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Frequency of urinary tract infection among cancer patients receiving the chemotherapeutic drug at radiation and isotopes center of Khartoum (RICK)

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Abstract

Background: Chemotherapy often decreases the number of white blood cells in the body, Neutropenic patients, usually have their course of treatment interrupted and stopped unless blood cells return to normal.

Aims: To isolate and identify the bacterial causative agent of UTI among cancer patients receiving a chemotherapeutic drug. Also, evaluation of antibiotics used for treatment and the incidence of infection in males, females and children

Methods: Fifty midstream urine (MSU) specimens were collected from patients who undergo chemotherapy treatment then specimens were analyzed to isolate and identify bacterial pathogens, then standard AST was performed to screen the antibiogram of isolates

Results: Out of 50 urine specimens investigated, 23 different isolates were recovered giving a percentage of (46%), and 27 urine specimens (54%) showed no growth. *S. aureus* (26.1%) followed by *E.coli* (21.7%), *S. epidermidis* (17.4%), *K. pneumoniae* (13%), *p. mirabilis* (13%), and *Ps. aeruginosa* (8.7%).

Conclusion: The most frequent isolate is *S. aureus* and *E.coli.* Females and adults were more infected than males and children respectively.

Keywords: UTI, a chemotherapeutic drug, and RICK

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Introduction

The therapies that are usually used to treat cancer (for example chemotherapy), often decrease the number of white blood cells in the body. White blood cells fight bacterial, fungal, and viral infections (1). Most patients with cancer who have few white blood cells have a very weak immune system and can't fight infection well. They get infections easily and as result can die, particularly if the infections are not recognized early and treated (2). The spectrum of bacterial and fungal infections undergo periodic change and is impacted by several factors including the use of antibacterial/antifungal prophylaxis, the use of foreign medical devices, and the nature and intensity of the antineoplastic used (3).

Fever is usually one of the earliest signs of infection. Thus, powerful antibiotics are used to treat an infection in a patient with cancer whose white blood cell count is low. Combinations of antibiotics that work against many different types of bacteria are successful.

Neutropenic patients, usually have their course of treatment interrupted and stopped unless blood cells return to normal (4).

Methods

Study area: The study was carried out at the Radiation and Isotope Center Khartoum (RICK).

Collection of specimens: Fifty midstream urine (MSU) specimens were collected from patients who undergo chemotherapy treatment, in sterile, dry, wide-mouth, leak-proof containers. These specimens were collected from the Radiation and Isotope Center of Khartoum (RICK).The specimens were immediately inoculated on blood agar and MacConkey agar (5).

Isolation and identification

Using several media and biochemical test for Isolation, identification and susceptibility of the antibiotics to the bacterial causative agent of UTI, urine sample cultivated on MacConkey agar medium and Blood agar (HiMedia Laboratories Pvt Ltd, India), to isolate the bacteria, according to colonial morphology and gram stain the isolated microorganism identified by set of biochemical test including), catalase test, Coagulase test, Deoxyribonuclease agar (DNase), Kligler iron agar (KIA), Simmon's citrate media, Christensen, urea agar media, Mannitol salt agar (HiMedia Laboratories Pvt Ltd, India).

Kirby-Bauer method used to detect the sensitivity of isolated bacteria to the antibiotic (table 1) using Muller Hinton agar (HiMedia Laboratories Pvt Ltd, India).

Table 1: Antimicrobial drugs

Antimicrobial agents	Symbol	Disc potency	Diameter of zone of inhibition (mm)		
			Susceptible	Intermediate	Resistant
Ampicillin	AMP	10 mcg	≥17	_	≤16
Chloramphenicol	C	30 mcg	≥18	13-17	≤12
Ciprofloxacin	CIP	5 mcg	≥21	16-20	≤15
Erythromycin	E	15 mcg	≥23	14-22	≤13
Gentamicin	GEN	10 mcg	≥15	13-14	≤12
Methicillin	MET	5mcg	≥14	10-13	≤9
Nitrofurantoin	NIT	300mcg	≥17	15-16	≤14
Novobiocin	NV	30mcg	≥17	18-21	≤22
Oxacillin	OX	1 mcg	≥20	11-12	≤10
Penicillin	P	10 units	≥29	-	≤28
Tetracycline	TE	30 mcg	≥15	12-14	≤11

Results

During the period between February and March 2022, a total of 50 samples was collected from cancer patients who receive chemotherapy treatment (29) were female and (21) were male, (78%) of female were infected and (22%) of male were infected, (Table 5).

The incidence of infection among the different ages was (26%) in children and (74%) in adults, (Table 6).

From the 50 urine specimens investigated, 23 different isolates were recovered giving a percentage of (46%), and 27 urine specimens (54%) were clear, (figure 1). The predominant isolate was *S.aureus* (26.1%) followed by *E.coli* (21.7%), *S.epidermidis* (17.4%), *K.pneumoniae* (13%), *P.mirabilis* (13%) and *Ps.aeruginosa* (8.7%), (Figure 2).

In-vitro sensitivity tests for four antimicrobial agents by the Kirby-Bauer method were carried out on (10) Gram`s positive organisms and (13) of Gram`s negative organisms.

S.aureus susceptibility, using four antibiotics, showed that Chloramphenicol is highly active (100%), followed by fusidic acid (83%), penicillin (67%), and methicillin (50%), (Figure 3).

S.epidermidis susceptibility, using four antibiotics, showed that gentamicin was highly active (100%), followed by Chloramphenicol (75%), penicillin (25%), and then methicillin (0%), (Figure 4).

E.coli susceptibility, using four antibiotics, showed that Chloramphenicol is highly active (80%), followed by ampicillin and nitrofurantoin (60%), and ciprofloxacin (40%), (Figure 5).

Proteus mirabilis susceptibility, using four antibiotics, showed that Chloramphenicol, ciprofloxacin, and tetracycline were highly active (100%), followed by ampicillin (67%), (Figure 6).

Klebsiella pneumoniae susceptibility, using four antibiotics, showed that ciprofloxacin was highly active (100%) followed by Chloramphenicol, tetracycline (67%), and nitrofurantoin (0%), (Figure 7).

Pseudomonas aeruginosa susceptibility, using four antibiotics, showed that Chloramphenicol and ciprofloxacin were highly active (100%), followed by ampicillin (50%), nitrofurantoin (0%), (Figure 8).

Table 2: Morphological characteristics on CLED agar and Gram`s reaction of isolates

Organisms	CLED	Gram stain
E. coli	Moderate, moist, yellow L.F Colonies	Gram- negative bacilli
S. aureus	Small, moist, yellow L.F Colonies	Gram- positive cocci
Ps. Aeruginosa	Moderate, moist, blue-green NLF colonies	Gram- negative bacilli
K. pneumonia	Large, mucoid, yellow L.F Colonies	Gram- negative bacilli
S. epidermidis	Small, moist, yellow LF Colonies	Gram- positive cocci
P. mirabilis	Moderate, moist, blue-green NLF colonies	Gram- negative bacilli

Table 3: Biochemical tests

species	Biochemical tests						
	Indole test	Urease test	Citrate test	KIA			
				slope	butt	Gas	H2S
E. coli	positive	Negative	Negative	Y	Y	+ve	-ve
K. pneumoniae	Negative	Positive	Positive	Y	Y	+ve	-ve
Ps. aeruginosa	Negative	Negative	Positive	R	R	-ve	-ve
P. mirabilis	Negative	positive	Positive	R	Y	+ve	+ve

Table 4: Biochemical test of isolated gram positive bacteria

Species	Biochemical tests		
	Mannitol fermentation	Catalase test	DNase test
S. aureus	positive	Positive	positive
S. epidermidis	negative	positive	negative

Table 5: Incidence of urinary tract infection among both males and females who receive chemotherapeutic drugs:

Gender	Urinary tract infection	
	Frequency	percentage
Female	18/23	78%
Male	5/23	22%

Table 6: Incidence of urinary tract infection among adults and children who receive chemotherapeutic drugs

Age	Urinary tract infection	
	Frequency	percentage
Adult	17/23	74%
Children	6/23	26%

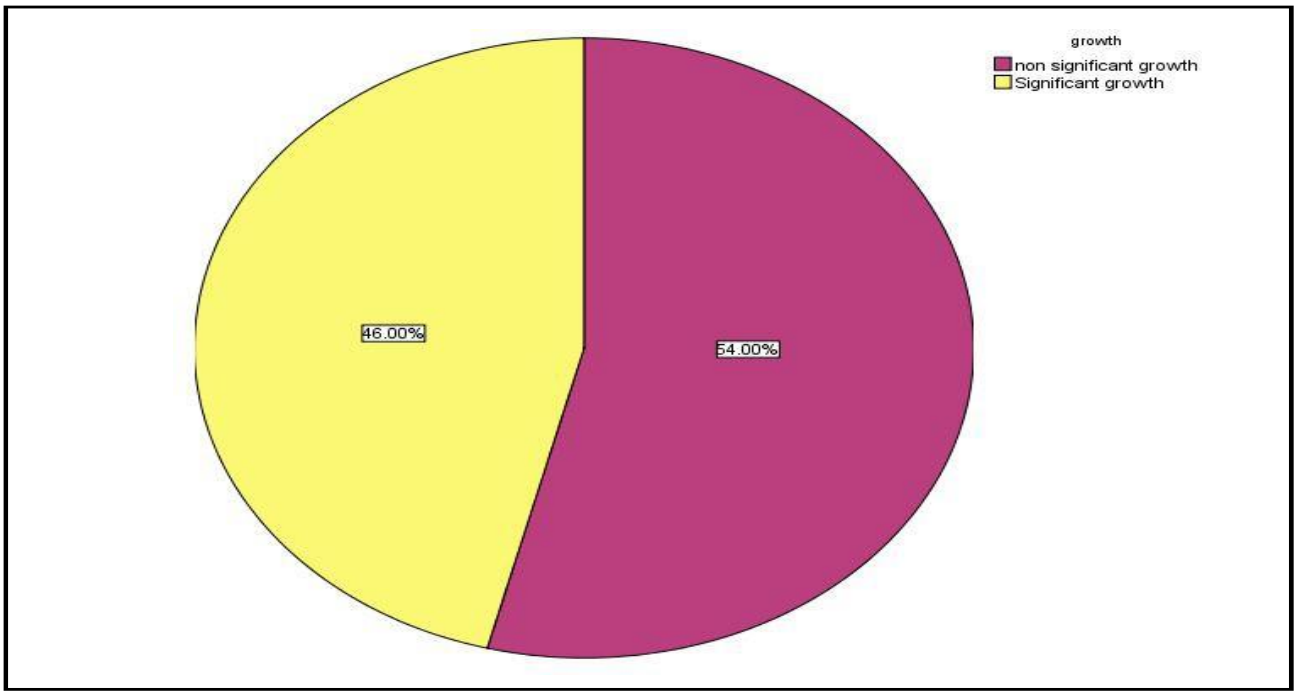

Figure 1: Bacterial growth on CLED media for primary isolation of causative agents.

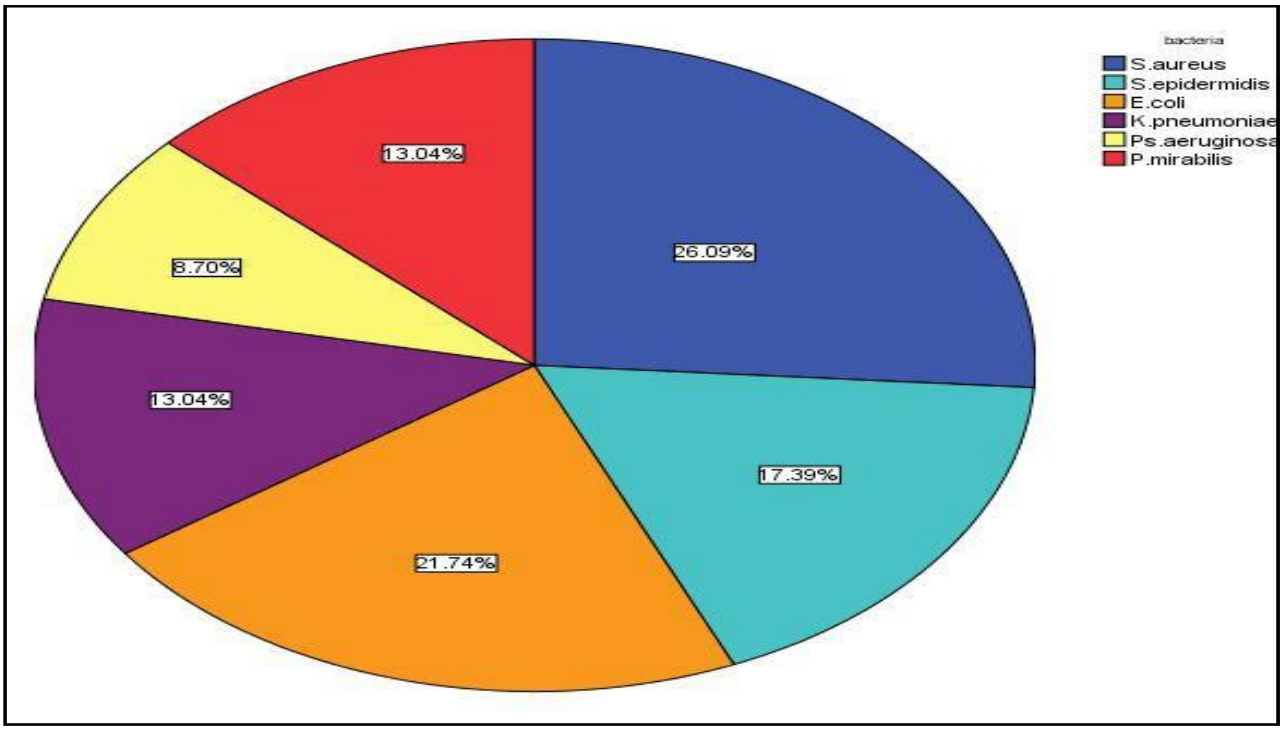

Figure 2: Percentage of the isolated bacteria that cause urinary tract infection.

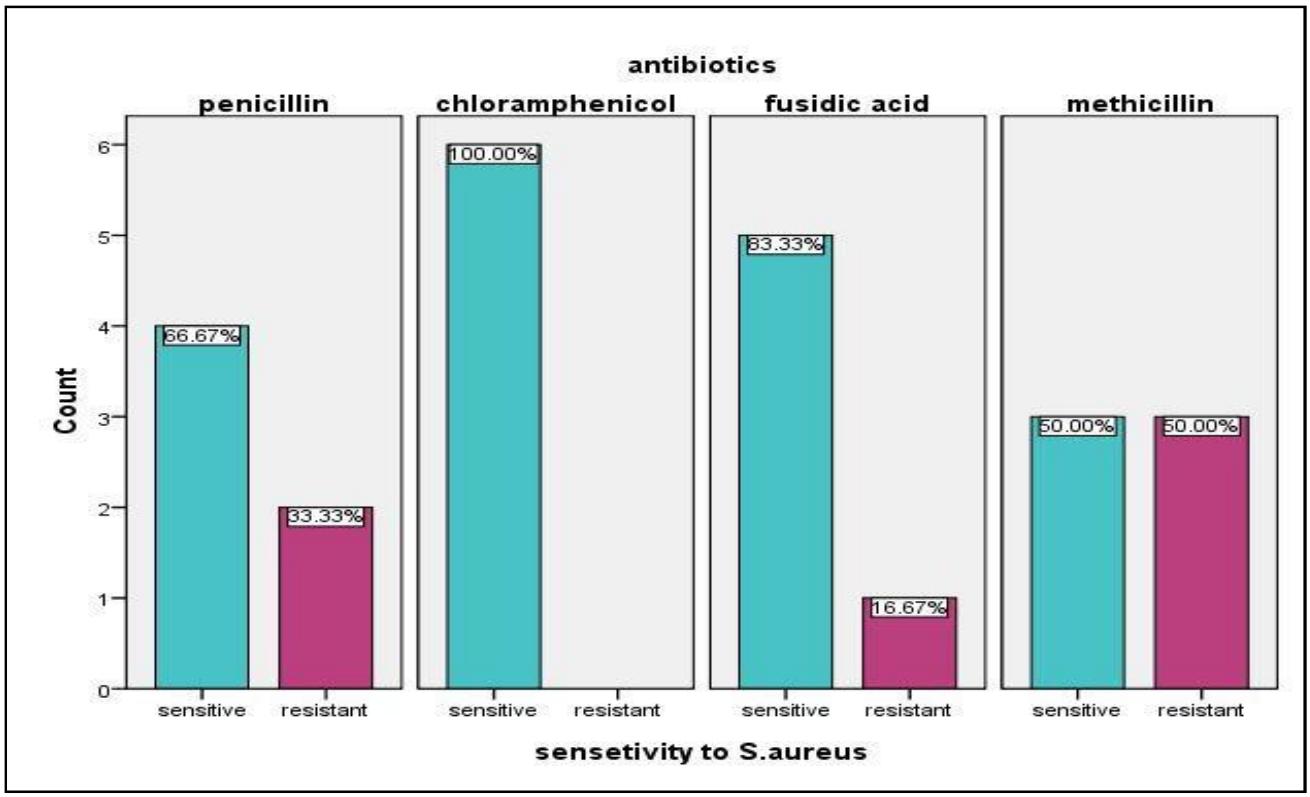

Figure 3: Antimicrobial susceptibility test for *S. aureus*

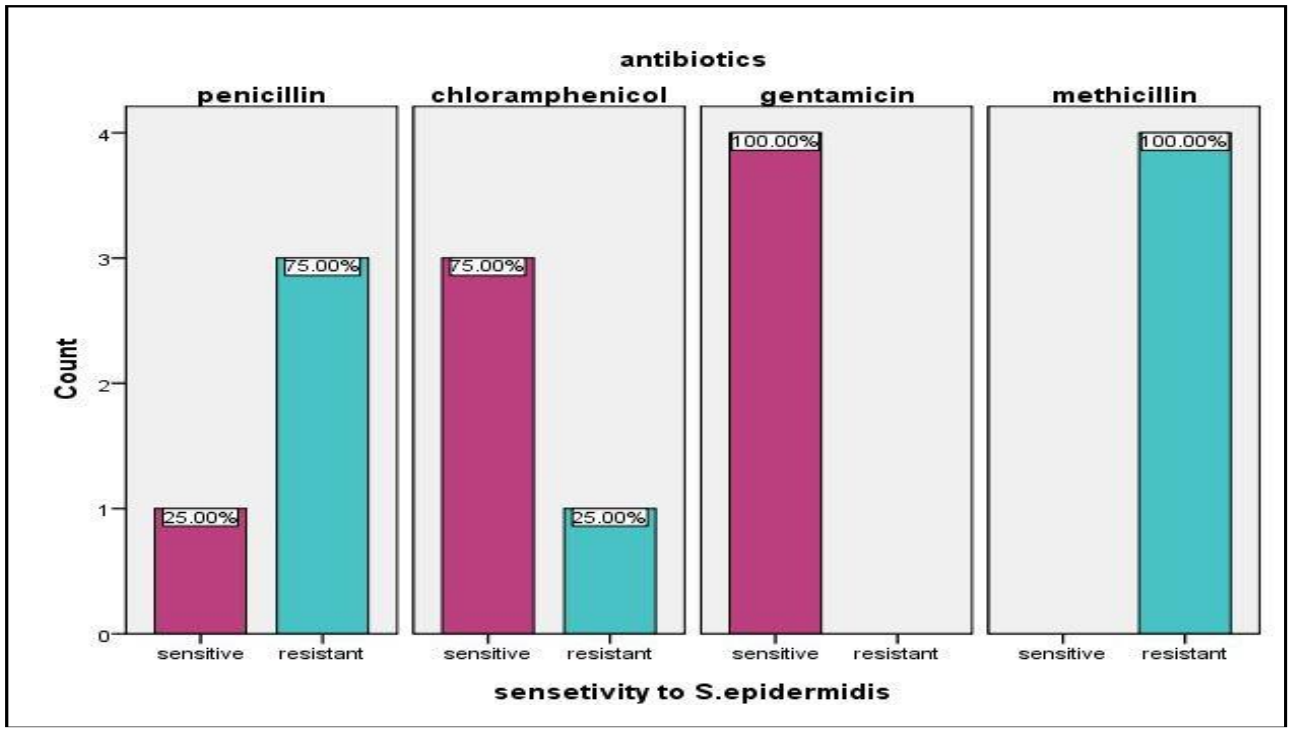

Figure 4: Antimicrobial susceptibility test for *S. epidermidis*

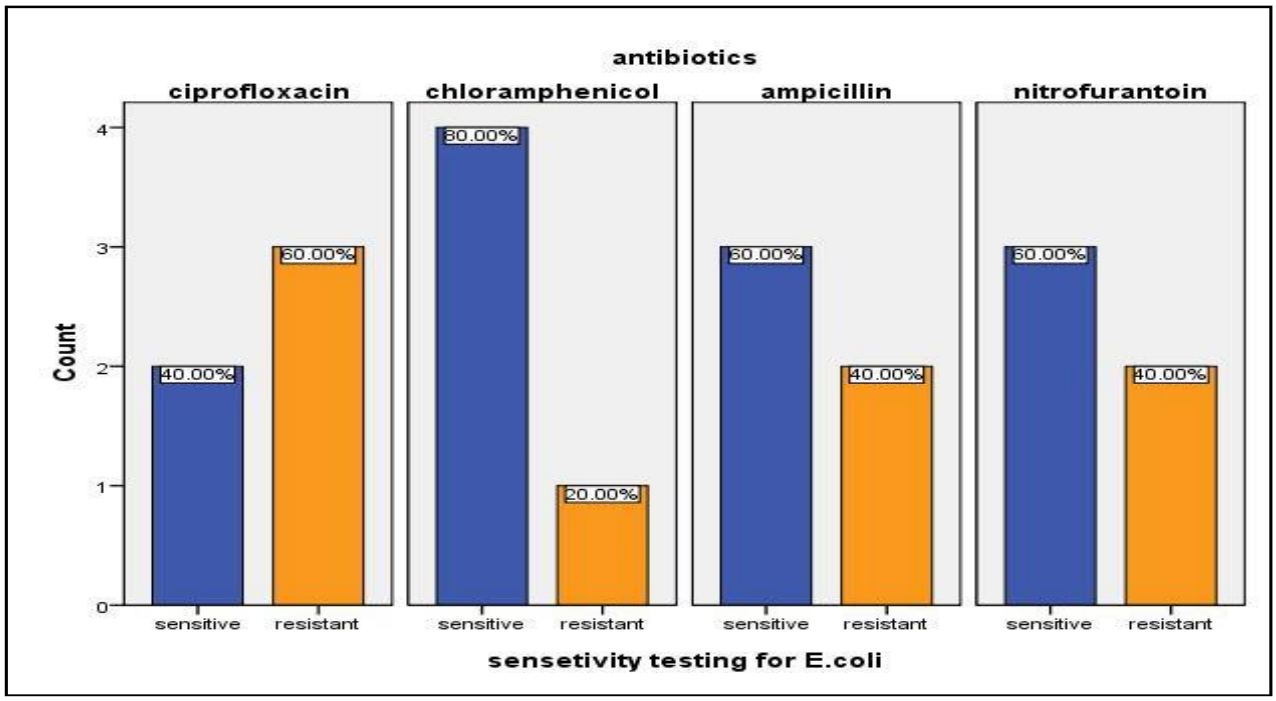

Figure 5: Antimicrobial susceptibility test for *E.coli*

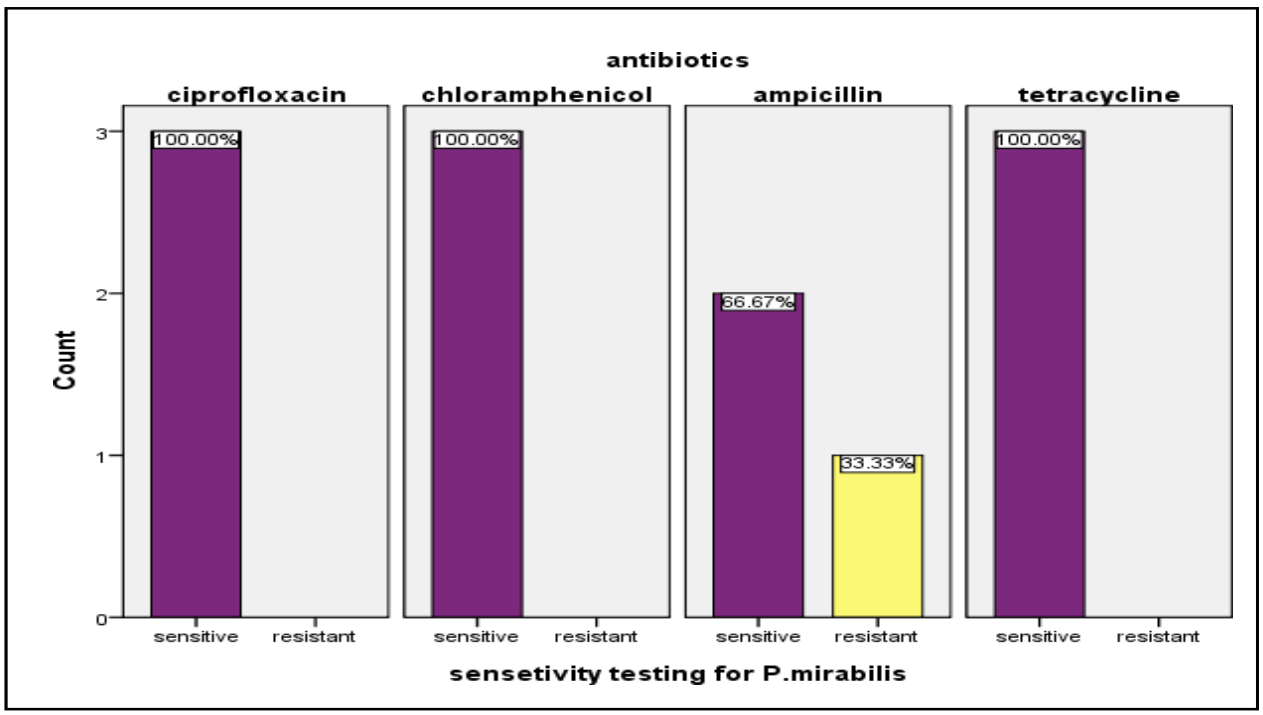

Figure3.6: Antimicrobial susceptibility test for *P. mirabilis*

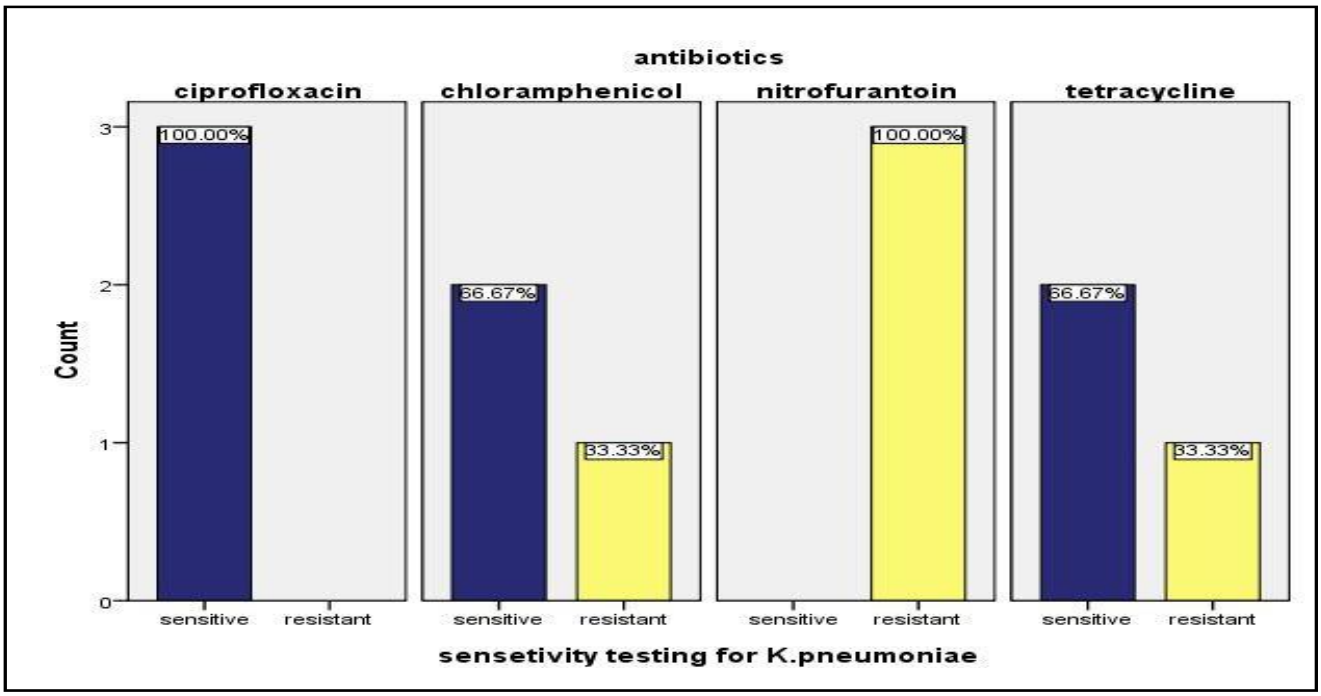

Figure 7: Antimicrobial susceptibility test for *K. pneumoniae*

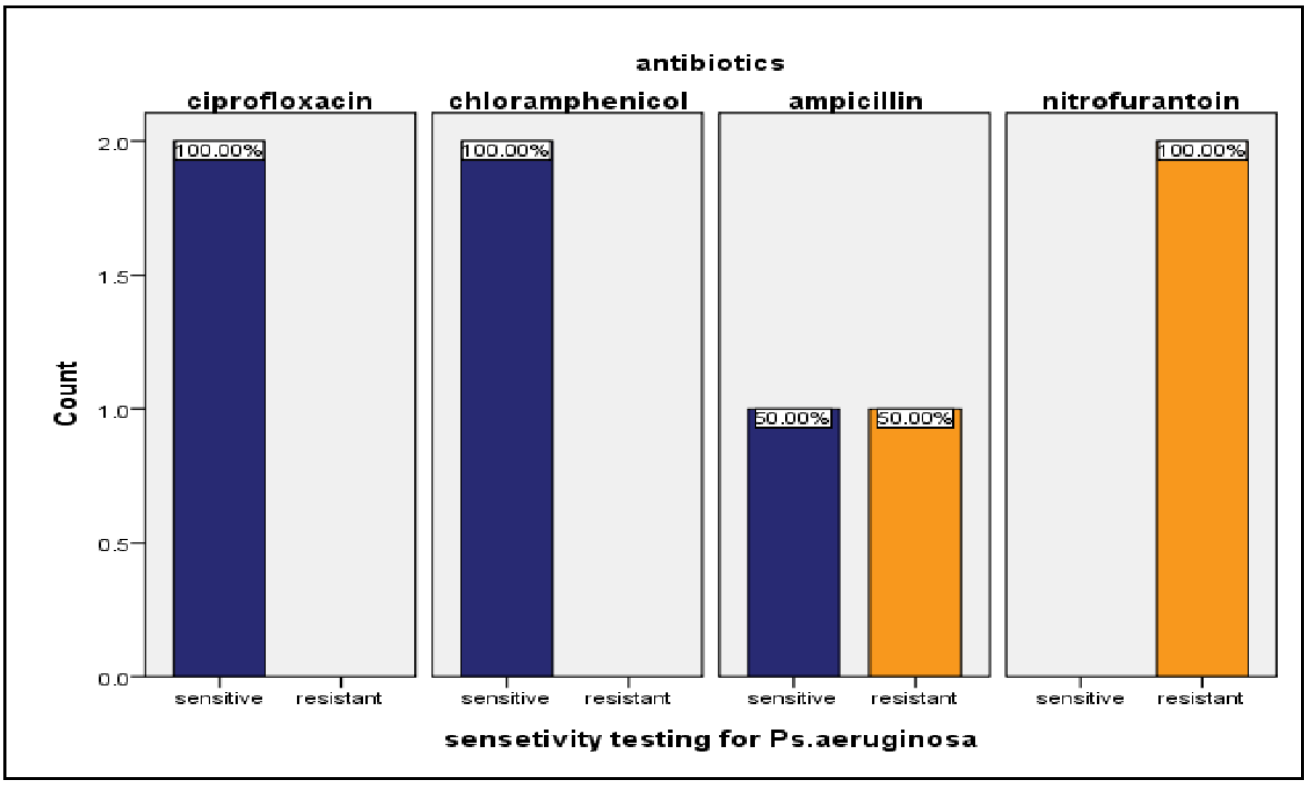

Figure 3.8: Antimicrobial susceptibility test for *Ps. aeruginosa*

Discussion

The main objective of the present study was to isolate the main common pathogens that cause urinary tract infections (UTI) among patients receiving a chemotherapeutic drug. Fifty specimens were collected for patients, prepared, and adopted different standardized tools and methods for the realization of the problem through isolation and identification of bacterial strains which cause UTI.

The study relived that gram`s positive pathogens are commonly isolated from the patients and *Staphylococcus aureus* was the predominant microorganism recovered (26.6%) disagrees with a study done by Purewal and his colleagues (6). Followed by *E.coli* (21.7%) agree with a study done by Purewal and his colleagues(11), while disagreeing with a study done by Tancheva S and his colleagues whom found that *E.coli* is the common pathogen isolated, then *S.epidermis* (17.4%), K.pneumonia (13%), *pr.mirabilis* (13%) and *Ps.aeruginosa* (8.7%) (7).

The percentage of urinary tract infections among patients whom receive chemotherapeutic drug is (46%) this result agrees with study done by Kenneth V. I. whom found that bout (45%) were positive (8), while disagree with a study done by Tancheva S and his colleagues their result show (68%) where positive (7). Our result showed that the distribution of disease among female (62%) higher than male (28%) which disagree with study done by Hayami and his colleagues which revealed that (88%) of infected were female (9).

Our results showed that the chloramphenicol was highly active against gram negative bacteria (84.6%), followed by ciprofloxacin (77%) agreeing with a study done by Theodore which showed that the Chloramphenicol (100%) was highly active against gram`s positive (10).

Susceptibility test for *E.coli* shows that Chloramphenicol is active (80%) which disagrees with a study done by Boris and his colleagues reported that the activity of Chloramphenicol (54%) followed by ampicillin and nitrofurantoin (60%) (11), while agreeing with a study done by Hayami and his colleagues which report the activity (65%), while the ciprofloxacin (40%) disagrees with the previous study which reports activity (85%) (9).

The susceptibility test for *Proteus mirabilis* shows that Chloramphenicol, tetracycline, and ciprofloxacin are highly active (100%) which disagrees with a study done by Sohail M and his colleagues, while our result shows ampicillin activity (67%) which agrees with the same study that reports ampicillin activity (61%) (12).

The susceptibility test for *klebsiella pneumoniae* shows that ciprofloxacin is highly active (100%) agrees with a study done by Archana and Harsh that report activity of ciprofloxacin (90%) followed by Chloramphenicol and tetracycline (67%) disagree with same study result which that report activity (40%) (13).

The susceptibility test for *staphylococcus aureus* shows that Chloramphenicol is highly active (100%) which disagrees with a study done by Adebola and Josiah, while the result of fusidic acid and penicillin, and methicillin agrees with the same study results (14).

Susceptibility test result for *Pseudomonas aeruginosa* shows that Chloramphenicol and ciprofloxacin were highly active (100%) and (100%) resistant to nitrofurantoin reported (96%) resistance which agrees with a study done by Jonathan and Jiyoung, while and show (50%) resistance to ampicillin which disagree with same a study result (15).

Susceptibility test for *S.epidermidis* shows that gentamicin is highly active (100%) disagrees with a study done by Hellmark and his colleagues that report activity of gentamicin is (21%), while Chloramphenicol, penicillin, and methicillin (100%) resistance which agrees with our study results (16).

Conclusion

Of the 23 positive samples, *S.aureus* and *E.coli* are the most frequent. Females are more infected than males. Adults are more infected than children. Chloramphenicol, gentamicin, and ciprofloxacin have good effects against causative agents and are recommended as the first line of treatment.

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