
Prevalence of urinary tract infection among chronic renal failure in Khartoum state

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Abstract:

Introduction: Urinary tract infection (UTI) is one of the most common infections and it account for about 1 – 2% of all consultation. It has been estimated that more than six million out-patient visits and 300,000 hospital stays every year are due to UTIs. Approximately 10% of humans will have a UTI at some time during their lives. Despite an increasing population of patients with chronic renal insufficiency, the literature on the management of urinary tract infections (UTI) in these patients is sparse.

Objective: This study was conducted to detect the frequency of UTIs in chronic renal failure patients, isolate and identify the bacterial causative agents, determine the effective treatment and to study the validity of pyuria as indication to UTIs.

Methods: Descriptive cross-sectional study was conducted at Khartoum state dialysis centers. The period of the study enrollment extended from April to August 2005. One hundred and ten patients suffering from chronic renal failure (CRF) were admitted into the study, fifty five urine samples were collected from patients diagnosed as chronic renal insufficiency and treated by conservative management. The other fifty five samples were collected from patients diagnosed as end stage renal disease and treated by haemodialysis.

Results: Out of 110 CRF Patients, the frequency of UTIs (significant bacteruria) was 33 (30%) while there were no significant bacteruria in 77 (70.0%) of patients. *E. coli* was the commonest isolated organism 17(51.6%). Followed by *E. faecalis*, *Klebsiella*, *S. saprophyticus*, *S. aureus*, *Proteus mirabilis*, *Citrobacter davisea* that represent 6 (18.3%), 3 (9%), 3 (9%), 2 (6.1%), 1(3%), and 1(3%) respectively

Conclusion: frequency of UTIs (significant bacteruria) and significant pyuria were 30% and 42.7% respectively. This frequency of UTIs was higher in haemodialysis than those on conservative management patients. The pyuria had high sensitivity and specificity in detection of significant bacteruria and so can use as screening test in patients suspected of having UTIs including CRF patients.

Keywords: urinary tract infection, chronic renal failure

Introduction:

Sudan is a large multiethnic country with an area of about one million square miles and a population of about thirty million. The annual incidence of chronic renal failure (CRF) in Sudan is estimated to be about 70 – 140 per million population per year.¹

Urinary tract infection (UTI) is one of the most common infections and it account for about 1 – 2% of all consultation.² It has been estimated that more than six million out-patient visits and 300,000 hospital stays every year are due to UTIs.³⁻⁵ Approximately 10% of humans will have a UTI at some time during their lives.⁶

UTIs, can cause serious and permanent renal damage in patients with underlying urinary tract abnormalities, diabetes mellitus, pregnancy, immuno compremise or sickle cell

disease.⁷ In addition, UTIs are a leading cause of gram negative sepsis in hospitalized patients and are the origin of about half of all nosocomial infections caused by urinary catheters.⁶

Chronic pyelonephritis is responsible for about 20% of cases of CRF in adult in developed countries⁸ and for up to 29% in Africa.⁹

CRF is an irreversible deterioration in renal function progresses slowly over at least three months and can lead to permanent renal failure.¹⁰ CRF consists of persistent impairment of both glomerular and tubular function of gradual onset and of such severity that the kidneys are no longer able to keep the internal environment normal.¹¹

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The prevalence of ESRD is 96 cases/ million population / year. 500 – 600 /million population on renal replacement therapy with mortality rate 22.4 /100 patients / year.¹²⁾

The annual incidence of ESRD varies in different countries. It is estimated to be about 25 per million population (pmp) in developing country, 58.6 pmp in Europe, 169 pmp in USA and 194.2 pmp in Japan.¹³⁾

The incidence of ESRD differs according to age, sex and race, being more common in males, higher in the elderly. Also the incidence higher in black people by four fold compared with white people.

The causes of CRF may be classified as the following²⁾:-

- Congenital and inherited diseases: such as polycystic kidney disease, Alports syndrome and fubrys disease.
- Vascular diseases: such as vasculitides and arteriosclerosis.
- Glomerular diseases: Including primary and secondary glomerulonephritis.
- Interstitial diseases: including chronic pyelonephritis, vesicoureteric reflux, tuberculosis, analgestic nephropathy, nephrocalcinosis, schistosomiasis, diabetic nephropathy and hypertension.
- Obstructive uropathy: obstruction of the urinary tract by stones, fibrosis or tumours.

In tropical countries, including Sudan, endemic disease are major causes of CRF. *Plasmodium malariae* and *Schistosoma haematobium* were reported to be among the most common causes of CRF in Nigeria and Zimbabwe respectively.¹⁴⁾

Patients with CRF are more susceptible to develop UTIs, because of altered immunity, uraemia, low urinary flow rate and urinary concentration defects, all of which favour growth and multiplication of bacteria.¹⁵⁾ Furthermore, UTIs can lead to more deterioration of renal function in patients with CRF due to many factors including septicaemia, fluid depletion leading to hypotension and reduced cardiac output with reduced renal perfusion and obstruction of the urinary tract by sloughed papillae, stones or plugs of pus.¹⁶⁾

Methods:

One hundred and ten patients suffering from CRF were admitted into the study during the period of April to August 2005. Fifty five urine samples were collected from patients diagnosed as chronic renal insufficiency and

treated by conservative management. The other fifty five samples were collected from patients diagnosed as end stage renal disease and treated by haemodialysis.

Each specimen was inoculated on cystine lactose electrolyte deficiency (CLED) medium by using sterile standard loop of 0.001 microlitre in diameter. All cultures were aerobically incubated at 37⁰C for 24 hours

Microscopic examination was done by placed 2 to 3 drops of urine on a clean dry slide and covered with cover glass and using low and high power field to detect the presence of pus cells, red blood cells, epithelial cells, yeast cells, crystals, casts, ova or other materials.¹⁷⁾

The presence of 10⁵ cfu/ ml or more colony forming units of bacteria per millilitre of urine (100 or more colonies on the media) was regarded as significant bacteruria. The count of less than 10⁵ cfu/ ml consider as insignificant result.¹⁷⁾

Colonies were identify by gram stain and biochemical test, the isolated bacteria were tested for antibiotic sensitivity using disc diffusion method

Results:

There were different ages ranging from 11 to 85 years old with mean age of 44.63. figure[1]. And according to residence, most of them from Khartoum 46 patients (41.8%), followed by Omdurman 42 (38.2%) and then Bahri 22 (20%) Figure [2].

According to duration of CRF most study population were belong to more than 2 years group (62.7%). Followed by less than one year group and then from 1 – 2 year group (26.4 and 10.9% respectively).

Thirty one (28.2%) of CRF patients had no symptoms of UTIs and 43 (39.1%) had past history of UTIs.

Out of 110 CRF Patients, the frequency of UTIs (significant bacteruria) was 33 (30%) while there were no significant bacteruria in 77 (70.0%) of patients.

As summarized in table [1], the rate of UTIs was higher on haemodialysis (41.8%) than conservative management patients (18.2%).

Figure [4] showed that, the females were more infected with UTIs than males (51.5 % and 48.5% respectively).

Out of the total 30 (33%) isolates, 17 (51.6%) was *E. coli* which is the commonest isolated organism. Followed by *E. faecalis*, *Klebsiella*, *S. saprophyticus*, *S. aureus*, *Proteus mirabilis*, *Citrobacter davisea* that represent 6 (18.3%), 3

(9%), 3 (9%), 2 (6.1%), 1(3%), and 1(3%) respectively Figure [3].

As shown in figure [5] 22 (66.7%) of total isolates were sensitive to Meropenem. Followed by Chloramphenicol 12 (63.6%), then 15 (45.5%) to both Amikacin and Cefoxitin, 11 (33.3%) to Nitrofurantoin, 10 (30.3%) to Gentamicin, Norfloxacin and Ampicillin and only 4 (12.1%) to Nalidixic acid.

There was significant pyuria (10 or more pus cells / hpf) in 47 (42.7%) of CRF patients while 63 (57.3%) patients had normal pus cells

count in urine. The significant pyuria was higher in haemodialysis (56.4%) than in conservative management patients (29.1%). Table [2].

As indicated in figure [6] there was no strong relation between the past history of UTIs and acquiring new UTIs.

Figure [7] show the relation between the UTIs and the duration of CRF.

The sensitivity and specificity of significant pyuria as indication to UTIs was 81.9% and 74.0% respectively. Table [3].

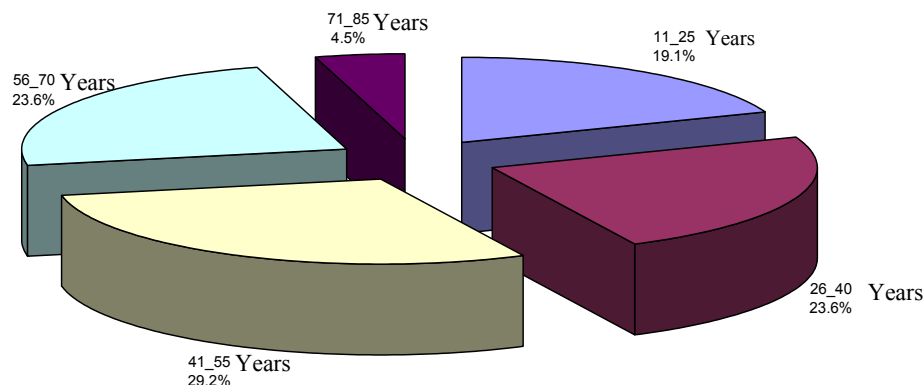


Fig. 1: Age distribution of study group

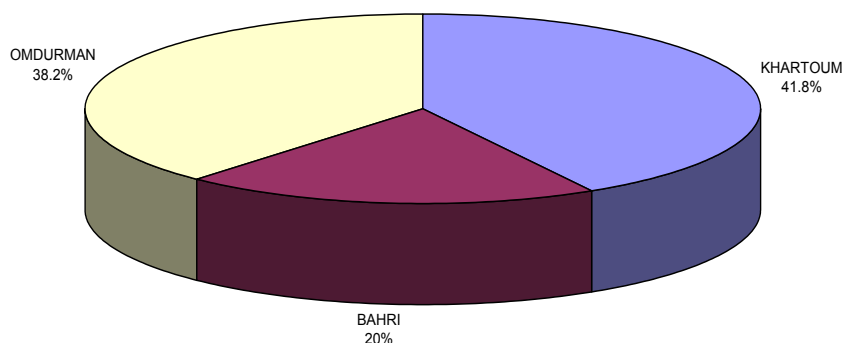


Fig. 2: Geographical distribution of study group in Khartoum State

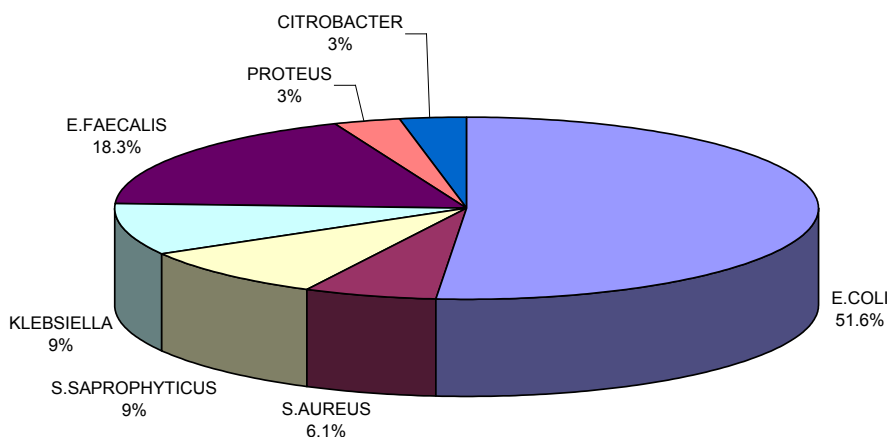


Fig. 3: The types and percentages of different isolates causing UTIs among CRF patients.

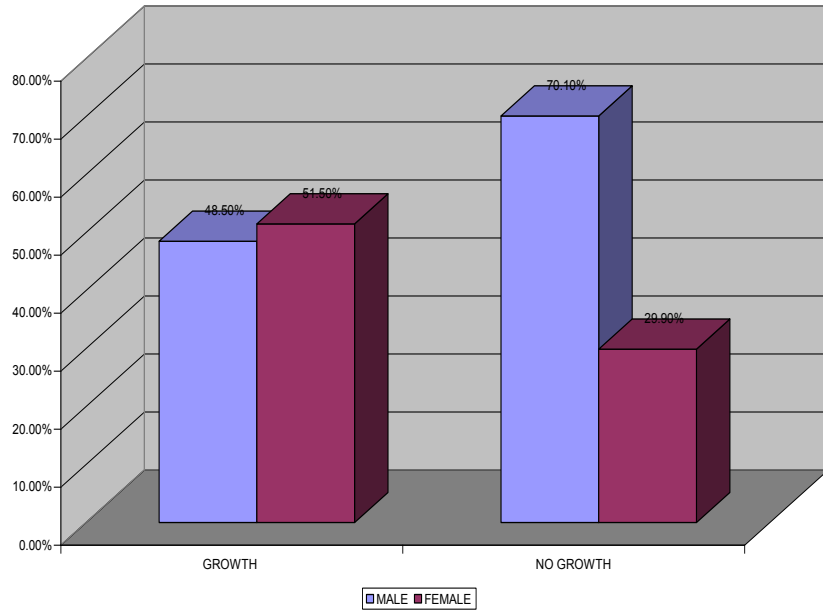


Fig. 4: The relation between the sex of the patients and the result of urine culture among the study group.

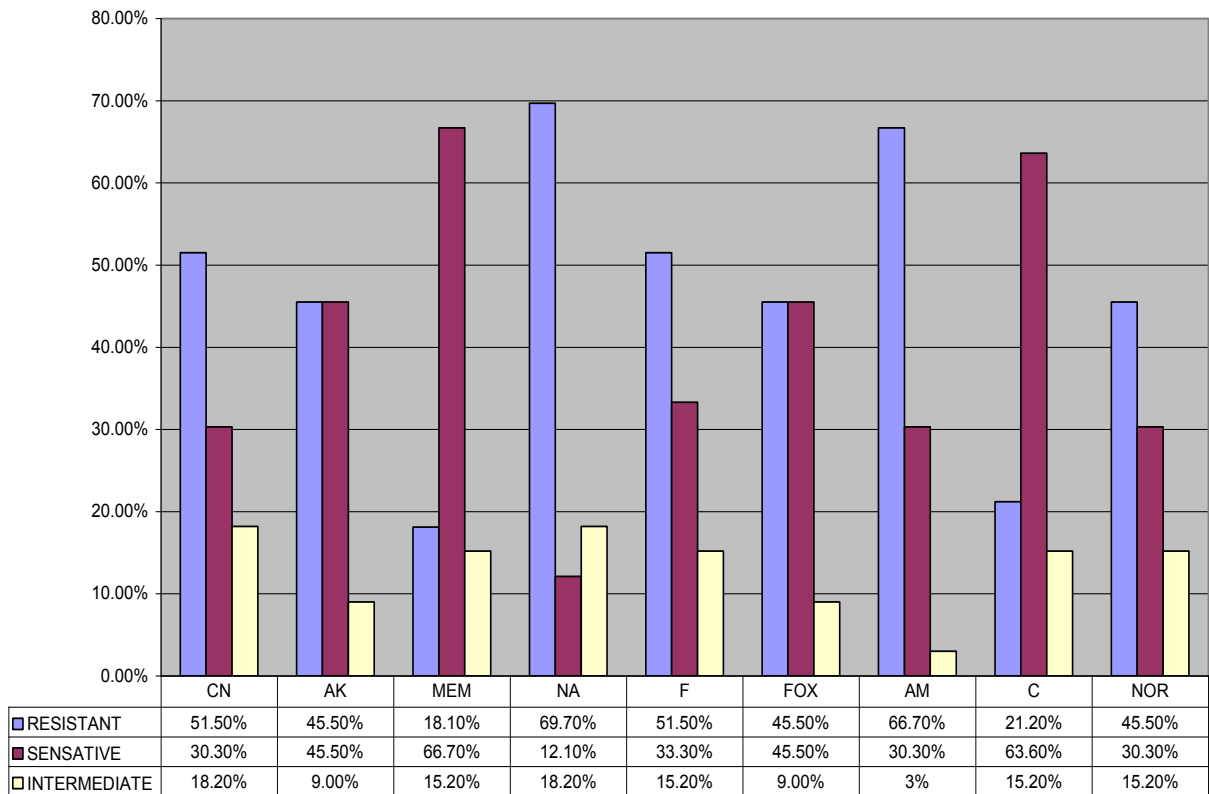


Fig. 5: The pattern of antibiotic sensitivity of total isolates causing UTIs in study group.

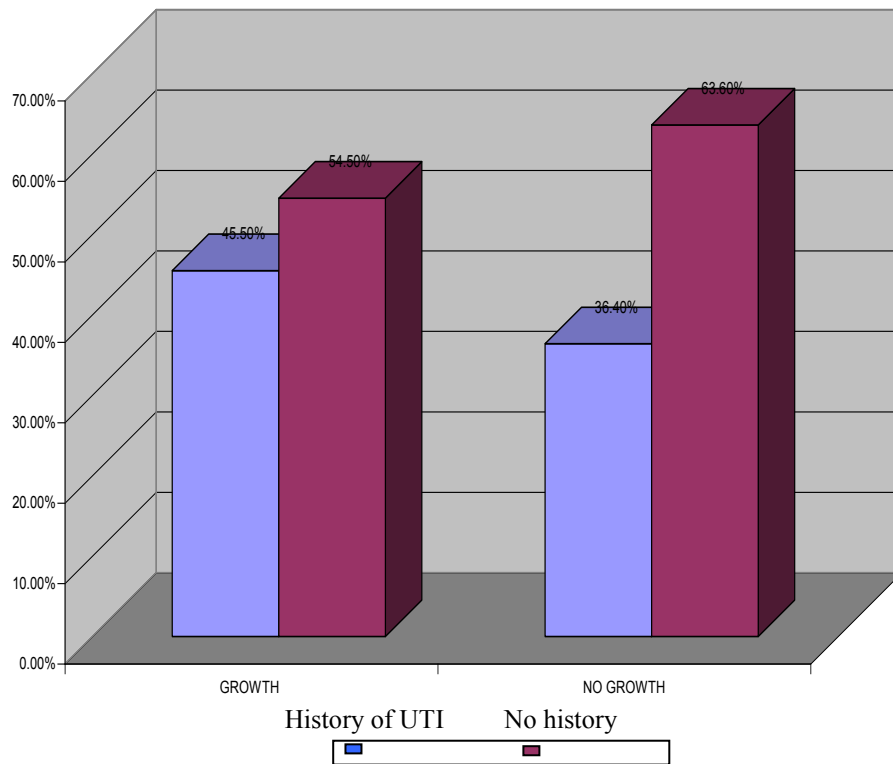


Fig. 6: The relation between the past history UTIs and the result of urine culture among study group.

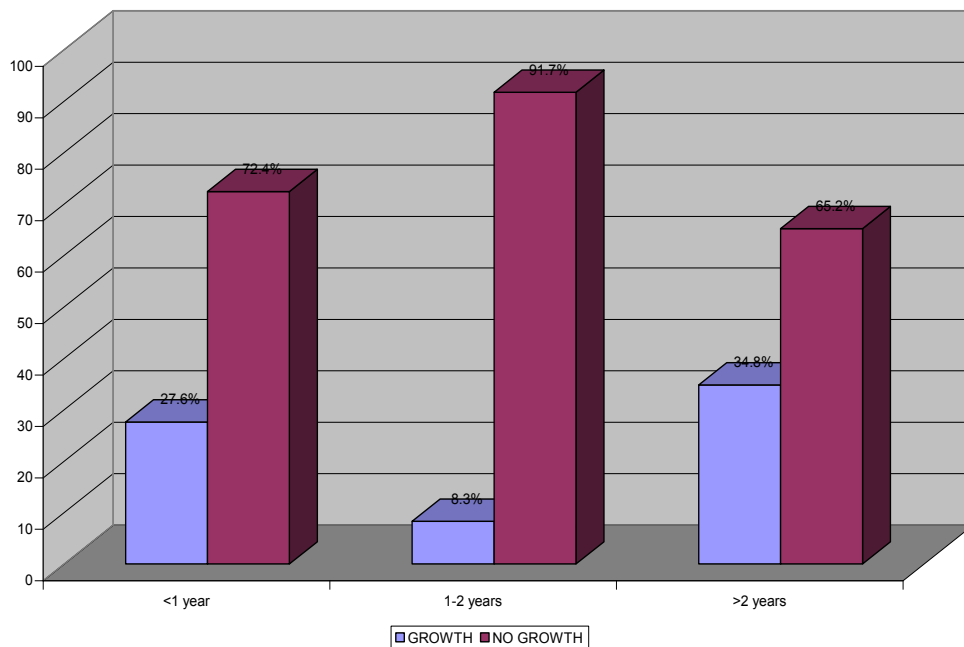


Fig. 7: The relation between the result of urine culture and the duration of CRF among study group.

Table 1: The frequency of significant and insignificant growth among the study group:-

Group	Haemodialysis		Conservative Management		Total	
	N	%	N	%	N	%
Significant growth	23	41.8	10	18.2	33	30
In Significant growth	32	58.2	45	81.8	77	70
Total	55	100	55	100	110	100

Table 2: The results of pyuria as detected by microscopic urinalysis among the study group:-

Group	Haemodialysis		Conservative Management		Total	
	N	%	N	%	N	%
Significant	31	56.4	16	29.1	47	42.7
In Significant	24	43.6	39	70.9	63	57.3
Total	55	100	55	100	110	100

Table 3: Comparison between the result of pyuria and urine culture in detection of UTIs:-

		Culture		Total
		Significant Growth	In Significant Growth	
	Count	Number	Number	Number
pyuria	Significant	True + ve 27	False + ve 20	47
	In Significant	False - ve 6	True - ve 57	63
	Total	33	77	110

Discussion:

In the present study the frequency of UTIs (significant bacteruria) among of CRF patients was 30% and the significant pyuria was 42.7%. These results were slightly higher than those detected by Saitoh, *et. al.*,¹⁰ in study done in Japan in 1985 who found a rate of 27% of significant bacteruria and 38% significant pyuria.

In this study the rate of bacteruria in conservative management patients was 18.2%, which is relatively lower than that detected in 1973 by Nielsen, *et.al.*,¹⁸ as 22% of patients.

The rate of bacteruria and pyuria among haemodialysis group was 41.8% and 56.4% respectively. This results are higher than those detected in America in 1993 by Chaudry, *et.al.*,¹⁹ which were 25% and 31% respectively. The rate of infection was also higher in this study compared with the study done by Kolendo, *et.al.*,²⁰ in 1996 who investigated 112 patients on haemodialysis and found that the frequency of UTIs was 27.7%. the current study findings may be explained by more deterioration of renal function and increasing the stone formation on the study patients which consider as predisposing factors leading to a higher rate of infection. The increase in the rate of UTIs in haemodialysis group if compared with conservative management

patients explained by more susceptibility to infections (including UTIs) on haemodialysis patients as result of more immune deficiency.

E. coli was the commonest organism isolated from CRF patients accounting for 51.6% of all significant growths, followed by *E.faecalis* in 18.3%. Then *Klebsiella* and *S.saprophyticus* accounting for an equal rate of 9%. *S.aureus* was isolated from 6.1%. *Proteus mirabilis* and *Citrobacter davisae* isolated with an equal rate of 3%. This result is similar to findings of Saitoh, *et.al.*,¹⁰ in 1985 who found that the commonest cause of UTIs in CRF patients was *E.coli* accounting for 50% of cause, followed by *Enterococcus faecalis* (27%), *Streptococcus* (12%) and *S.epidermidis* (9%). Also, Mamoun, *et. al.*,²¹ in study done in Sudan at Soba hospital in 1990, found that *E.coli* was the commonest cause of UTIs in patients with clinical features of UTIs accounting for 60% of cases and this was followed by *Coliforms* (8%), *Klebsiella* (8%), *Proteus* (6%) and *Pseudomonas* (6%).

This study revealed that, the best tested antibiotics, were Meropenem and chloramphenicol with sensitivity of 66.7% and 63.6% respectively. Followed by Amikacin and Cefoxitin (45.5% each). Then nitrofurantoin (33.3%). Gentamicin, Norfloxacin and Ampicillin (30.3% each) but Nalidixic acid

showed the lowest sensitivity (12.1%). Compared to another study conducted in 1990 in Soba hospital by Mamoun, *et al.*²¹ Which showed that, the best antibiotics with high sensitivity rates were Nalidixic acid, Gentamicin and Nitrofurantoin. This variable results may be due to genetic mutation of bacteria, inadequate drug therapy in repeated UTIs and abuse of antimicrobial agents by wide range of Sudanese patients lead to production of drug resistance and multiplication of resistance organisms.

Although, Meropenem was the most effective antibiotic, it does not use routinely because it's very expensive.

This study showed that, females were more affected by UTIs than males and this is similar to the study done by Wanger, *et al.*²² in 1996 who found the same results.

Out of total, 39.1% of patients with CRF had past history of one or more episodes of UTIs. This is explained by the increased risk of infections (including UTIs) in CRF patients. There was no strong relation found between the past history of UTIs with the significant growth on urine culture but no data was available on the previous episodes of UTIs in CRF patients from other studies to explain this relation.

Asymptomatic UTIs observed only in 24.2% of total CRF patients, these findings are differ compared to previous study done in India in 1997 by Gauba, *et al.*⁶¹ who reported that the majority of UTIs were a symptomatic. This may be due to the similarity between the

symptoms of CRF (like loin pain) with symptoms of UTIs and so can not differentiate if the symptoms due to CRF or UTIs.

The duration of CRF affect the frequency of UTIs. For duration less than one year, the frequency of UTIs was 24.2% and it increased to the highest level in duration of more than 2 years (72.7%). The decrease in the frequency of UTIs in duration from 1 to 2 years (8.3%) maybe due to small sample size in this group (10.9%) compared with the number of patients taken from more than 2 years and less than 1 year group (62.7% and 26.4% respectively) Davison, *et al.*² in 1992 showed that the UTIs increase when duration of CRF exceed for longer time.

The comparison between the result of pyuria and urine culture in detection of UTIs was performed by calculating the sensitivity and specificity according to the method of Galen and Gambio.²³ The pyuria give sensitivity of 81.8% and specificity of 74% in detection of significant bacteruria. This is almost similar to that detected in 1995 by Bailey, *et al.*²⁴ who studies urinalysis predictive of urine culture results and found that, the sensitivity of urinalysis pyuria was 81.6% and specificity was 65.1%. Other study done in Israel in 1999 by Waisman, *et al.*²⁵ to detect the validity of the uriscreen test for early detection of UTIs should that, the sensitivity of urinalysis was 88.6% and specificity of 88.4%. Therefore, pyuria can be used as screening test to detect UTIs in CRF patients.

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