A Study of Some Bacteria Affecting Urinary Tract of Children with Renal Disease

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Summary

This study was carried out between December 17, 2008 and August 25, 2009. It included 62 pediatric patients at the age range (1-12) years of both genders: 26 with chronic renal failure (CRF) and 36 with nephritic syndrome (NS), who were outpatients and in-patients in the dialysis unit in both Al-Mansour pediatric teaching hospital and Child's central teaching hospital. The control group consisted of 26 children. Urine and blood samples were collected from children with both renal diseases and healthy controls. Renal function was evaluated by biochemical tests of blood. After culturing the urine samples on both MacConkey agar medium and blood agar medium, general urine examination (GUE) was applied regardless the type of the renal disease. Results explained significant increase in both urea and creatinine concentrations in serum ($P<0.001$). General urine examination of both CRF and NS patients showed that casts presence in urine was not significant ($p=0.056$), while albuminuria was significant ($P=0.049$). The negative urine cultures were present in 64.5% of both patients' groups. The control group showed no bacteria in urine. The positive cultures in patients (35.5%) were indicating urinary tract infections (UTIs) with a significant relation with the type of renal disease ($P=0.042$). UTIs seemed to be related with gender ($P=0.044$). The bacterial growth included the following isolates: *E. coli* (54.55%), *Pseudomonas aeruginosa* (22.73%), *Klebsiella pneumoniae* (9.09%), *Proteus mirabilis* (9.09%) and *Morganella morganii* in one case only (4.55%). The bacterial isolates were different in their sensitivity to antibiotics, which included Ceftazidime, Cefteriaxone, Gentamycin, Nalidixic acid, Nitrofurantoin and Trimethoprime).

Keywords: Urinary tract, children, renal diseases.

دراسة لبعض الملوثات البكتريولوجية للمسالك البولية لدى الأطفال المصابين بأمراض كلوية

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الخلاصة

نفذت هذه الدراسة بين 17-12-2008 و 25-8-2009 وشملت 62 طفلاً مريضاً في المدى العمري (1-12) سنة ومن كلا الجنسين: 26 طفلاً مصاباً بالفشل الكلوي المزمن و 36 طفلاً مصاباً بالمتلازمة الكلائية، وكان المرضى خارجيين وراقدين في وحدة غسل الكلية في كل من مستشفى المنصور التعليمي للأطفال ومستشفى الطفل التعليمي المركزي وشملت المجموعة الضابطة 26 طفلاً. جمعت عينات الدم والادرار من مجاميع المرضى والأصحاء. تم تقييم الوظيفة الكلوية بواسطة الاختبارات الكيميوحيوية للدم. بعد زرع النماذج على وسطي آغار ماكونكي وآغار الدم أجري لها الفحص العام (بغض النظر عن نوع المرض الكلوي) . أظهرت النتائج زيادةً معنويةً في يوريا وكرياتنين المصل (P<0.001). أما نتائج الفحص العام للادرار فأظهرت أن وجود القوالب في ادرار المرضى لم يكن معنوياً (الاحتمالية=0.056) ، بينما كان وجود بروتين الالبومين في ادرار المرضى معنوياً (الاحتمالية=0.049). وجدت نتائج زرع الادرار السالبة في 64.5% من كلتا المجموعتين المرضيتين، كذلك كانت نتائج زرع الادرار سالبةً في المجموعة الضابطة. أما نتائج زرع الادرار الموجبة في المرضى (35.5%) فكانت تشير الى وجود التهاب السبيل البولي مع علاقةٍ معنويةٍ بنوع المرض الكلوي (الاحتمالية= 0.042). لقد أظهر التهاب السبيل البولي علاقةً معنويةً مع الجنس (الاحتمالية= 0.044). تضمن النمو الجرثومي الأنواع التالية: *E. coli* (54.55%) و *Pseudomonas aeruginosa* (22.73%) و *Klebsiella pneumoniae* (9.09%) و *Proteus mirabilis* (9.09%) وعزلةً واحدةً فقط من *Morganella morganii* (4.55%). اختلفت العزلات البكتيرية في حساسيتها للمضادات الحياتية والتي اشتملت على السفترياكزون و السفتازديم و الجنتامايسين و حامض الناليدكسك و التراي ميثوبريم والنايتروفيورانتين.

كلمات مفتاحية: الجهاز البولي، الأطفال، أمراض الكلى.

Introduction

Chronic kidney disease (CKD) is a worldwide public health problem progresses towards end stage renal disease (ESRD). In childhood, it is generally non-curable and progressive condition that leads to death by early adulthood [1]. Nephrotic syndrome (NS) is an important CKD in children which is characterized by the presence of proteinuria, hypoalbuminemia, hyperlipidemia and edema. The other important CKD in childhood is chronic renal failure (CRF) which is a progressive irreversible destruction of the kidney tissues leading to the loss of renal function, and if not treated, it will result in death [2]. Urinary tract infection (UTI) is a common and important pediatric problem. The clinical importance of UTI is in the susceptibility to renal parenchymal damage and the presence of challenges moving to imaging the strategies focused on children at risk of developing renal damage [3]. The knowledge of the causative agent of UTI in children is very important for effective treatment [4]. So, this study was carried out to:

1. Evaluate renal function by urea and creatinine in serum.
2. Detect the relation between bacterial UTIs occurrence and both of renal disease and gender
3. Investigate the bacterial antibiotic sensitivity according to the selected antibacterial agents.

Materials and Methods

Materials:

1. Ethanol 70% (GCC/ U.K)
2. Hydrochloric acid (HCl) (BDH/ U.K)
3. Hydrogen peroxide (H_2O_2) 30% (BDH/ U.K)
4. Isoamyl alcohol (BDH/ U.K)
5. N-N-N-N-tetramethyl-1,4-phenelene diamine dihydrochloride (BDH/ U.K)
6. Normal saline (PSI/ K.S.A)
7. p-dimethelaminobenzaldehyde (Oxoid/ U.K)
8. Sedar oil (BDH/ U.K)
9. 9.Standard MacFarland solution (matching a turbidity of 1.5 x10^8 cell/ml) (BioMérieux/France)
10. 5-sulphosalicylic acid dehydrate (Himedia/ India)
11. Urea (Fluka/ Switzerland)

Methods

Study groups

The pediatric patients were 26 of CRF and 36 of NS at the age of 1 to 12 years of both genders, who were outpatients and inpatients in the dialysis unit in both Al-Mansour pediatric teaching hospital and Child's central teaching hospital. The control group consisted of 26 children of both genders and at the same age range of the study groups.

Blood and urine samples:

These samples were collected in sterile containers. In infants and small children, urine was collected in urine bags [5]. Specimens were taken from the patients and controls, and then transported to the library for required tests.

Evaluation of renal function:

After centrifugation of blood, sera were stored in Eppendroff tubes at -20°C. Then the following biochemical tests were applied:

1 Blood urea:

Serum concentration of urea in the current study was determined by enzymic method (Urease – Modified Berthelot Enzymatic-Colorimetric). The procedure was applied according to the manufacturing company (BioMérieux/France).

Calculation:

$$\frac{\textbf{A sample}}{\textbf{A standard}} \times \textbf{Standard concentration}$$

Normal values of blood urea in children = (20 – 45) mg/dl

2 Serum creatinine:

Principle:

This assay was done by using calorimetric method. Creatinine in alkaline solution reacts with picrate to form a colored complex according to (Randox Company).

Calculation:

$$\frac{\textbf{A sample}}{\textbf{A standard}} \times \textbf{Standard concentration}$$

Normal values of creatinine in children = (0.7 – 1.4) mg/dl

Preparation of indicators and culture media:

All indicators were prepared according to the directions of manufacturing companies.

General urine examination (GUE):

It is essential to report turbidity, pH and albumin concentration. Color and turbidity were detected by naked eye. pH paper for urine was used to quantify the acidity. Albumin indicator (prepared in 2.4) was used to detect the presence of albumin in urine. After centrifugation, one drop of sediment of each sample was taken on a slide and covered by cover slip and then was examined by light [6].

Urine culture:

Urine samples were cultured on both blood agar medium and MacConkey agar. This culture is the optimal method in UTIs diagnosis and detection of the causative agents. In this study, the bacterial growth was considered significant as below [7]:

-Equal to or less than 30 colonies: non significant growth.

-Equal to 31-100 colony: moderate and significant growth.

-More than 100 colony: heavy growth.

Then the bacterial isolates were identified.

Identification of bacterial isolates [8]:

The microscopically features of the isolated microorganisms after staining with Gram stain were identified, such as staining reaction to Gram stain, cell shape and arrangement of cells. The bacterial growth and motility were also tested as cultural characteristics. The biochechemical tests were done as in Bergey's manual of microbiology, and then confirmed by api20E system to identify each bacterium.

Antibiotics sensitivity test:

This test was carried out by Kirby Bauer's disc diffusion method [10]. The resulting inhibition zones have been measured by using a ruler then compared with standard inhibition zones determined by Clinical and Laboratory Standards Institute, 2009 [11]. Both of sensitivity and resistance to antibiotics was recorded. The antibiotics used in this study were part of drugs commonly used in the treatment of UTI in children [12].

	Antibiotic	Symbol	Company
1	Ceftazidime 30 µg	CAZ	Bioanalyse/ Turkey
2	Cefriaxone 30 µg	CRO	Bioanalyse
3	Gentamicin 10 µg	CN	Bioanalyse
4	Nalidixic acid 30 µg	NA	Bioanalyse
5	Nitrofurantoin 300 µg	F	Bioanalyse
6	Trimethoprime 10 µg	Tr	Himedia

Statistical analysis:

Data were translated into a computerized database structure. Statistical analysis was computer assisted using SPSS (Statistical Package for Social Sciences) 2008, version 17. The charts were done by using curve estimation system (the quadratic mode). The statistical significance of association between two variables within the same group was assessed by Chi-square. LSD was used in comparison between two different groups. p-value less than 0.05 was considered statistically significant (SSPS, 2008).

Results and Discussion:

1. Renal function tests:

Blood urea values:

As recorded in Table (1), the blood urea levels were significantly higher ($P<0.001$) in both NS and CRF groups than that in the controls' blood. Our results agree with the findings of many studies [13,14,15,16,17] about CRF patients, and agree with Małyszko and Abeyagunawardena [18,19] about NS patients.

Our finding did not agree with that of Rizk *et al*. [20] because there was no statistically significant differences in their study groups; which may in-fact, have normal renal function [21].

The concentrations of urea in the blood depend not only on kidney function; but also on non-nephrogenous (non-renal) factors, like increased protein intake, accelerated protein catabolism, dehydration, and oligurea. Impaired renal perfusion and urinary tract obstruction can be possible causes of uremia (high blood urea levels). They may in turn cause damage to the kidney and thus cause renal uremia [22].

Serum creatinine values:

The levels of creatinine were much higher in the both sick groups' sera ($P<0.001$) than those of the healthy ones (Table 1).

This result agreed with the results of those about CRF [13,14,15,16]. Also it agreed with others [20,23,24] about NS patients.

Serum creatinine levels are not affected by a high protein diet as in the case of urea levels [15]. The creatinine level is more reliable parameter than urea level for identification of renal dysfunction, because the serum level of creatinine rises earlier than that of urea and the formation of creatinine is largely independent of protein metabolism. Any rise in blood creatinine is a sensitive indicator of kidney malfunction, because it is normally and rapidly removed from the blood and excreted [26]. Therefore, serum creatinine may evaluate the progression of renal disease [24].

Table (1): Biochemical tests results of nephrotic syndrome, chronic renal failure and control group.

Test	Group	Mean	S.D ±	Minimum value	Maximum value
Blood urea	NS	59.5	10.3	44.97	74.2
	CRF	96.2	14.4	75.9	115.1
	Control	29.5	6.9	20	44
Serum creatinine	NS	1.85	0.43	1.33	2.73
	CRF	4.93	1.52	2.3	6.9
	Control	0.87	0.14	0.7	1.2

Normal values:

Blood urea: (20-45) mg/dl.

Serum creatinine: (0.7-1.4) mg/dl.

The increase in urea and creatinine levels in serum (called renal impairment) could be due to the decrease in the number of functioning nephrons in addition to the subsequent hypertrophy of them [27].

2. The presence of casts in urine:

The detected urinary casts in the GUE of each patient in NS and CRF groups were not statistically significant in their presence (the p-value was 0.056). This is clarified in Table (2). No casts were detected in the urine samples of control group. It was recorded that only 9.1% of patients with renal disease showed cast nephropathy [28,29]. Some reference [20,29] mentioned that some children might occasionally have casts in their urine; such as hyaline, waxy and granular casts, which may be present especially when there is acute tubular necrosis [20,29]. Casts may be present especially when there is an acute tubular necrosisor the patient is at a risk of renal injury [30].

Table (2): The urinary casts' presence in sick groups as compared with control group.

Presence of casts	NS patients	CRF patients	Total
Positive	66.67%	42.3%	35
Negative	33.33%	57.7%	27
Total	100%	100%	62

3. The presence of albumin in urine:

The albuminuria was significant (p-value was 0.049). See table (3). This may indicate the increased glomerular permeability [31]. The urine samples of controls were albumin negative. This result is similar to others (14, 32) and [20,24] about CRF and NS respectively. Albuminuria indicates that the glomerulus is more permeable to serum proteins than usual, as it occurs in renal disease, because of glomerular injury [27]. The highest molecular weight plasma proteins, such as immunoglobulins and metal-binding proteins, can also pass the glomerulus in severe protienuria [33]. Moreover, the diet habits of children, particularly high milk uptake, may increase the effort on the kidney for albumin or protein filtration, and hence encourage renal disease development (34). The p-value was not markedly significant; this could be due to that not all the sick children had reached to ESRD [33].

Table (3): Albumin presence in the urine of each patients groups as compared with controls.

Albumin in urine	NS patients	CRF patients	Total
Positive	91.67%	73.08%	52
Negative	8.33%	26.92%	10
Total	100%	100%	62

4. Urinary tract infection occurrence with renal disease:

The incidence of UTI had a significant association with the type of the renal diseases. The p-value was 0.042. The percentage of the positive cultures was 50% in the CRF patients, while it was 25% in the NS patients. The data are shown in table (4). 25% of nephrotic children had UTIs; it is the same percentage in [34]. A large number of bacteria in the urinalysis of CRF patients suggests UTIs [14]. Some authors [35,36] reported that 12.2% and 9.1% respectively of children with renal failure were having UTIs.. While the positive cultures were 92.7% in CRF patients in [37]. In NS patients, the immunoglobulins are lost in proteinuria, especially in chronic glomerular disease placing the child at risk of bacterial infections and UTI [31]. Many factors, such as accumulation of uremic toxins and dialysis itself, may affect the immune system or make them susceptible to viral or bacterial infections. The wide use of catheters in order to facilitate urination could be the main cause of nosocomial UTI, in addition to uroscopy and the long period of hospitalization for dialysis [38].

Table (4): The significant association of urinary tract infection with renal disease.

Urinary tract infection	NS patients	CRF patients	Total
Positive	25%	50%	22
Negative	75%	50%	40
Total	100%	100%	62

5. Urinary tract infection occurrence with gender:

The gender was significantly related to the occurrence of UTI in the children in this study. The p-value was 0.044. The higher rates of UTIs were observed in females. The females' predisposition to UTI is higher than that of males as stated by many researchers [39,40,41]. Some references [42,43] noticed that males' percentage of UTI in pediatric patients was the greatest (61.53% and 51.72% respectively) as the majority of them were uncircumcised (penile foreskin was present). There was a slight male elevation as the males' percentage was higher (54%, 56%) than that of females (46%, 44%) respectively (36). There was no significant difference between both genders in the frequency of UTI in [35]. The shorter length of urethra in females and the close anatomical position with the contaminated vagina and anus opening can explain females' predisposition. While in males, the long urethra makes the ascending infection less frequent [44].

Table (5): The significant relationship between urinary tract infection and gender.

Urinary tract infection	Male patients	female patients	Total
Positive	28.3%	71.7%	22
Negative	56.25 %	43.25 %	40
Total	100%	100%	62

6. The bacteriological aspects:

The positive cultures of urine samples formed 35.5% of the total count of patients' samples. The negative results formed the remaining (64.5%). Urine cultures of controls were negative. The bacteria were identified by morphological and biochemical tests according to Bergey's manual; confirmed by using api 20E system. The isolates included the following bacteria:

- ***E. coli***: the majority of bacterial isolates was attributed to this bacterium (54.55% of UTI cases). Many references recorded that a variety of virulence factors of this bacterium has been identified, such as endotoxins in all strains, adhesins (pili) associated with UTIs and colonization factors. Capsule is present in some strains [8]. Children also may posses certain physiologic and anatomic characteristics that influence cell adhesiveness [45]. ***E. coli*** may be a less important cause of UTI after instrumentation of the UT (catheterization), or in patients with an underlying anatomic abnormality [27]. These bacteria colonize the intestine and periurethral region [43]. ***E. coli*** predominance was found in many studies [4,35,42,43,46] in children.
- ***Pseudomonas aeruginosa***: it was in 22.73% of positive cultures. This result may be overweighed to the ability of this bacterium to utilize a very wide range of carbon and energy sources and to grow over a wide temperature range. So, it is widespread in various areas, such as moist environments in hospitals. Patients usually become infected from the environmental sites. ***Pseudomonas aeruginosa*** produces some substances that act as an adhesins and cellular toxins, such as endotoxin, numerous exotoxins and exoenzymes [8,27]. This

bacterium was isolated only from 4 years old children (5%) in [46], while it was 7.9% in [35] as it has predilection for the old and the very young age groups. The main cause of ***Pseudomonas aeruginosa*** UTIs in renal disease patients could be catheterization. It causes disease in humans with abnormal host defense and isolated mainly from patients with nosocomial UTI [8,45].

- ***Klebsiella pneumoniae***: This bacterium formed 9.09% of total UTI pathogens similar to those were isolated in [46] ranked the third class. Unlike ***E. coli,*** this bacterium is rarely associated with infections except as opportunists in compromised patients (like CRF patients). It occasionally produces UTI and it is common in the recurrent UTIs in hospitalized patients as it is hospital-acquired [8,45].
- ***Proteus mirabilis***: it was in 9.09% of UTIs. This was not similar to the result of (35, 43, 46) because ***Proteus mirabilis*** was the third causative agent of UTI in children (17.3%, 16.55%, 15% and 14.6% respectively) in these studies. The low incidence of ***Proteus*** UTI in our study could be attributed to the fact that this bacterium is rarely isolated from the faeces of children (8). This type might be hospital acquired. It has characterized virulence factors; such as endotoxins and urease, which have possible role in pathogenesis (45). The rapid motility may contribute to its invasion of the UT. It can produce UTIs in human only when it leaves the intestinal tract (8).
- ***Morganella morganii***: This bacterium was isolated from one case only (4.55%) only. This result was the same as that of (42) about UTIs in children with renal problem. Lewczyk *et al*. (2001) stated that this bacterium have been mainly raised from the urine of (1-18) years old children (47). It is an important nosocomial pathogen. ***Morganella morganii*** is commonly isolated from patients who are chronically catheterized (8).

Table (6): Distribution of bacterial isolates according to the type of renal disease.

Bacteria	CRF group	NS group	Total	Percentage
E. coli	5	7	12	54.55%
Pseudomonas aeruginosa	5	0	5	22.73%
Klebsiella pneumoniae	2	0	2	9.09%
Proteus mirabilis	1	1	2	9.09%
Morganella morganii	0	1	1	4.55%
Total of positive cultures	13	9	22	35.5%
No growth	13	27	40	64.5%
Total	26	36	62	100%

The differences in the rates of infecting microorganisms probably due to multifactorial etiology of which different cultural habit, nutritional, socioeconomic and environmental factors and, also, might be due to age, gender or racial variations (46). These results are in agreement with those of (37) who isolated the same bacteria at the same classes from UTIs in patients with CRF. The primary reasons for ***E. coli*** and ***Pseudomonas aeruginosa*** predominance are their wide occurrence, ability to survive outside the human body for long periods and resistance to antibiotics (44). UTIs may result from ascension of pathogens via the urethra. Development of such an infection is also furthered by obstructive anomalies, instrumentation, neurogenic bladder or VUR

[48]. Nosocomial UTI has the higher rate in many Iraqi hospitals. This is significantly associated with the duration of hospitalization, urinary catheterization or urinary endoscopy [38].

7. The antibacterial aspects:

As shown in table (7), it is obvious that the antibiotic discs varied in their effects on the five types of bacteria. The significance was also different between cases according to the bacterial isolates and the drug used. Multiple drug resistance is common and might be under the control of transmissible plasmids [8].

♦ Nitrofurantoin, which had 0% of resistance, was the unique effective antibiotic on ***E. coli***. Nitrofurantoin was the most active agent against this bacterium in the results of [40,42] in Iraq. Nitrofurantoin is only used in urinary tract infections, and it is effective against Gram-positive and Gram-negative bacteria [48]. This bacterium was 100% resistant to both of Ceftazidime and Cefteriaxone. This resistance could be due to lack of Penicillin binding proteins (PBPs), the target cells, or poor permeation of bacteria by the drug [8]. ***E. coli*** was also resistant to Gentamicin, Nalidixic acid and Trimethoprime at a percentage of 100% for each of them. This disagreed with the [40] finding in Iraq, in which ***E. coli*** resistance against each one of those antibiotics was low. However, ***E. coli*** had recorded a high resistance to Trimethoprime (94.9%) in [49]. High rates of resistance were reported in [39] towards Gentamicin (75%) and Nalidixic acid (70%). The incidence of resistance in ***E. coli*** was variable and often it was plasmid-mediated. Multiple-drug resistance is widely present in ***E. coli*** populations [45].

♦ ***Pseudomonas aeruginosa*** was resistant to all antibiotics in this study. This bacterium is difficult to control due to the presence of multiple drug-resistant strains. This is a therapeutic problem. These bacteria are often characterized by multiple resistance [48]. Antibiotic resistance has probably developed by the transfer of R plasmids from other drug-resistant enteric Gram-negative bacteria; or because of its propensity to develop resistance during therapy [45]. ***Pseudomonas aeruginosa*** isolates were the most potent ones against tested antibiotics in other references [4,41,49,50].

♦ Multiple antibiotic resistance, usually plasmid-mediated, is common in ***Klebsiella pneumoniae*** UTIs [45]. This may be related to highly resistance of ***Klebsiella spp*** to several types of antibiotic, and many reports have indicated the presence of multi-drug resistance in ***Klebsiella pneumoniae*** causing UTI [35,50]. The percentages of resistance against Nalidixic acid and Nitrofurantoin were the lowest (0%). The same resistance percentage against Nalidixic acid was reported in [39]. Nalidixic acid is very effective in ***Klebsiella pneumoniae*** UTIs [8]. Nitrofurantoin is only used in urinary tract infections, and it is effective against Gram-positive and Gram-negative bacteria [48]. This bacterium had a percentage of 50% resistance against Gentamicin. That may be attributed to the production of modification enzymes of active groups (amine and carboxyl) in Gentamicin by ***Klebsiella pneumoniae***; so, it would be inactive. The resistance was 50% against Trimethoprime. The moderate Trimethoprime resistant was recorded [49]. The Trimethoprime resistance might be as a result of plasmid R transfer. The highest resistance rates appeared towards Cefteriaxone and Ceftazidime (100% of each). The significant increase towards these two Cephalosporins was present in Saudi Arabia [4]. A percentage of resistance equals to 92.7% was recorded towards Cefteriaxone and 68.3% towards Ceftazidime. Cephalosporins are widely used. Therefore, they encountered significantly raising resistance by ***Klebsiella*** [51].

♦ The resistance percentage of ***Proteus mirabilis*** isolates was 100% towards each of Gentamicin, Cefteriaxone and Nitrofurantoin. While it was 0% against Ceftazidime and Trimethoprime. The Nalidixic acid resistance rate was 50%. The findings were not agreeing with those of [39]in Kirkuk to Gentamicin. The big difference between the mentioned results and ours may be due to the difference in residents. A moderate resistance was recorded towards Gentamicin [36,42,49]. The Cefteriaxone resistance rate was 0% in [42]in contrast with our study rate that was 100%, while [43]rate was 79.2%. The high susceptibility towards Ceftazidime was recorded by [42]in 85.7%. Strains of ***Proteus mirabilis*** vary greatly in antibiotic sensitivity [8]. Strong resistance against Nitrofurantoin (100%) equals to this study rate was recorded in [49], while others [36,42,50]recorded lower resistance percentages (22%, 55% and 21% respectively) towards it. As in other Gram-negative bacilli in nosocomial infections, multiple drug resistance was present. It may attribute to transmissible plasmids [8]. Trimethoprime resistance rate was 100% by [49]. The study result may indicate a higher affinity of isolates for sulfonamides than for ρ-amenobenzoic acid (PABA) [8]. The moderate susceptibility towards Nalidixic acid was shown [36]. Nalidixic acid is useful as urinary antiseptic with low resistance rates [8].

♦ ***Morganella morganii*** was isolated from one case only, so the resistance pattern could be related to this strain. The variation of antibiotic susceptibility in ***Morganella morganii*** may attribute to genetic variation between isolates. So, the isolate which has the greatest number of resistance genes against some antibiotics will resist them [8].

Table (7): The resistance percentage of each type of bacteria according to the antibiotics discs.

Bacteria	**Antibiotics discs***					
	CAZ	**CRO**	**CN**	**NA**	**F**	**Tr**
E. coli	100%	100%	100%	100%	0%	100%
Pseudomonas aeruginosa	100%	100%	100%	100%	100%	100%
Klebsiella pneumoniae	100%	100%	50%	0%	0%	50%
Proteus mirabilis	0%	100%	100%	50%	100%	0%
Morganella morganii	100%	0%	100%	100%	0%	100%
p-value	0.001	0.001	0.063	0.003	0.001	0.003

*CAZ: Ceftazidime, CRO: Cefteriaxone, CN: Gentamicin, NA: Nalidixic acid, F: Nitrofurantoin, Tr: Trimethoprime.

There are many resistance mechanisms against antibiotics by different Gram-negative isolates [8]. Plasmid controlled resistance is increasing in coliforms because they are growing nosocomial problem (30). Nitrofurantoin was the most effective antibiotic with less bacterial resistance. This result agreed with many findings [10,24,23]. Nitrofurantoin can be considered as the first line antibiotics for prophylaxis and or treatment of patients with recurrent UTI [4]. The highest resistance rates were recorded against Gentamicin. The same result was proved [21].

Conclusion

1. ***E. coli*** had a predominance of more than half of UTIs in children with renal disease (54.55%), followed by ***Pseudomonas aeruginosa*** (22.73%). The other isolated bacteria were less frequent.
2. The highest resistance rates were recorded against Gentamicin.
3. GUE of both CRF and NS patients showed that casts presence in urine was not significant, while albuminuria was significant.
4. UTIs showed a significant relation with the type of renal disease and with gender.

References

1. Nühl, E. and Schaefer, F. (2008). Therapeutic strategies to slow chronic kidney disease progression. Pediatr. Nephrol. 23(5):705-16.

2. Bagga, A. and Mantana, M. (2005). Nephrotic syndrome in children. Indian J. Med. Ress. Vol. 122: 13-28.

3. Biassoni, L. and Chippington, S. (2008). Imaging in urinary tract infections: current strategies and new trends. Semin Nucl Med. 38(1):56-66.

4. Al-Harthi, A.A. and Al-Fifi, S.H. (2008). Antibiotic resistance pattern and empirical therapy for urinary tract infections in children. Saudi Med. J. 29(6): 854-858.

5. Polnay, L.; Hampshire, M. and Lakhanpaul, M. (2006). *Manual of pediatrics, an integrated approach.* 1st ed. Churchill Livingstone Elsevier. China. p. 14-16.

6. Keeson, A. M.; Talbott, T. M. and Gyory, A. Z. (1978). Microscopic examination of urine lancet. Vol.1: 809-811.

7. Sleigy, J. D. and Timburg, M. C. (1983). *Notes on medical microbiology.* Churchill Livingstone, New York. U.S.A.

8. Brooks, G. F.; Butel, J. S.; Carroll, K. C. and Morse, S.A. (2007). *Jawetz, Melnick & Adelberg's medical microbiology*. 24th ed. McGraw-Hill, New York. U.S.A. p. 249-266.

9. MacFaddin, J. F. (2000). *Biochemical tests for identification of medical bacteria*. 3rd. ed. The Williams and Wilkins. Baltimore, U.S.A.

10. Larry, M. and Kandel, J. (1996). *Microbiology essential and applications*. 2nd ed. Saunders company U.S.A. p: 23-31**.**

11. Clinical and laboratory standards institute (CLSI), (2009). Performance standards for antimicrobial susceptibility testing, Nineteenth informational supplement. Vol.29 (3): 31-70.

12. Beattie, J. and Carachi, R. (2005). *Practical pediatric problems*. 1st ed. Hodder Arnold, Chennai. India. p. 355-365.

13. Ismaeel, A.A. (2004). Study of trace and essential elements in sera of chronic renal failure before and after dialysis. M. Sc. Thesis. College of Ibn Al-Haitham. Baghdad University. Iraq.

14. Al-Kafagy, S. A. (2004). Biochemical study of patients serum and urine with renal failure and renal calculi diseases and the activity of some plant extracts in renal calculi destruction *in vitro*. M. Sc. Thesis. College of science. Al-Mustansiriyah University. Iraq.

15. Abdul-Wahid, H.H. (2004). Interleukin-6 level in Iraqi patients on maintenance hemodialysis therapy. M.Sc. thesis. College of medicine. University of Baghdad. Iraq.

16. Muftin, N. Q. (2008). Biochemical changes in Iraqi patients with chronic renal failure after renal dialysis. M.Sc. thesis. College of Science. Al-Mustansiriya University. Iraq.

17. Shakir, A. A. (2009). The effect of Chronic Renal Failure on Thyroid Hormones Specificity Measured fT3 in a Sample of Iraqi Patients. M Sc. thesis. College of medicine. University of Baghdad. Iraq.

18. Małyszko, J.S.1.; Małyszko, J.1.; Skrzydlewska, E.; Pawlak, K.1.; Myœliwiec, M.1. (2004). Protein Z and vitamin K in kidney disease. . Roczniki Akademii Medycznej Białymstoku · Vol. 49: 197-200.

19. Abeyagunawardena, A. S. (2005). Treatment of Steroid Sensitive Nephrotic Syndrome. Indian Journal of Pediatrics, Vol. 72: 763-770.

20. Rizk, M.K.; El-Nawawy, A.; Abdel-Kareem, E.; Amer, E.S.; El-Gezairy, D. and El-Shafei, A. Z. (2005). Serum interleukins and urinary microglobulin in children with idiopathic nephrotic syndrome. East Mediterr Health J. 11(5-6): 993-1002.

21. Fink, J. C.; Salmanullah, M.; Blahut, S. A.; Weir, M. R.; Sawyer, R.; Henrich, W.L. and Hise, M. K. (2001). The inevitability of renal function loss in patients with hupercreatinemia. Am. J. Nephrol. 21: 386-389.

22. George, C.R. (2002). Development of the idea of chronic renal failure. Am J. Nephrol. Vol.22: 231-239.

23. El-Gayar, A.; Sobh, M.; El-Kholy, A.; Sallam, S. and Wafa, E. (1994). Alterations of plasma free amino acids in nephrotic syndrome. Int Urol Nephrol. 26(6): 707-12.

24. Bantis, C.; Heering, P.J.; Luther, Y.; Aker, S.; Kuhr, N.; Grabensee, B. and Ivens, K. (2004). Influence of cytokine gene polymorphism on focal segmental glomerulosclerosis. Am. J. Nephrol. Vol.24: 427-431.

25. Albright, R. (2001). Acute renal failure: A practical update. Myo. Clin Proc. 76 (1): 67-74.

26. Champe, P. C.; Harvey, R. A. and Ferrier, D. R. (2008). *Lippincott's illustrated reviews: Biochemistry*.4th ed. Lippincott Williams & Wilkins, U.S.A. p 287-288.

27. Rudolph, A. M.; Kamei, R. K. and Overby, K. J. (2002). *Rudolph's fundamentals of pediatrics*. 3rd ed. McGraw-Hill. U.S.A. p. 612-620.

28. Prakash, J.; Mandal, A. K.; Vohra, R.; Wani, I. A.; Hota, J. K.; Raja, R. and Singh, U. (2009). Renal disease is a prodrome of multiple myeloma: an analysis of 50 patients from eastern India. Ren. Fail. 31(4): 267-71.

29. Assadi, F. (2008). Clinical Decisions in Pediatric Nephrology. 1st ed. Springer. U.S.A.

30. Hiromura, K. and Nojima, Y. (2007). Renal disease in multiple myeloma. Nippon Rinsho. 65(12): 2229-34.

31. Falk, R. J.; Jenette, J. C. and Nachman, P. H. (2004). *Primary glomerular diseases. In: Brenner & Rector's, the kidney*. 7th ed. Saunders. U.S.A. p: 681-742.

32. Hawez, S. A. (2008). Evaluation of Biochemical Parameters including Proteinuria in Patients with Chronic Renal Failure. M. Sc. thesis. College of science. Al-Muustansiriya University. Iraq.

33. Avner, E. D.; Harmon, W. E. and Niaudet, P. (2004). *Pediatric nephrology.* 5th ed. Lippincott Williams & Wilkins, Philadelphia. U.S.A. p: 503-568.

34. Al-Bewyaney, H. M. (2005). HLA-typing for Iraqi children with nephrotic syndrome. M. Sc. thesis. College of Health and Medical Technology. Foundation of Teaching Education. Iraq.

35. Al-Oqaily, A. Y. (2007). Urinary tract infection in febrile infants and young children. Ph. D. dissertation. College of medicine. University of Baghdad. Iraq.

36. Ali, A.Z. (2008). Urinary tract infection in infants and children. Higher diploma project. College of Health and Medical Technology. Foundation of Teaching Education. Iraq.

37. Telhe, M. H. (2009). Comparison of enzymatic activity of *Escherichia coli* isolated from urinary tract infection patients with renal failure and non-renal failure. M. Sc. thesis. College Science. Al-Mustansiriyah University. Iraq.

38. Abbass, B.I. (2007). Nosocomial infections in the urology department at surgical specialties hospital in Baghdad during the year 2005. Iraqi board dissertation. The scientific council of family and community medicine. Baghdad. Iraq.

39. Korshed, P. (2005). Bacteriological study of some pathogens causing urinary tract infections in patients attendung Azadi General Hospital in Kirkuk city. M.Sc. thesis. College of Education. University of Tikrit. Iraq.

40. Al-Hemidawi, T. F. (2005). Hemolytic Activity of *Escherichia coli* Isolated from Urinary Tract Infections and its Resistance to Antibiotics**.** Ph. D. dissertation. College of Science. Al-Mustansiriya University. Iraq.

41. Abdel-Rahman, M. I. (2006). Study of some bacteriological and immunological parameters in chronic urinary tract infection. M.Sc.thesis. College of Science. Al-Mustansiriyah University. Iraq.

42. Al-Mahdi, F. E. (2004). Bacteriological studies on urinary tract infections in children. M.Sc. thesis. College of Medicine. Al-Mustansiriyah University. Iraq.

43. Tawfiq, S. M. (2005). Isolation and characterization the bacteria cause urinary tract infection in pediatrics under three years and determination their resistance towards some modern antibiotics. M. Sc thesis. Al-Mustansiriyah University. Iraq.

44. Wilson, M. (2008). *Bacteriology of humans*.1st ed. Blackwell publishing. Oxford. U.K.

45. Goering, R.V.; Dockrell, H.M.; Wakelin, D.; Zuckerman, M.; Chiodini, P.L.; Roitt, I.M. and Mims, C. (2008). *Mims medical microbiology*. 4th ed. Mosby. China.

46. Al-Ma'amoory, R. J. (2005). Prevalence of asymptomatic urinary tract infection among pre-school female children in Babylon governorate. M.Sc. thesis. College of medicine. University of Baghdad. Iraq.

47. Lewczy, E.; Drulis-Kawa, Z.; Drosz K. and Jankawskijs (2001). Etiological factors of urinary tract infections in children. Pol. Mer. Lek. 11: 422.

48. Kayser, F. H.; Bienz, K. A.; Eckert, J. and Zinkernagel, R. M. (2005). Medical microbiology. 1st ed. Thieme Stuttgart, New York. U.S.A.

49. Al-Gherawi, R. S. (2009). Effect of *Cinnamomum zeylanicum* Bark and *Apium graveolens* L. Seed on the antibiotic resistant bacteria isolated from UTI female patients (*in vitro*). M. Sc. thesis. College of Science. Al-Mustansiriya University. Iraq.

50. Mashouf, R. Y.; Hooshang, B. and Javad Y. (2009). Urinary Tract Infections: Bacteriology and Antibiotic Resistance Patterns. Indian Pediatrics. Vol. 46: 617-620.

51. Bonnet, P. (2004). Growing group of extended-spectrum beta-lactamase: The CTX-M enzymes. Antimicrob. Agent Chemother. Vol. 48: 1-14.