# The Role of *Pseudomonas* Spp. as a Cause of Bacteremia in Immunocompromised Patients and Its Response to Antibiotics in presence or absence of Candida.

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**Abstract:** The present study has demonstrated that the immunocompromised patients in National Cancer Institute (NCI) (Cairo, Egypt) are infected with several microorganisms due to their immunodificiency as a result of chemotherapy. The study included 435 of immunocompromised patients in NCI. The mean age of patients with infections was 42.5 ± 14.7 years (range, 20 to 72) in adult, and pediatric 4.1±3.2 years (range, 0.5 to 13). The nosocomial infections occurred in 173 patients, these patients infected with Gram positive, Gram negative bacteria and *Candida albicanes*. Gram positive bacteria constituted the majority of isolates 70.9% compared with Gram negative bacteria 29.1%.The most effective antibiotics against Gram positive bacteria were found to be Vancomycin Linozolid and Synercid (71.5%), (63.1%) respectively, In case of Gram negative bacteria, the most effective antibiotics were Tobramycin and Amikacin with percentage (88 %) and (68%), respectively. The infection with *pseudomonas* spp. in immunocompromised patients occurred 5.8% and we observed that the percentage of infection among females was higher than in males with significant association (*P*= 0.02). The most effective antimicrobial agents against *Pseudomonas* spp. were Impienem, Meropenam 70%, Tobramycin and levofloxacin 60%.
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**Key words:** Immunocompromised patients, Bacteremia, Nosocomial bloodstream infections, Candida.

## 1. Introduction:

The immunocompromised describes a patient who is susceptible to bacterial, fungal and viral infections as a consequence of primary or secondary immunodeficiency disorder or from the use of immunosuppressive agents that used for the treatment of tumors and for the prevention of rejection in organ transplant recipients. In addition, acquired immunodeficiency syndrome (AIDS) has resulted in the existence of many immunocompromised patients **(Rajan, 2012)**. The congenital causes of immunocompromised include a number of defects in B cells, T cells, and complement deficiencies. Acquired conditions may also interfere directly with the immune system or may disrupt barrier function. These include HIV (human immunodeficiency virus) infection, solid organ and bone marrow transplant, diabetes, cancer, alcoholism and cirrhosis, autoimmune diseases (treated with steroids), immunosuppressive therapy (chemotherapy), malnutrition, severe trauma and burns, surgeries **(Niyonsaba and Ogawa, 2005).**

Bacteremia is the presence of viable bacteria in the bloodstream, it is different from sepsis (so-called blood poisoning or toxemia), bacteremia (causing systemic inflammatory response syndrome, characterised by rapid breathing, low blood pressure, fever) **(Forner*et al.*, 2006).**

*Pseudomonas* spp. are a Gram-negative non-fermenting bacilli that belong to the family Pseudomonadaceae, infection is clinically indistinguishable from other forms of Gram-negative bacterial infection. For this reason, patients with *Pseudomonas* infection might receive empirical antibiotics that are inactive against *Pseudomonas* especially before antibiotic susceptibility results become available **(Kollef *et al.*, 1999).** More than half of all clinical isolates produce the blue-green pigment pyocyanin. It has minimal nutrition requirements, which contribute to its broad ecological adaptability and distribution. The large genome of *P. aeruginosa* provides a tremendous amount of flexibility and the metabolic capability to develop and grow in environments that are inhospitable to most other organisms **(Stover *et al.*, 2000).**

Also*Pseudomonas*spp. is an opportunistic and nosocomial bloodstream pathogens often invades the host tissue and cause infection and bacteremia especially in immunocompromised hosts specially cancer patients **(Feldman *et al.*, 1998).** Also *Pseudomonas aeruginosa*has become the most common Gram-negative bacterial species associated with serious hospital-acquired infections, particularly within intensive care units (**Neuhauser*et al.*, 2003**). The nosocomial infections with *Pseudomonas aerugenosa* in hospitals conistitute10-15% of this type of infection worldwide **(Blanc *et al.*, 1998)**.The

hospital mortality associated with *P. aeruginosa* bloodstream infections is reported to be greater than 20% in most series and is highest among patients receiving inappropriate initial antimicrobial treatment (**Osmon*et al*., 2004).** The complete sequencing of wild type *P. aeruginosa* (PA01) at the turn of the century has provided a great deal of useful information, concerning not only its pathogenicity but also its antibiotic resistance. In addition its ability to release endotoxin, *P. aeruginosa* possesses a repertoire of exotoxins and enzymatic products designed to avoid host defences**(Sadikot*et al*., 2005).** It has also an array of chromosomal and plasmid-mediated antibiotic resistance factors, making antibiotic treatment difficult and potentially unsuccessful. These infections are hard to treat due to the nature of acquiring further mechanisms of resistance to many of antibiotics **(Kohler *et al*., 1999).** These mechanisms exist simultaneously, thus conferring combined resistance to many strains **(McGowan, 2006).**

As antipseudomonal antibiotics were introduced, treatment outcomes in cases of *Pseudomonas aeruginos*bacteremia improved. However, *P. aeruginosa* continues to be a serious cause of infection, associated with a high rate of morbidity and a mortality rate ranging from 18% to 61% **(Chatzinikolaou *et al.,* 2000*)***.** Bacterial bloodstream infections are serious infections associated with significant mortality and health-care costs *nosa.*

It has been well documented that inappropriate antimicrobial therapy is associated with adverse outcome but little information exists about whether ineffective empirical antimicrobial therapy given during the first 48–72 h, when results of microbiological testing are unavailable, affects the outcome adversely. We aimed to determine the influence of effective antimicrobial therapy on the clinical outcome of patients with *pseudomonas* bacteremia **(Hilf *et al*., 1989).**

*Candida* is agenus of yeast,many species are commensals in human parts as agut found as normal flora but if these species located in another parts it converted to pathogens specially in immunocompromised patients**(Ryan*et al*., 2004).** *Candida albicanes* is acomensals of normal flora in gut and mouth,it lives in 80%of human population but overgrowth of *candida* cause big problems specially in immunocompromised patients who suffer from immunodisorders due to chemotherapy,organ or bone marrow transplantation **(Zadik*et al*., 2010).** *Candida albicanes* is an apportunistic pathogenic yeast that infect immunocompromised patients and cause nosocomial blood infection and increase the rate of death **(Wilson*et al*., 2002 and Tumbarello, *et al.*, 2007).** The virulence of Candida is due tosecreation anumber of virulence factors and transition from budding yeast to pseudohyphal forms **(Sudbery *et al*., 2004, Berman, 2006, Whiteway and Bachewich**, **2007).**

**2. Material and Methodes:**

The patients blood samples were collected from National Cancer Inistitute,(Cairo- Egypt) and inoculated in one or more vials and inserted into Bactec fluorescent series Institute, for incubation and periodic reading.

**The principles of the procedure:**

If microorganisms are present in the test sample inoculated in to the Bactec vial,$CO_2$ will be produced when the organisms metabolize the substrates present in the vial **(Wallis,1980).** increases in the fluorescence of the vial sensor caused by the higher amount of $CO_2$ are monitored by the Bactec fluorescent series insterument, analysis of the rate and amount of $CO_2$ increase enable the Bactec fluorescent series insterument to determine if the vial is positive(The test sample contains viable organisms) **(Applebaum, 1983 and Pohlman,1995).**

**Explanation:**

Each vial contains achemical sensor which can detect increases in $CO_2$ produced due to the growth of microorganisms, the sensor is monitored by the instrument every ten minutes for an increase its fluorescence then the positive samples inoculated in blood and Macconkey`s media to determine bacterial growth, Plates were incubated at 37ºC. andSabaroud medium was used for detection of *Candida*.

**Screening for antibiotic susceptibility**

Both automated and manual methods were used to detect the antimicrobial susceptibility pattern of the isolates. (disc diffusion method) was used to detect antibiotics susceptibility. Discs of several antibiotics (Oxoid Ltd., Basin Stoke, United Kingdom) were placed on the surface of Muller-Hinton agar plates followed by incubation at 35°C **(Drew *et al.*,1972).** Reading of the plates was carried out after 24 hours using transmitted light by looking carefully for any growth within the zone of inhibition **(Cafferkey, 1992).**

Antimicrobial susceptibility tests occurred in microScan to determine the minimum inhibitory concentration (MIC) or aqualitative Susceptibility (Susceptible, intermediate or Resistant) for the test organism is determined by observing the lowest antimicrobial concentration showing inhibition of growth.

The microdilution procedure for antimicrobial susceptibility testing has provided the clinical microbiologist with areliable method for obtaining quantitative susceptibility test results. The procedure

is used to determine the minimum inhibitory concentration (MIC) of antimicrobial agents and has rapidly gained broad acceptance in the clinical laboratory **(Gerlach, 1974).** Accuracy and reproducibility in the MIC procedure depend on use of defined materials and methods.

One of the important requirements in the MIC procedure is control of bacterial population of the inocula within defined limits. This step may be accomplished in two ways:

1- Manual adjustment of the inoculum to match a 0.5 McFarland turbidity standard **(Barry *et al.*, 1970)** followed by appropriate dilution or

2- Incubationto stationary phase in broth culture followed by appropriate dilution.

**Principles**

The prompt inoculation System –D consists of an inoculation wand and bottle of diluents. The wand is apolypropylene rod with a break way collar that serves as a wiping mechanism. The rod is attached to as topper. At the tip of the wand is a groove designed to hold a specific number of bacteria. 30 ml of diluents are provided in the plastic bottle.The wand is touched to several bacterial colonies on aprimary isolation plate, wiped, then placed in the plastic bottle. The bacteria are suspended by shaking the bottle. The bacterial suspension is stable for four hours **(Gerlach, 1974).**

The prompt inoculation System-D facilitates the MIC inoculum preparation by eliminating 1) the incubation period, and 2) the need to adjust the inoculum`s concentration.

## 3. Results and Discussion:

**Distribution of the study population according to presence in National Cancer Institute__NCI) (Culture Results)**

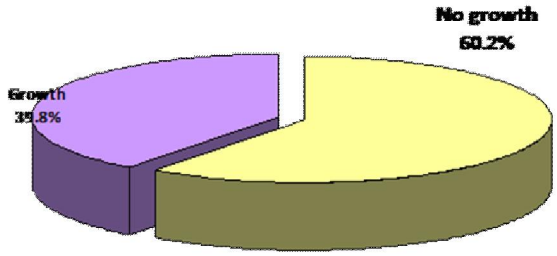


**Figure 1: Culture results of the studied group.**

The study period(19 months from 1 Jan.2011 to 10 July 2012 435 immunocompromised patients were hospitalized in different wards of National Cancer Institute (NCI), among this 173 (39.8%) of immunocopromised patients prevalence of infection colonization with different strains of microorganisms (Nosocomial infection), 262 (60.2%) of immunocompromised patients gave no growth in blood culture (Figure1).

**Relationship of the studied group with age**

In our study we found that the relation between culture results (Positive results) and age was 75of immunocompromised patients were pediatric with age 4.1 ± 3.2 years(range, 0.5 to 14) and 98 adults with age 42.5 ± 14.7 years (range, 20 to70) (Table 2) with Significant association (p-value<0.001). All pediatric patients were Leukemic patients.

**Table (1):Relationship between Culture results and age.**

| Culture_result | | | Age | | Total |
|---|---|---|---|---|---|
| | | | Adult | Pediatric | |
| | No growth | Count | 262 | 0 | 262 |
| | | % within Age | 72.8% | .0% | 60.2% |
| | Growth | Count | 98 | 75 | 173 |
| | | % within Age | 27.2% | 100.0% | 39.8% |
| Total | | Count | 360 | 75 | 435 |
| | | % within Age | 100.0% | 100.0% | 100.0% |

Significant association was found. *P*- value< 0.001

The statistical analysis show in the figure below that the isolates of bacteremia in infected patients (173 patients) were Gram positive, Gram Negative and Candida(Table 3).The current shift from Gram-negative to Gram-positive bacteria in causing BSI has been observed, Gram positive bacteriamore percent than Gram negative bacteria (70.9%), (29.1%) respectively. **(Figure 2).** This agreement with **(Aboud *et al.*, 2005)**. The predominance of Gram-positive bacteria isolates from cancer patients was shown in other studies **(Schabrun and Chipchase, 2006).**

**Gram positive bacteria.**

Gram positive bacteria are considered recently one of the most pathogens in immunocompromised patients (Cancer patients**) (Ahmed *et al.*, 2009).** The amount of Gram positive bacteria in patient`s blood was found to be greater than of Gram negative bacteria (70.9%).

Figure (3), indicated that *Staphylococcus* spp. was isolated from almost of nosocomial bloodstream infections caused by Gram positive bacteria and represented the majority 115 (94.3%), Where other bacterial isolates were less frequent Streptococcus spp. 2 (1.6%), Micrococcus spp. 2 (1.6%),Gram positive Cocci 2 (1.6%) and Mixed Gram positive cocci 1 (0.8%) were isolated from the remainder of nosocomial bloodstream infections (BSIs).

**Table(2): Relationship between bacteremia with Gram positive and Gram negative bacteria.**

| Type of microorganisms | | Frequency | Percent | Valid Percent |
|---|---|---|---|---|
| | G-ve | 50 | 11.5 | 29.1 |
| | G+ve | 122 | 28.0 | **70.9** |
| | Total | **172** | 39.5 | 100.0 |
| Missing | No growth | 262 | 60.2 | |
| | **Candida** | **1** | 0.2 | |
| | Total | 263 | 60.5 | |
| Total | | 435 | 100.0 | |

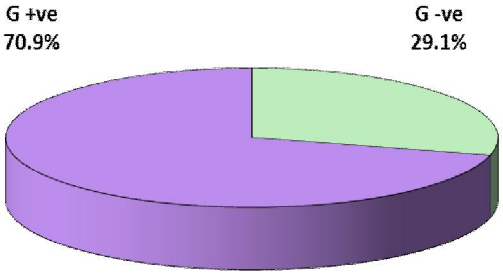


**Figure (2): Distribution of microbial isolates according to Gram stain (n=172).**

Incidence of Gram positive and Gram Negative Bacteria inimmunocompromised patients in National Cancer Institute(NCI).

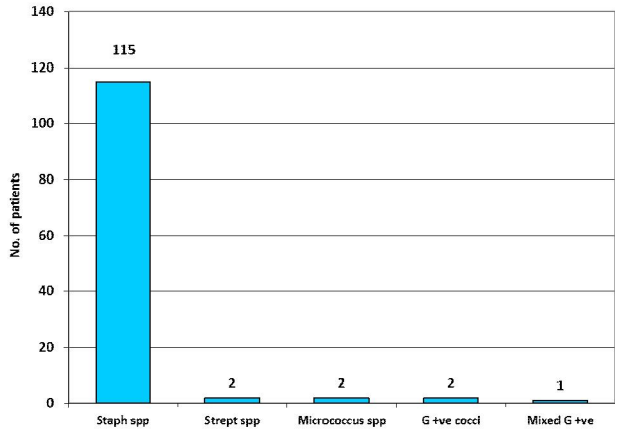


**Figure** 3**: Species of the Gram positive bacteria (n=122).**

**Antimicrobial Susceptibility Patternes of the Isolated Microorganisms.**

The isolated bacteria from each 172 positive blood cultures results were made susceptibility patterns to antimicrobial agents.

**Over all Sensitivity patterns of Gram positive isolates towards antibiotics**

Figure (4): indicated that the most effective antimicrobial agents for the 122 obtained Gram positive isolates were vancomycin 86 (71%), linozolid, synercid 77 (63%) for each,followed by remactan 71 (58%), chloramphenicol 60 (49%), clindamycin 59 (48%), gentamicin 50 (41%), tetracycline 45(36.9%) and sutrium 41(34%), On the other hand, the lowest effective antimicrobial agents were ciprofloxacin 36 (23%), ofloxacin 31 (25%), moxifloxacin 25 (21%), levofloxacin, tazocin 17(14%) for each, imipenem, azithromycin 15 (12%), cefotaxime, maxipime13 (11%) for each, augmentin, unasyn and oxacillin 12 (10%) for each.

**Gram negative bacteria**

Figure (5), indicated that *Klebsiella pneumonia* 12 (24%) was the most predominant bacteria isolated from nosocomial bloodstream infections *(BSIs), followed by E.coli and Pseudomonas spp.* 10 (20%) for each, the other bacterial isolates were less frequent *Achromobacter*spp 5 (10%), *Acinetobacterspp*4 (8%), *Enterobacterspp, Citrobacterfreundii 3 (6%)* for each, *Yersinia & Shigilla*2 (4%) and *Acinetobacterbaumanii*1(2%).

Sensitivity patterns of Gram- negative isolates towards antibiotics

Over all Sensitivity patterns of Gram- negative isolates towards antibiotics

Figure (6): indicated that the most effective antimicrobial agents for the 50 obtained Gram negative isolates was tobramycin 44 (88%), followed by amikacin 34 (68%), imipenem 31 (62%), meropenam 29 (58%), tetracycline 25 (50%), gentamicin 24 (48%),levofloxacin 23 (46%), and ciprocin 19 (38%). On the other hand the least effective antimicrobial agents were tazocin, ticaricillin / Clav 15 (30%) for eachmaxipime12 (24%), rocephin11(22%), sutrium, gatifloxacin, ceftazidime, cefotaxime and moxifloxacin 10 (20%) for each, augmentin 8 (16%), unasyn 7 (14%), cefazoline, chloramphenicol and aztreonam 5 (10%) for each.

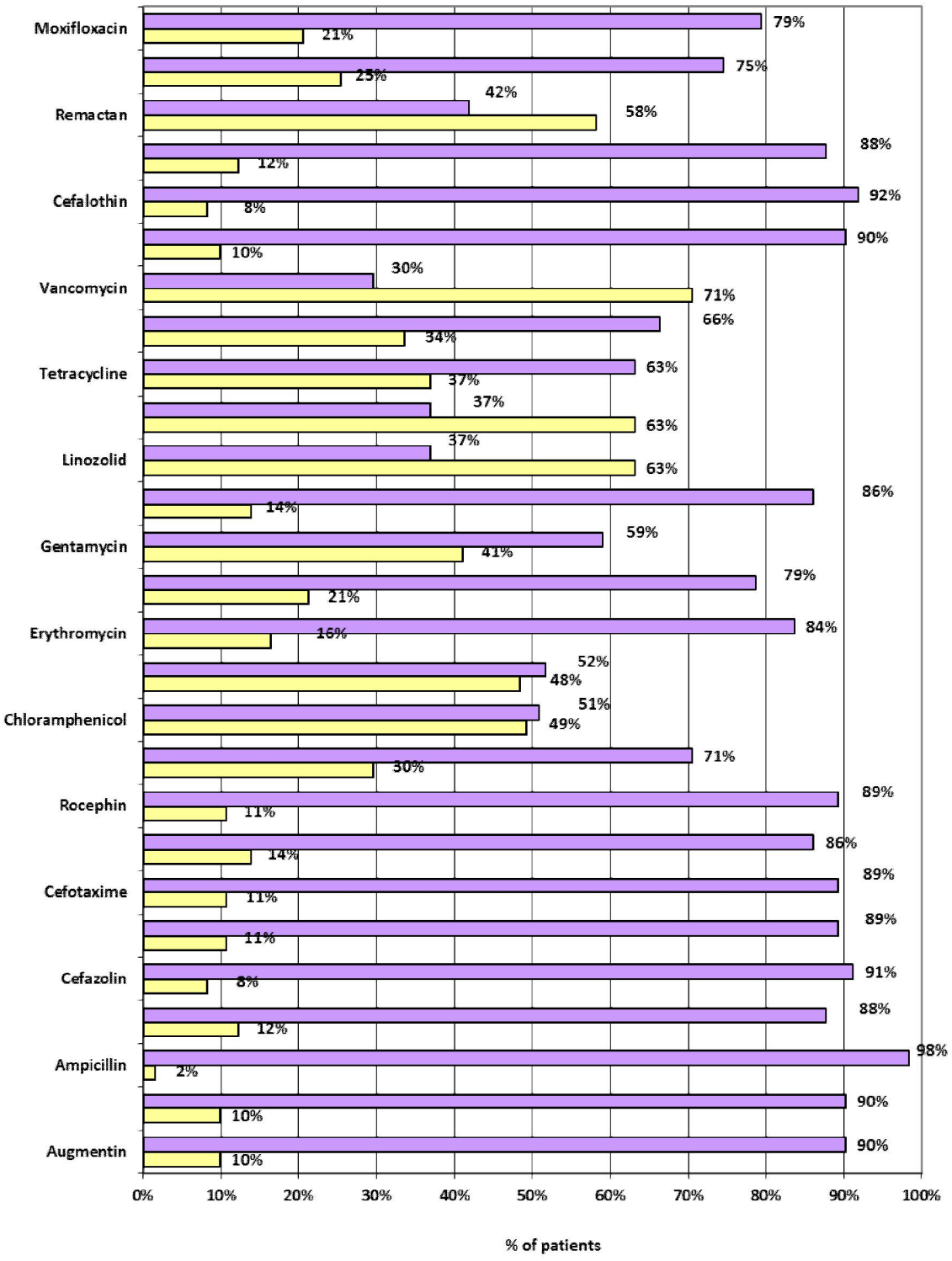


Figure 4: Antibiogram for Gram positive bacteria.

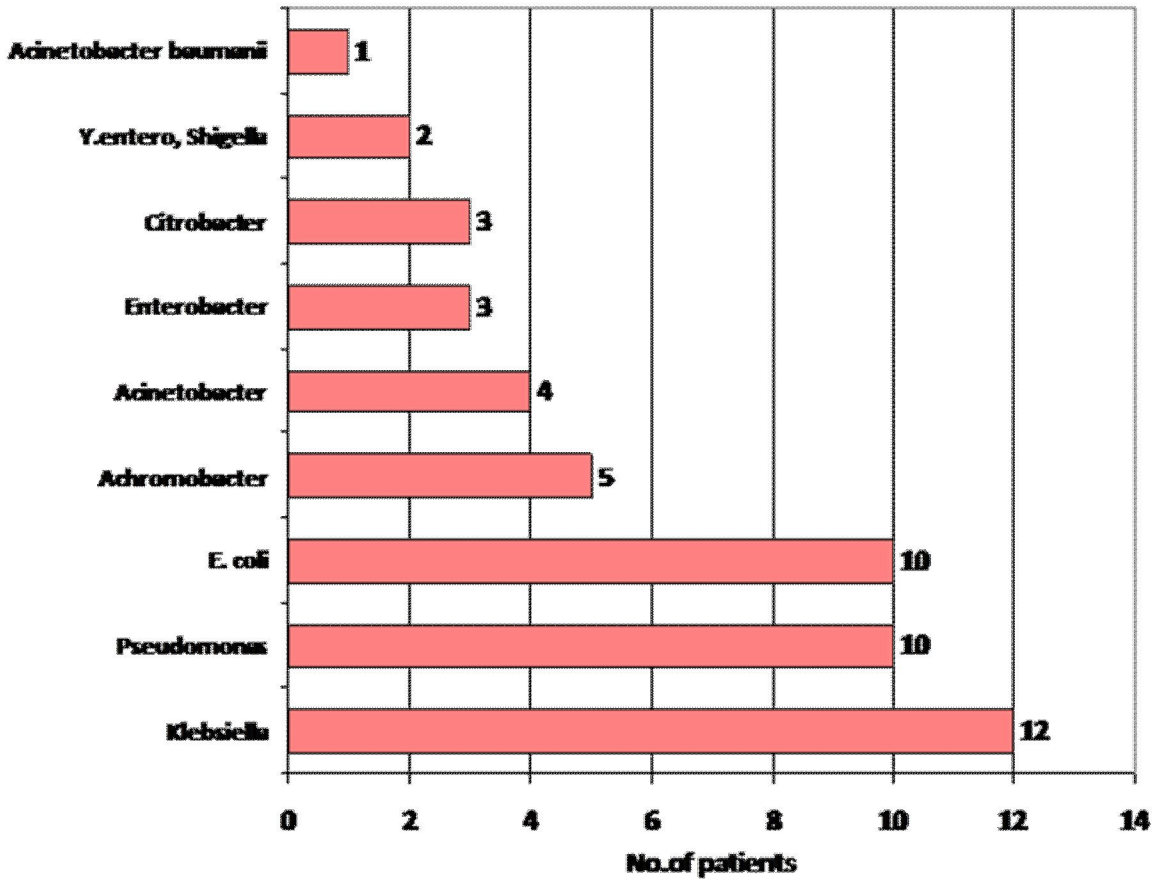


Figure 5: Species of Gram Negative bacteria.

**Percentage of *Pseudomonas* to other microorganisms in relation to Sex and age.**

Among the patients with *Pseudomonas* spp., the prevalence of infection or colonization was 5.8% (10 patients). Of these 10 patients, 6 were adults and 4 were pediatric. No significant association was found (*P*>0.827) (Table6).

**Table (3):Relation of Pseudomonas with patient's age**

| Pseudomonas_others | | | Age | | Total |
|---|---|---|---|---|---|
| | | | Adult | Pediatric | |
| | Pseudomonas | Count | 6 | 4 | 10 |
| | | % within Age | 6.1% | 5.3% | 5.8% |
| | other organisms | Count | 92 | 71 | 163 |
| | | % within Age | 93.9% | 94.7% | 94.2% |
| Total | | Count | 98 | 75 | 173 |
| | | % within Age | 100.0% | 100.0% | 100.0% |

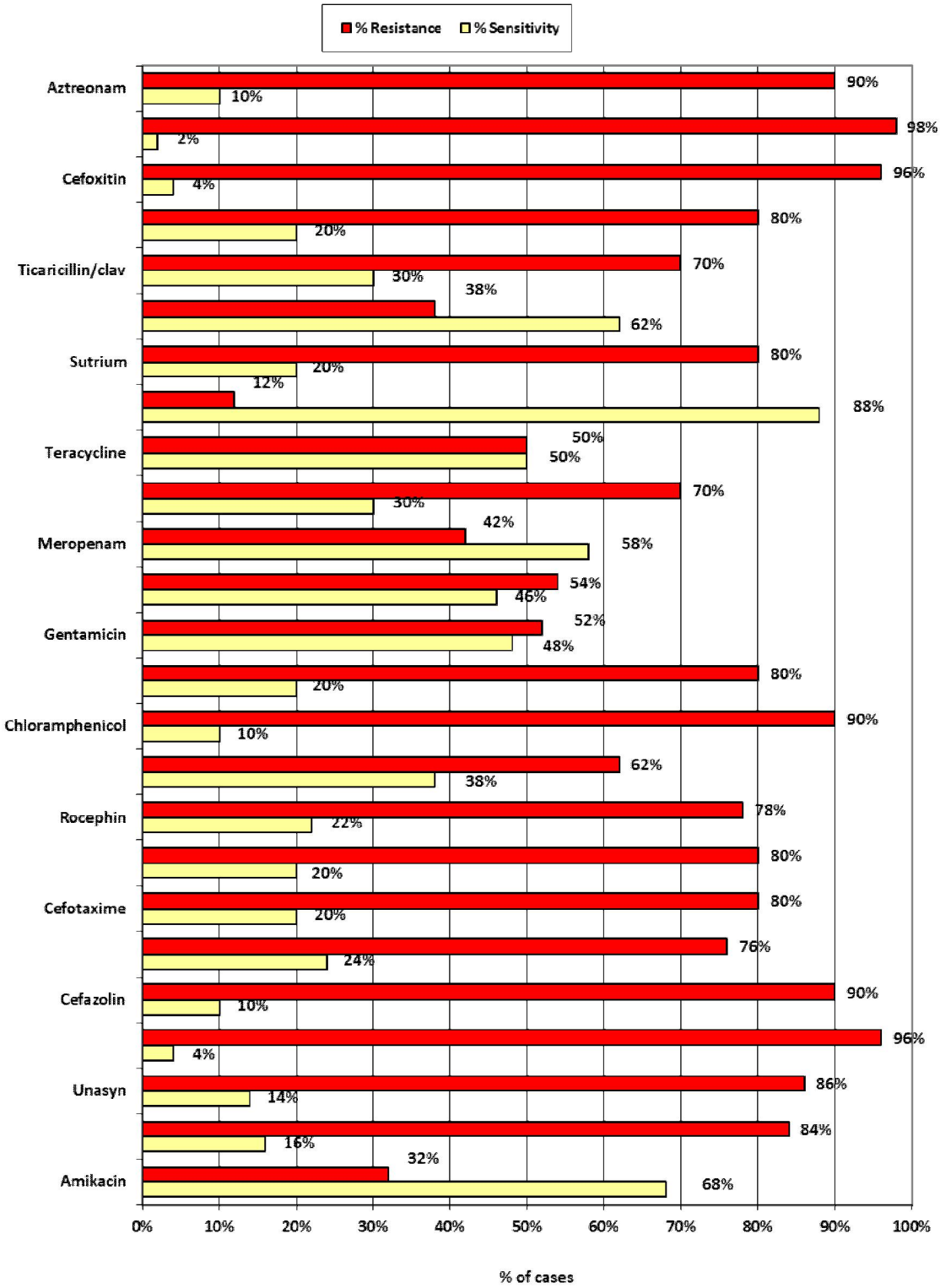


Figure 6: Antibiogram for Gram negative bacteria.

**Relationship between*Pseudomonas* and Sex.**

The distribution of *Pseudomonas* culture results according to gender, it was found that the highest percentage of pseudomonas infectionfound in females thanmales8, 2respectively with significant association was found between pseudomonas and sex. (p-value = 0.02)(Fig.7).

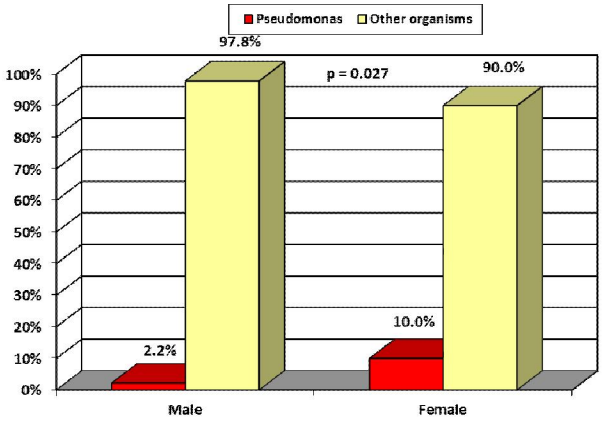


**Figure 7: Relationship between patient`s sex and *Pseudomonas* infection.**

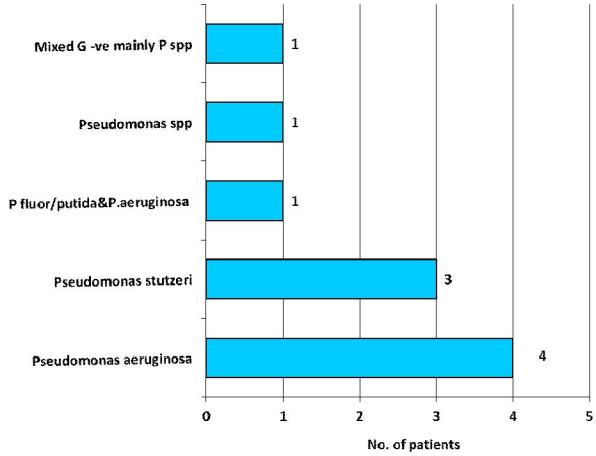


**Figure 8: Species of *Pseudomonas* spp.in the infected patients (n=10).**

***Pseudomonas* strains**: *P. aeruginosa*was isolated from blood cultures of 4 cases (2.3%) and non-aeruginosa in 6 cases (3.5%).

**Distribution of pseudomonas spp. according to seasons of the year in relation to other microorganisms.**

Figure(9) illustrated that the immunocomromised patients who infected with *Pseudomonas* spp. during 1.0 year and 7 months period in the four seasons increased in autumn 18.8% in contrast the infection with other microorganisms increases in winter. significant associatio was found (*P*=0.002).

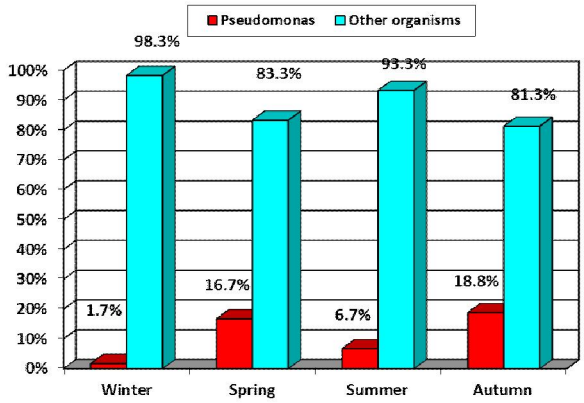


**Figure 9: Distribution of bacterial isolates in the different seasons of the year**

There is a significant association between *pseudomonas* and other microorganisms in different seasons with (*P*-value=0.002).

**Individual sensitivity patterns of *Pseudomonas* spp. isolates towards antibiotics.**

**Results of figure(10) show the susceptibility of *Pseudomonas* spp.to different antibiotics, to determine which antibiotic will be most successful in treating a bacterial infection *in vivo*.**

In our study wefoundthat the *pseudomonas* spp. were susceptible to some antipseudomonal antibiotics, the most effective antibioticswere Imipenem and Meropenam 7 (70%), for each, followed by Tobramycin6 (60%), Levofloxacin6 (60%) foreach, Ciprofloxacin, Amikacin, Gentamicin (50%) for each. on the other hand the lowest effective antimicrobial agents were Ceftazidime, Maxipime 3 (30.0%), Ticaricillin/ Clav(30.0 %), Tazocin (20 %), Rocephin, Cefotaxime, Tetracycline, Sutrium and Unasyn (10%) (Figure 10).

**** Percentage of Candida in relation with other microorganisms inimmunocompromised patients.**

In our study we observe the infection of immunocompromised patients with *candida albicanes* due to their immunodeficiency result from taking chemotherapy or radiotherapy (Cancertreatment). Among the patients with *Candida albicanes*, the prevalence of infection or colonization was 4.6% (8 patients) (Table7**).** all patients were adults (8/90) (8.2%) no *candida* infection in pediatric (P=0.01) there was significant association between *candida* and age.(Table 8), (Figure 10).

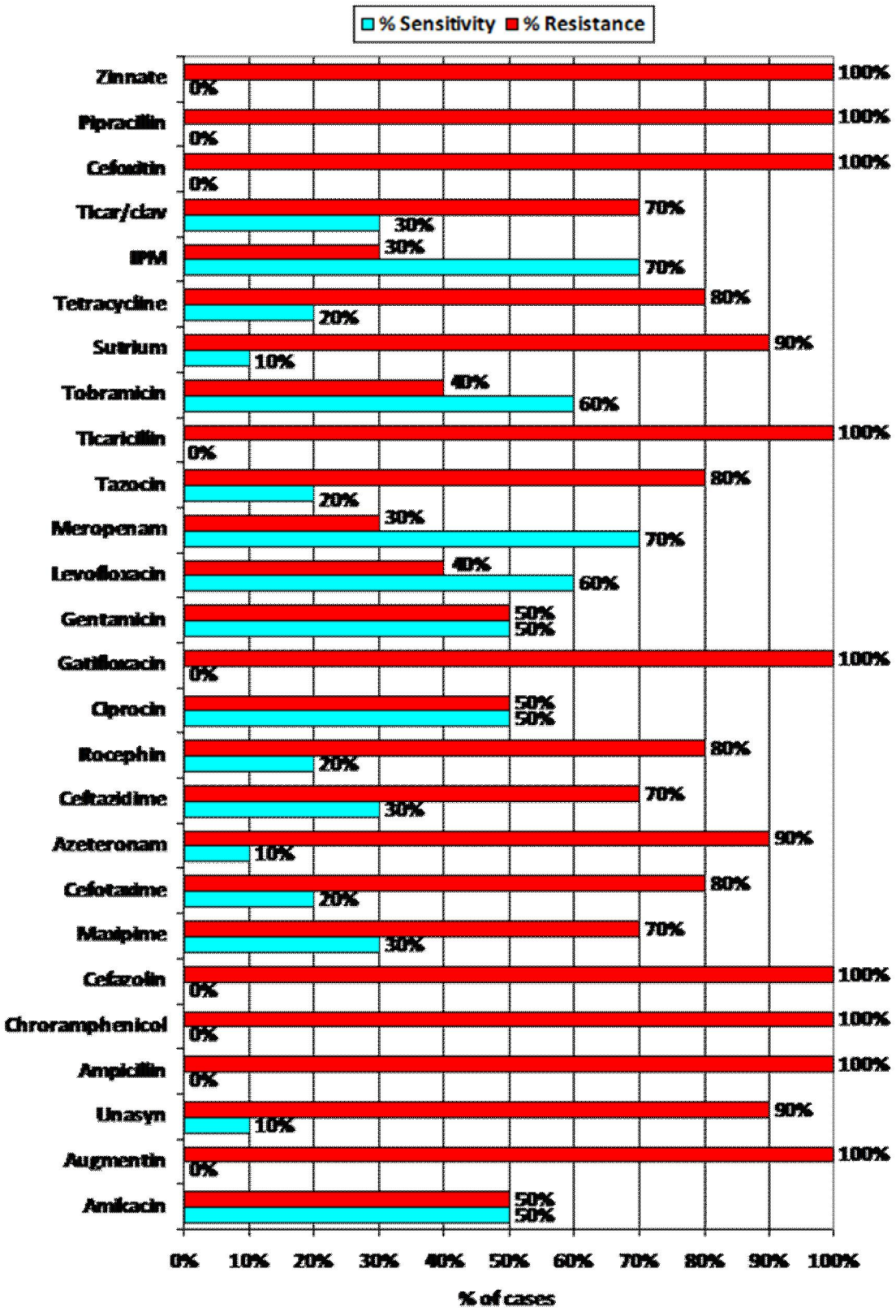


Figure 10: Antibiogram for pseudomonas spp.

Table(4): Percentage of*Candida* in the studied groups

| Candida | | Frequency | Percent | Valid Percent |
|---|---|---|---|---|
| | No | 165 | 37.9 | 95.4 |
| | Yes | **8** | 1.8 | 4.6 |
| | Total | **173** | 39.8 | 100.0 |
| Missing | No growth | 262 | 60.2 | |
| Total | | 435 | 100.0 | |
| | | | | |

Table (5): Relationship between Candida and patient's age.

| Candida | | | Age | | Total |
|---|---|---|---|---|---|
| | | | Adult | Pediatric | |
| | no | Count | 90 | 75 | 165 |
| | | % within Age | 91.8% | 100.0% | 95.4% |
| | yes | Count | 8 | 0 | 8 |
| | | % within Age | 8.2% | .0% | 4.6% |
| Total | | Count | 98 | 75 | 173 |
| | | % within Age | 100.0% | 100.0% | 100.0% |

p-value = 0.01 Significant association was found.

Figure (10): illustrated the candida infections in relation to the age, all patients were adults (8/90) (8.2%) no *candida* infection in pediatric (P=0.01**)** there was significant association between *candida* and age.

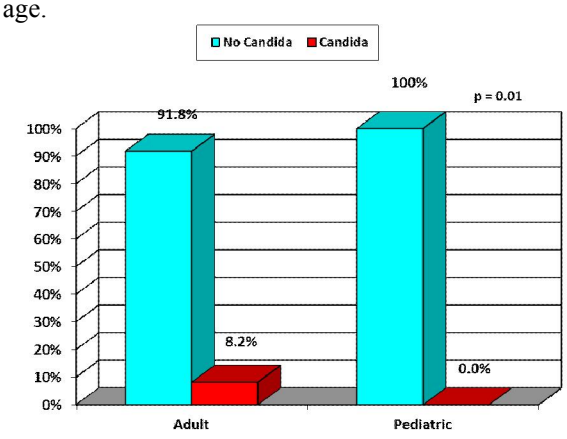


**Figure 10:*Candida* infection among adult and pediatric patients.**

**4. Discussion**

Immunocompromised patients who suffer from cancer and treated with chemotherapy (anticancer) this treatment increase the incidence of mucositis which lead to increase of bacteremiaand make patients more susceptible to infections because of their compromised immune system **(Guinan *et al.*, 2003).** There is a shift of the microbial spectrum of cancer patients from Gram-negative bacteria to Gram-positive bacteria, compared with the predominance of Gram-negative species in the 1960 and 1970 **(Yadegaryni*et al.*, 2003).** this report is agreement with our result were The amount of Gram positive bacteria in patient`s blood was found to be greater than of Gram negative bacteria (70.9%) (Figure 2). Gram-positive bacteria cause about 50–60% of nosocomial bacteremic events. *Staphylococcus epidermidis* and *Staphylococcus aureus* cause a significant number of blood stream infection **(Banerjee *et al.*, 1989).** Also it has been reported that *Staphylococcus* spp. Coagulase negative (CoNS) and coagulase positive usually accounted for the majority of Gram-positive infections in cancer patients in previous studies with percent (69.23%) **(Mutnick*et al.*, 2003 and Rolston*et al.*, 2006)** (Figure 3). There are factors that account for this surge in Gram-positive bacterial infections. For example, intensive chemotherapy leads to damage of the mucosal barriers, which increases the risk of infection with Gram-positive oral and Gastrointestinal (GI) flora **(Hughes *et al.*, 2002)** In addition, the use of implantable intravenous catheters with cancer patients can facilitate the entry of organisms colonizing the skin into the bloodstream, and thus increase the rate of Staphylococcal infections **(Viscoli*et al.*, 2005).**

In this study we found that the most effective antimicrobial agents for Gram positive bacteria were Vancomycin 86 (71%), Linozolid, Synercid 77 (63%) for each, followed by Rematan 71 (58%), Chloramphenicol 60 (49%), Clindamycin 59 (48%), Gentamicin 50 (41%), Tetracycline 45(36.9%) and Sutrium 41(34%), (Figure 4).This finding agreement with that revealed by **(Tsiodras*et al.*, 2001).**

Linezolid, the first oxazolidinone, it has antibacterial spectrum and pharmacokinetic profile. Linezolid has activity against Gram- positive bacteria including methicillin - resistant *Staphylococcus. Aureus* (MRSA) and vancomycin-resistant enterococci (VRE). In controlled clinical trials, linezolid was as effective as vancomycin in eradicating infections caused by these pathogens **(Perry and Jarvis, 2001).**

Our study has demonstrated that The predominant Gram-negative bloodstream pathogens isolated were *Escherichiacoli 10 (5.8%)*, *Pseudomonas* spp*10* (5.8%), *Klebsiellapneumonia 12*(6.9%) our result was agreement with**(Rolston, 2004 and Klastersky *et al.*, 2007).** Who reported that among Gram-negative which have isolated and caused bactremia for cancer patients were, *Escherichia coli*, *Klebsiella* spp., and *Pseudomonas aeruginosa.*

These isolates are sensitive to different antibiotics as Tobramycin 44 (88%), Amikacin 34 (68%), IPM 31(62%), Meropenam 29 (58%), Tetracycline 25 (50%),Gentamicin 24 (48%) Levofloxacin 23 (46%),Ciprocin 19 (38%),Tazocin, Ticaricillin / Clav 15(30%) for each. The least effective antimicrobial agents were

Maxipime12(24%),Rocephin11(22%),Sutrium,Gatifloxacin,Ceftazidime,Cefotaxime and Moxifloxacin 10 (20%) for each, Augmentin 8 (16%), Unasyn 7(14%), Cefazoline, Chloramphenicol and Aztreonam

5 (10%) for each**.** This was agreement with **(Anthony, 2008)** (Figure 6).

*Pseudomonas* spp. is an opportunistic human pathogen commonly responsible for nosocomial bloodstream infections (BSIs), most commonly affecting immunocompromised patients, such as those who, treatment with chemotherapy or radiation **(Elkin and Geddes, 2003)**. Treatment of such infections can be difficult due to multiple antibiotic resistance **(McGowan, 2006).**

Regarding the distribution of *Pseudomonas spp*. according to the age and gender we found that there was no significant association in relation with age (adult and pediatric) (*P*=0.826), but our study showing a statistically a significant between *pseudomonas* infection and gender the *pseudomonas*infections increased in females than males (*P*-value=0.027) (Figure 7). Thisresult agree with result occurred in United kingdom which reported that the *pseudomonas* infections in females more than in males **(Pier and Ramphal, 2005).**

The main anti-pseudomonalanti microbial groups are Penicillin-ß-lactamase inhibitor combinations (Cefoperazone- Sulbactam, Piperacillin-Tazobactam), Cephalosporins Cefoperazone, Ceftazidime), Monobactam (Aztreonam), Fluoroquinolones (Ciprofloxacin, Levofloxacin), Carbapenems (Meropenem, Imipenem) and Aminoglycosides (Amikacin, Gentamicin, Tobramycin) **(Magiorakos, 2011).** From This studywe concluded that *Pseudomonas* spp. were Susceptible to Carbapenem, Fluroquinolones, aminoglycosides,Cephalosporins This in agreement with the antibiotics that have activity against *pseudomonas* **(Hachem*et al*., 2007).** *Pseudomonas* spp. which infected immunocompromised patients in NCI (Cairo, Egypt) sensitive to aminoglycoside antibiotics (Tobramycin, Amikacin and Gentamicin), Carbapenem which highly resistant to most B - lactamases as (Imipenam, Meropenam) and Flouroquinolones (Ciprofloxacin, Levofloxacin) (Figure 10).

On contrast the prevalence of antimicrobial-resistant *P. aeruginosa*is increasing among ICU patients. Data from the National Nosocomial Infection Surveillance system show that, in 2000, the prevalence of resistant *P. aeruginosa*increased to 17.7% forimipenem, 27.3% for quinolones, and 26.4% for third - generation cephalosporins. European ICUs, the prevalence of *P. aeruginosa*with decreased susceptibility to Imipemen, Ceftazidime, Piperacillin, and Ciprofloxacin ranged from 16%–24% for Imipemen, 2%–16% for Ceftazidime, 5%–26% for Piperacillin, and 8%–37% for Ciprofloxacin **(Hanberger *et al.*, 1999).**

The term multidrug resistant (MDR) *P. aeruginosa*bacteremia, according to the definition of the Centers for Disease Control and Prevention (CDC), resistance to Ciprofloxacin, Ceftazidime, Imipenem, Gentamicin, and Piperacillin **(Garner *et al*., 1988).** Various mechanisms by which *Pseudomonas aeruginosa*develops resistance are efflux pumps, biofilm formation and mutations in chromosomal genes **(Nadeem *et al.*, 2009, Tam *et al*., 2010).** We observed in our study two cases (2/10) (20%) were multidrug resistant *Pseudomonas aeruginosa* one of them associated with *Candida* but the second was *pseudomonas only*. andwe observe in our study that the infection with *pseudomonas* spp associated with *candida* decrease the susceptibility of *pseudomonas* spp. to antibiotics (presence of*Candida* increase the pseudpmonas resistance to antibiotics). This is agreement with the study of **(Williamson *et al*., 2011).**

About 13% of severe healthcare-associated infections caused by *Pseudomonas aeruginosa*are multidrug resistant, meaning several classes of antibiotics no longer cure these infections (**Horan *et al*., 2008).** Our percentage more than the percent which recorded by Centers for Disease Control and Prevention (CDC), because our study occurred in National Cancer Institute where free hospital, the lack of possibilities and all patients were immunocompromised. more investigations and other studies must be occurred on more patients to detect Multidrug resistant *Pseudomonas aureginosa*.

Candidiasis is a fungal infection of any of the *Candida* species, of which *Candida albicans* is the most common **(Walsh and Dixon, 1996).** Candidiasis is also known as candidosis, moniliasis, and oidiomycosis **(James*et al.*, 2006).** Candidiasis infections range from superficial, such as oral and vaginitis, to systemic and potentially life-threatening diseases. *Candida* infections of the latter category are also referred to as Candidimia and are usually confined to severely immunocompromisedpatients, such as cancer, organ transplant patients **(Kourkoumpetis et *al*., 2010).**

In our study we observe the infection of immunocompromised patients with *Candida albican*s to their immunodeficiency result from taking chemotherapy or radiotherapy (Cancertreatment). Among the patients with *Candida albicanes*, the prevalence of infection or colonization was 4.6% (8 patients) (Table7)**.** all patients were adults 8/90 (8.2%) no *candida* infection in pediatric (*P*=0.01) there was significant association between *candida* and age.(Table 8), (Figure 10).

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