or negative for bacterial isolates	5	10%
Total	50	100%

Table (2): Incidence of UTI according to gender

	Male	Female
Samples Number	4	41
Percentage	9%	91%

Table (3): Profile of urinary isolates and sensitivity of antibiotics

Bacteria	No. of Isolates	% of Isolates	AX		P		AMC		CIP		S		CN		C		SXT		CTX		T	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<i>E. coli</i>	17	37.7	0	0	0	0	4	23	12	70	7	41	10	58	1	5	1	5	3	17	5	29
<i>Staphylococcus saprophyticus</i>	14	31.1	0	0	0	0	5	35	7	50	0	0	0	0	2	14	2	14	0	0	8	57
<i>Pseudomonas aeruginosa</i>	7	15.5	0	0	0	0	0	0	5	71	0	0	5	71	0	0	0	0	0	0	1	14
<i>Klebsiella pneumonia</i>	4	8.8	0	0	0	0	0	0	3	75	3	75	2	50	0	0	0	0	0	0	2	50
<i>Streptococcus agalactia</i>	3	6.6	1	33	0	0	2	66	2	66	0	0	0	0	0	0	0	0	0	0	1	33

The Discussion:

Urinary tract infections are serious health problem affecting millions of people each year. Infections of the urinary tract are the second most common type of infection in the body. Normally urine is sterile it is usually free from bacteria, viruses and fungi, but does contain fluids, salts and waste products. An infection occur when tiny organisms usually bacteria from the digestive tract cling to the opening of urethra and begin to multiply. In many cases bacteria first travel to the urethra when bacteria multiply an infection occur. If bacteria move to the bladder and multiply, bladder infection occurs. If the infection not treated promptly, bacteria may then ravel further up the ureters to multiply and infect the kidneys (Ronald A., 2002).

Women tend to have urinary tract infections more often than men because bacteria can reach the bladder more easily in women. Urethra is shorter in women than men, so bacteria have shorter distance to travel. The urethra is also located near the rectum can easily travel up the urethra and cause infection. Having sex may also cause UTIs in women because bacteria can pushed into the urethra (Stephan D., 2003).

Infection of the urinary tract could be divided in to two categories, community acquired UTI in which *E. coli* considered the main pathogen, other type of infection is hospital acquired UTI that caused mainly by *Staphylococcus saprophyticus* and *Pseudomonas aeruginosa* in addition to other type of bacteria that habitat in hospitals. The last type of infection characterized by high dangerous on health of patients as a result of high resistance of these pathogens to wide spread antibiotics and also these infections usually accompanied with using catheters (Mohammed *et al.*, 2007).

This study shows the distribution and antibiotics susceptibility pattern of microbial species isolated from patients with community acquired UTIs in Thi - Qar governorate. In this study, *E. coli* counted approximately 37.7% of all urinary isolates and this is consistent with the finding of other studies in which *E. coli* was

the predominant pathogen isolated from patients with community acquired UTI. This high incidence of *E. coli* may be that *E. coli* considered as normal flora in digestive system and when travel to the urethra cause UTI (Manges *et al.*, 2006).

However, the present study shows five species of bacteria with different incidence rate to cause UTIs and this confirmed by many of previous studies (Steink *et al.*, 1999).

In this study, most of bacterial isolates are highly resistant to most useful antibiotics (Amoxicillin, Penicillin, Trimethoprim/sulfamethoxazol and Cefotaxim) where as these drugs considered as the most suited antibiotics for empirical therapy due to have low resistance rate against potential pathogens and be free of adverse effect but according to the Infectious Disease Society of America that recommend an antibiotic for empirical therapy only if < 10 – 20% of the urinary pathogens are resistance to it, so these antibiotics must not be considered as empirical treatment for UTI because highly resistance that reach 70 – 100% for urinary pathogens in this study. In the other hand, the maximum antibiotic resistance against Amoxicillin, Penicillin, Trimethoprim/sulfamethoxazol and Cefotaxim could be attributed to their wide usage for a variety of indications and this result is consistent with the findings of other studies with different type of antibiotics (Gupta *et al.*, 2001).

In this study Ciprofloxacin counted the highly sensitivity rates about 50 – 75% of all urinary isolates and this is may be due to that it is a new antibiotic and have properties of broad spectrum against gram positive and gram negative bacteria and it is potency with few adverse effects limited on gastrointestinal irritation so it is recommended for treatment of UTI but not for long time to advice the Ciprofloxacin-resistance infections (Drusano *et al.*, 1986).

Other antibiotic that shown good effectiveness against urinary pathogens in this study was the Tetracycline, although it old antibiotic and have many of adverse effects on patient health (Genot M. T., 1970) but it gave a percentage of sensitivity approximately (17 – 57%) against the urinary isolates and this may be because of the long time of undespense this antibiotic on the patients after appear with high resistance against pathogens in the past.

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الخلاصة:

تعد اصابات المجاري البولية من اكثر الاصابات شيوعا في التشخيص سواءا عند المرضى الراقدين في المستشفى او خارج المستشفى، وان معرفة انماط الحساسية للمضادات الحيوية ضد الممرضات المسببة لاصابات المجاري البولية اساسا لوصف العلاج لمثل هكذا اصابات.

تم جمع ٥٠ عينة من الادرار من المرضى (٤ ذكور و٤٦ اناث) الذين لديهم اعراض الاصابة بالتهابات المجاري البولية والذين يراجعون المستشفيات العامة والمراكز الصحية في مختلف مدن محافظة ذي قار، حيث تم تشخيص ٤٥ عينة (٩٠%) منها على انها اصابات حقيقية بعزلة بكتيرية واحدة.

تعتبر بكتريا *E. coli* من اكثر الانواع شيوعا في اصابات المجاري البولية حيث شخصت في ١٧ عينة (٣٧.٧%) تليها بكتريا *Staphylococcus saprophyticus* في ١٤ عينة (٣١.١%).

تم استخدام طريقة الانتشار لاقراص المضادات الحيوية والمعرفة باسم Kirby Bauer's Method في تعيين انماط الحساسية للمضادات الحيوية المستخدمة، حيث اظهرت النتائج ان مضادات Ciprofloxacin و Tetracycline لهما تاثيرات فاعلة وكبيرة ضد العزلات البكتيرية في هذه الدراسة، في حين اظهرت العزلات البكتيرية المسببة لالتهابات المجاري البولية معدلات عالية من المقاومة تجاه انواع المضادات Amoxicillin و Penicillin، Trimethoprim/sulfamethoxazol و Cefotaxim.