Antibiotic Susceptibility Pattern of Bacterial Isolates from Burn Infection Patients Performed By Vitik-2 Instrument

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Abstract

A total of 208 microorganisms were isolated from burn wounds of 187 patients at Al-Kindy Training and Research Hospital, Baghdad, Iraq. The results revealed that the most frequent isolate was *Klebsiella pneumoniae* (37.5%), followed by *Pseudomonas aeruginosa* (25%), *Acinitobacter baumannii* (13.46%), *Escherichia coli* (7.2%), *Proteus mirabilis* (5.76%), *Staphyllococcus aureus* (3.8%), *Enterobacter aerogenes* (1.9%) and *Burkholderia cepacia* (1.4%). While *Enterobacter cloacae* and *Staphylococcus intermedius* were (0.96 %), respectively. Finally the lowest percentage were (0.48%) for *Aeromonas hydrophiliacaviae*, *Enterococcus faecalis, Enterococcus gallinarum* and *Providencia stuartii*, respectively. Multidrug- resistance has emerged as an important concern in our burn unit. Ciprofloxacin and Levofloxacin were found to be the most active drugs against most of isolated bacteria, Tobramycin, Ampicillin/Sulbactam were found to be the most active drugs against *Acinetobacter baumannii*. While, Moxifloxacin and Tigecyclin were active against gram positive bacteria.

Introduction

Burns are characterized by the loss of varying proportions of the protective layers of the skin, depression of immune responses, and increased wound susceptibility to infection. Wound infection is a major cause of morbidity and mortality in burn cases, the antimicrobial resistance of bacteria isolated from burn patients has increased. Exposure of subcutaneous tissue following loss of skin integrity. It provides moist, warm, nutritive conducive to microbial colonization and proliferation [1].

Wound contaminants may not persist, but species that grow and divide may become established, causing wound colonization or infection. The outcome depends on the interaction of complex host and microbial factors [2]. The wound consisting of moist necrotic tissue represents an

ideal culture medium for a wide variety of microorganisms [3] it is now estimated that about 75% of the mortality following burns is related to infections, rather than burn shock and hypovolemia [4].

Knowledge of the responsible bacterial flora of burn wounds, its prevalence, and bacterial resistance becomes of crucial importance for fast and reliable therapeutic decisions [4]. Thus, the aim of the current study was to determine the microorganisms and their susceptibility patterns which were isolated from burn wounds of patients at Al-Kindy Training and Research Hospital, Baghdad, Iraq.

Patients and methods

Patients

This study included patients with acute and chronic wounds with purulent discharge or painful spreading erythema around a wound. This included cutaneous abscesses, traumatic wounds, foot ulcers and pressure ulcers. Total 187 patients of all the age groups were included in the study. Informed consent was obtained from the patients. All patients with major burns that were seen at the Surgical Emergency Centre and admitted into the Burn Wards of Al-Kindey Training and Research Hospital, Baghdad, Iraq, in the period of November 2012 to October 2013.

Methods

Pus was collected from patients with the help of sterile disposable cotton swab and immediately inoculated onto Blood agar and MacConkey agar media and incubated at 37˚C for 24 hours. Identification of isolates was done by conventional biochemical methods according to Standard microbiological techniques [5]. After determining mainly morphologic criteria of bacteria, panels of automized identification device Vitek 2 biomerieux Automated Microbiology System (Biomerieux-France) was used in order to determine the certain identification and anti-microbial susceptibility rates.

Duplicate isolates defined as repeated isolation of the same bacterial species for the same patient with the same profile of antibiotic susceptibility were excluded. *Pseudomonas aeruginosa* , *Acinetobacter spp* and *Klebsiella pnemoniae* were accepted as multidrug-resistant if the microorganism was resistant against at least three antimicrobials groups among antipseudomonal cephalosporins, β-lactam–β-lactamase inhibitor combination, antipseudomonal fluoroquinolones, antipseudomonal carbapenems or aminoglycosides. The antimicrobial susceptibilities were determined according to the Clinical and Laboratory Standards Institute (CLSI).

Results

A total of 208 bacterial isolates were obtained from 187 patients wound swab over 11 months period. The most predominant bacterial isolate was show in the Figure no.1. The most frequent isolate was *Klebsiella pneumoniae* (37.5%), followed by *Pseudomonas aeruginosa* (25%), *Acinitobacter baumannii* (13.46%), *Escherichia coli* (7.2%), *proteus mirabilis* (5.76%) *Stapyllococcus aureus* (3.8%), *Enterobacter aerogenes* (1.9%) and *Burkholderia cepacia* (1.4%). While Enterobacter *cloacae* and *Staphylococcus intermedius* were (0.96 %), respectively. Finally, the lowest percentage were (0.48%) for *Aeromonas hydrophiliacaviae*, *Enterococcus faecalis, Enterococcus gallinarum* and *Providencia stuartii*, respectively.

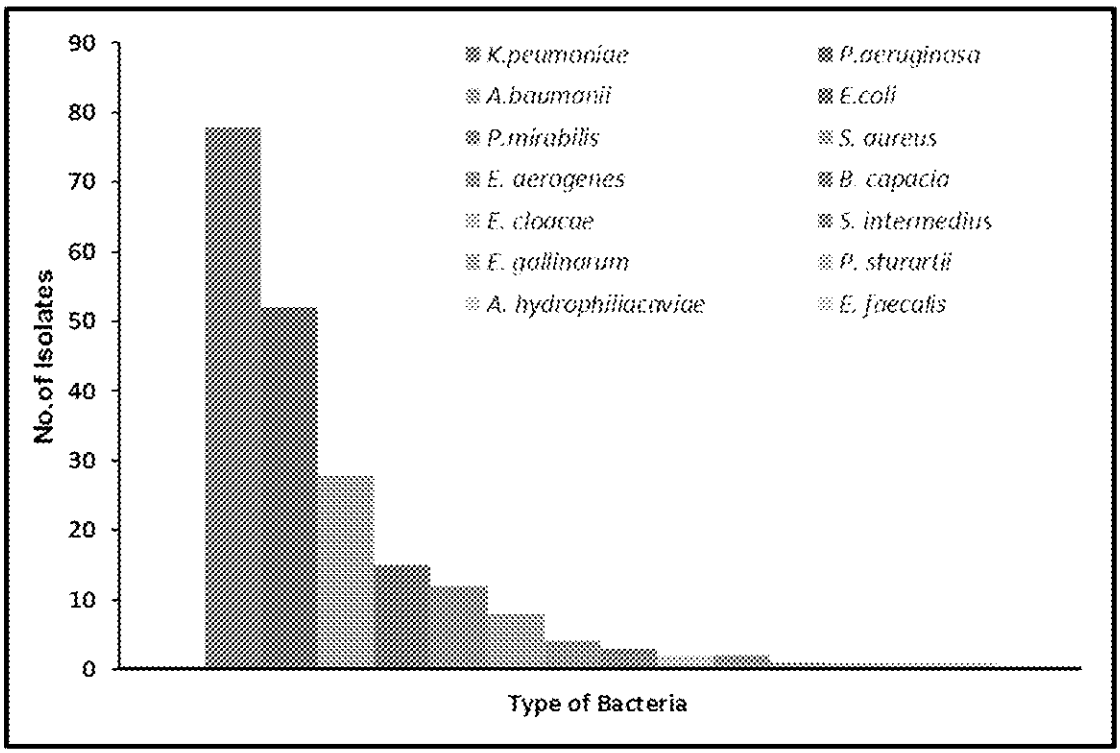

Fig.(1) : Type of bacteria and number of each isolates

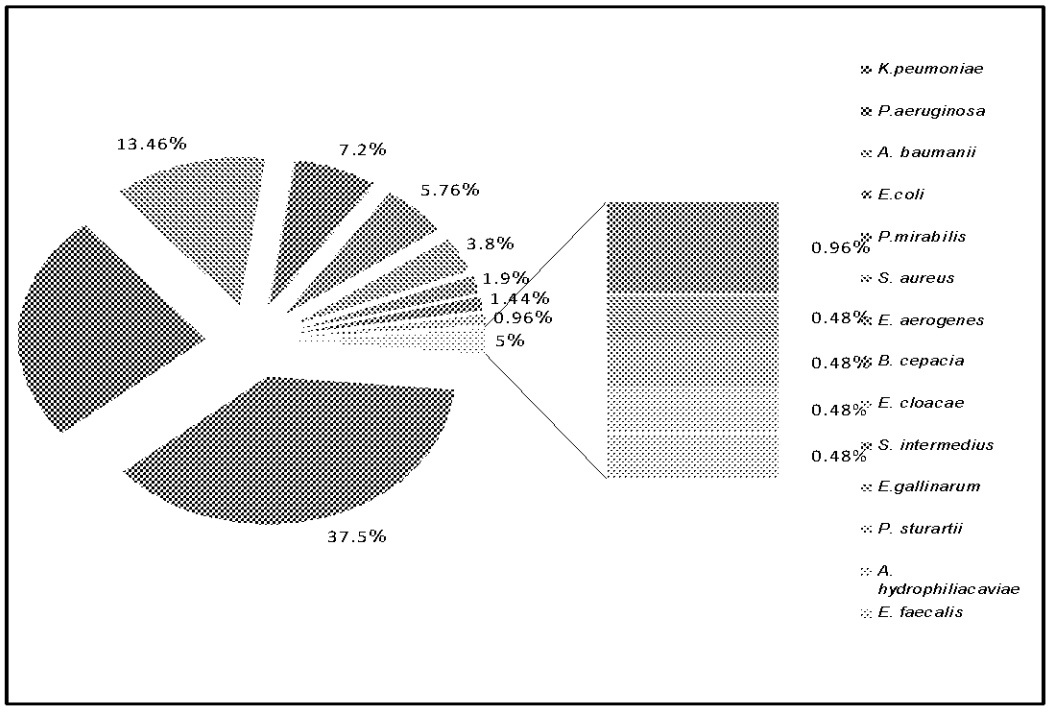

Figure 2: The percentage of each isolates from total number 208 isolates

The range of MIC has lower and higher concentration limit in µg/ml, the lower limit represent intermediate sensitivity and the higher concentration. Represent sensitive as shown in the column of each bacterial sensitivity tables (1, 2, 3, 4, 5, 6, 7). The susceptibility of the organisms to different antibiotic varied depending on the isolates. The present study was included the isolates above of four isolate and ignored others which have less than that number. However, *Klebsiella pneumonia* (78) isolates were sensitive as followed, and shown in Table (1): Ciprofloxacin (n.36=46.1%), Levofloxacin (n.31=39.7%), Imipenem (n.17=21.7%), Trimethoprim (n.16=20.5%) Amikacin (n.10=12.8%), Cefoxitin (n.8=10.2%),Tigecyclin and Gentamycin (n.5=6.4%) Pipracillin (n.4=5.1%), Ofloxacin (n.3=3.8%), Ceftrixone, Cefepime and Cefazoline (n.1=1.2%).

Table (1): Antibiotic sensitivity, percentage and Minimum inhibitory concentration of K. pneumoniae

Type of Antibiotic	***Sensitivity***	**%**	MIC*
Ampicillin	0	0	0
Gentamycin	5	6.4	1-2
Levofloxacin	31	39.7	0.12-4
Amikacin	10	12.8	2-32
Cefazolin	1	1.2	4
Cefepime	1	1.2	0.25-2
Ofloxacin	3	3.8	2-4
Ceftazidime	0	0	0
Tigecyclin	5	6.4	0.5-2
Ceftriaxone	1	1.2	1
Imipenem	17	21.7	0.25-2
Meropenem	14	17.9	0.25-8
Tobramycin	0	0	0
Trimethoprim sulfomethazole	16	20.5	20-40
Pipracillin Tazobactum	4	5.1	4-20
Ciprofloxacin	36	46.1	1.25-2
Cefoxitin	8	10.2	4-8

***MIC: Minimum Inhibitory Concentration (µg/ml)**

Pseudomonas aeruginosa (52) isolates were sensitive as followed, as shown in Table (2): Imipenem (n.23=44%), Amikacin (n.16=30.7%), Ciprofloxacin and Meropenem (n.12=23%), Cefepime (n.11=21%), Cetftazidime and Levofloxacin (n.9=17.3%), Pipracillin, Tazobactum and Gentamycin (n.8=15.3%), Tobramycin (n.5=9.6%), Ceftriaxone, Trimethoprim (n.3=5.7%) , Cefotaxim (n.1=1.9%).

Table (2): Antibiotic sensitivity, percentage and Minimum inhibitory concentration of P. aeruginosa

Type of Antibiotic	***Sensitivity***	**%**	MIC*
Ampicillin	0	0	0
Gentamycin	8	15.3	1-8
Levofloxacin	9	17.3	1-4
Amikacin	16	30.7	2-32
Cefazolin	0	0	0
Cefepime	11	21	1-4
Ceftazidime	9	17.3	2-16
Ceftriaxone	3	5.7	8
Imipenem	23	44.2	1-8
Meropenem	12	23	0.25-8
Tobramycin	5	9.6	1-8
Trimethoprim sulfomethazole	3	5.7	20
Pipracillin Tazobactum	8	15.3	4-16
Ciprofloxacin	12	23	0.5-2
Cefotaxim	1	1.9	4

*MIC: Minimum Inhibitory Concentration (µg/ml)

Acinitobacter baumanii (28) isolates were sensitive as followed and shown in Table (3): Ampicillin (n.14=50%), Tobramycin (n.13=46%), Levofloxacin (n.10=35%) Ciprofloxacin (n.6=21.4), Trimethoprim (n.4=14.2%), Imipenem (n.3=10.7%), Cefepime (n.2=7%), Gentamycin (n.1=3.5%).

Table (3): Antibiotic sensitivity, percentage and Minimum inhibitory concentration of A. baumanii

Type of antibiotic	*Sensitivity*	%	MIC
Ampicillin/Sulbactam	**14**	**50**	**2-16**
Gentamycin	**1**	**3.5**	**1**
Levofloxacin	**10**	**35**	**0.12-4**
Cefazolin	**0**	**0**	**0**
Cefepime	**2**	**7**	**2-8**
Ceftazidime	**1**	**3.5**	**4**
Ceftriaxone	**3**	**10.7**	**16-32**
Imipenem	**3**	**10.7**	**0.25-4**
Meropenem	**0**	**0**	**0**
Tobramycin	**13**	**46**	**1-8**
Trimethoprim sulfomethazole	**4**	**14.2**	**20**
Pipracillin Tazobactum	**2**	**7**	**4-8**
Ciprofloxacin	**6**	**21.4**	**0.25-2**
Cefoxitin	**0**	**0**	**0**

***MIC: Minimum Inhibitory Concentration (µg/ml)**

E.Coli (15) isolates were sensitive as followed and shown in Table (4): Amikacin (n.12-80%), Meropenem (n.10=66.6%), Gentamycin (n.9=60%) Cefoxitin, Ciprofloxacin and Tobramycin (n.7=46.6), Levofloxacin (n.6=40%), Ampicillin and Pipracillin (n.5=33%), Imipenem (n.4=26.6%), Ertapenem, Trimethoprim, Ceftrixone, Ceftazidime, Cefpime and Tigacyclin (n.2=13.2%), Qunipristin Dalfopristin, Linezolid ,Vancomycin, Cefazolin (n.1=6.6%).

Table (4): Antibiotic sensitivity, percentage and Minimum inhibitory concentration of E.coli			
Type of antibiotic	***Sensitivity***	**%**	MIC*
Ampicillin/Sulbactam	5	33	2-16
Gentamycin	9	60	1-8
Levofloxacin	6	40	0.12-1
Amikacin	12	80	2-4
Cefazolin	1	6.6	4
Ertapenem	2	13.2	0.5
Tigacyclin	2	13.2	1
Quunipristin	1	6.6	1
Linezolid	1	6.6	2
Vancomycin	1	6.6	0.5
Dalfopristin	1	6.6	1
Cefepime	2	13.2	1
Ceftazidime	2	13.2	1
Ceftriaxone	2	13.2	1
Imipenem	4	26.6	0.5-1
Meropenem	10	66.6	0.25
Tobramycin	7	46.6	1-4
Trimethoprim sulfomethazole	2	13.2	20
Pipracillin Tazobactum	5	33	4
Ciprofloxacin	7	46.6	0.25-2
Cefoxitin	7	46.6	4-16
***MIC: Minimum Inhibitory Concentration (µg/ml)**			

Proteus mirabilis (12) isolates were sensitive as followed and shown in Table (5): Levofloxacin and Ciprofloxacin (n.9=75%), Amikacin (n.8=66.6%), Meropenem (n.6=50%), Pipracillin, Tobramycin and Gentamycin (n.5=41.6%), Cefoxitin and Ampicillin (n.4=33.3%), Ceftazidime (n.3=25%), Cefepime, Ceftrixone and Trimethoprim (n.2=16.6%), Tigecyclin, Cefazolin and Aztreonam (n.1=8.3%).

Table (5): Antibiotic sensitivity, percentage and Minimum inhibitory concentration of P. mirabilis			
Type of antibiotic	***Sensitivity***	**%**	MIC*
Ampicillin	4	33.3	2-16
Gentamycin	5	41	1-8
Levofloxacin	9	75	0.12-0.5
Tigecyclin	1	8.3	1
Aztreonam	1	8.3	1
Amikacin	8	66.6	2-32
Cefazolin	1	8.3	4
Cefepime	2	16.6	1
Ceftazidime	3	25	1
Ceftriaxone	2	16.6	1
Imipenem	0	0	0
Meropenem	6	50	0.25
Tobramycin	5	41.6	1-8
Trimethoprim sulfomethazole	2	16.6	20
Pipracillin Tazobactum	5	41.6	4
Ciprofloxacin	9	75	0.25-0.5
Cefoxitin	4	33.3	4-8
***MIC: Minimum Inhibitory Concentration (µg/ml)**			

Staphylococcus aureus (8) isolates were sensitive as followed and shown in Table (6): Moxifloxacin (n.8=100%), Tigecyclin (n.7=87.5%), Quinipristin and Dalfopristin (n.6=75%), Linezolid (n.5=62.5%), Ciprofloxacin and Gentamycin (n.4=50%), Trimethoprim (n.3=37.5%), Vancomycin and Tetracyclin (n.2=25%) .

Table (6): Antibiotic sensitivity, percentage and Minimum inhibitory concentration of S. aureus

Type of antibiotic	***Sensitivity***	**%**	MIC*
Benzyl pencillin	0	0	0
Ampicillin	0	0	0
Oxacillin	0	0	0
Gentamycin	4	50	0.5-4
Levofloxacin	5	62.5	0.25-4
Moxifloxacin	8	100	0.25-2
Quinpritin dalfoprisitn	6	75	0.25-0.5
Linezolid	5	62.5	2
Vancomycin	2	25	0.25-1
Tetracycline	2	25	4
Tigecyclin	7	87.5	0.12-0.25
Trimethoprim sulfomethazole	3	37.5	40
Ciprofloxacin	4	50	0.25-0.5
Rifampin	1	12.50	0.5
***MIC: Minimum Inhibitory Concentration (µg/ml)**			

Enterobacter aerogenes (4) isolates were sensitive as followed and shown in Table (7): Imipenem, Meropenem, Ciprofloxacin and levofloxacin (n.3=75%), Tobramycin and Gentamycin (n.2=50%), Pipracillin and Amikacin (n.1=25).

Table (7): Antibiotic sensitivity, percentage and Minimum inhibitory concentration of E. aerogenes

Type of antibiotic	***Sensitivity***	**%**	MIC*
Gentamycin	2	50	1
Levofloxacin	3	75	1-2
Amikacin	1	25	2
Cefazolin	0	0	0
Cefepime	0	0	0
Ceftazidime	0	0	0
Ceftriaxone	0	0	0
Imipenem	3	75	1
Meropenem	3	75	0.25-2
Tobramycin	2	50	8
Trimethoprim sulfomethazole	0	0	0
Pipracillin Tazobactum	1	25	32
Ciprofloxacin	3	75	0.5-2
Cefoxitin	0	0	0
***MIC: Minimum Inhibitory Concentration**			

Discussion

Wound is a major concern among healthcare practitioners, not only in terms of increased trauma to the patients but also in view of its burden on financial resources and the increasing requirement for cost effective management within healthcare systems in terms of morbidity and long-term disability throughout the world [6, 7]. Thermal injury impairs the skin its normal barrier function, thus allowing microbial colonization of the burn wounds. Severe dysfunction of the immune system, a large cutaneous colonization, the possibility of gastrointestinal translocation, a prolonged hospitalization and invasive diagnostic and therapeutic procedures, all contribute to infections [6, 8].

This study reveals that a variety of bacterial pathogens are responsible for wound infection in Al- Kindy teaching hospital *Klebsiella pneumonie* was found to be the most common organism isolated. Majority of the bacterial isolates were resistant to almost all the antimicrobials employed. The most common pathogen isolated from burn wounds in my study was *Klebsiella pneumonia* the high prevalence of *Klebsiella pneumonia* in my study different markedly from most other studies in Iraq.

Turkey, Nepal and Singapore studies (9) which that supported the hypothesis that some isolates be most common in warm climate although my study is placed in both climates warm, dry cold climates this hypothesis could be an explanation for our result and also should be further studied. The finding of present study concerning the frequency of *Klebsiella pneumonia* (37.5%) of total isolates (208 isolates) where this organism was held responsible for the majority of invasive burn wound infections in burn treatment facilities (10), *S. aureus* was the sixth in the figure above of microbial isolates recovered in my study. This is contrary to many previous reports indicating much higher frequency of isolation of this organism (11-12).

In this study *E .Coli* was the fourth most frequently recovered organisms this is compatible with study done in Van hospital, Turkey, (13) the pattern of bacterial sensitivity to antibiotics is impartment for epidemiological and clinical purposes. The result of antibiotic sensitivity pattern give serious cause for concern because the predominant bacterial isolates were highly resistant to commonly available antimicrobial agents in Al-Kindy teaching hospital . *Klebsiella Pseudomonas* and *proteus* were found to be multidrug resistance, despite the increased knowledge of pathogenesis and antibiotic resistance mechanism. *Klebsiella, Pseudomonas, Acinitibacter, proteus* are special

concern in burn care unit. This in agreement with study of Huan and Tang (14) who found that *Acinetobacter baumanni* was dominant pathogent in burn patients.

Conclusion

This study concluded that incidence of *K. pneumoniae* sensitivity was observed to Ciprofloxacin, Levofloxacin and Imipenem. While *P. aeruginosa* was more sensitive to Imipenem, Amikacin, Meropenem and Ciprofloxacin. *A.baumanii* was more sensitive to Ampicillin, Tobramycin and Levofloxacin. While, *E. coli* were more sensitive to Amikacin then Meropenem and Gentamycin. *P. mirabilis* was more sensitive to Levofloxacin then Amikacin. Levofloxacin is the much antibiotic affect of more isolates while gram positive bacteria (*S. aureus*) was more sensitive to Moxifloxacin and Qunipristin dalfopristin. *E. aerogenes* was more sensitive to levofloxacin, imipenem and meropenem.

References

1- Bowler PG, Duerden BI, Armstrong DG. Wound Microbiology and Associated Approaches to Wound Management. *Clin. Microbio. Rev* 2001; 14: 244-69.
2- Adebayor OS, Deboye OK, Emiola AR. Wound Infections in two Health Institutions in IIE-Ife, Nigeria: Results of a cohort study. *Osto/Wound Manag* 2003;*49:52-7.*
3- Soares de Macedo JL, Santos JB. Nosocomial infections in a Brazilian Burn Unit. Burns 2006;32:477–81.
4- Fitzwater J, Purdue GF, Hunt JL, O'Keefe GE. The risk factors and time course of sepsis and organ dysfunction after burn trauma. J Trauma 2003;54(5):959–66.
5- Winn W, Allen S, Janda W, et al. Koneman`s Color Atlas and Textbook of Diagnostic Microbiology. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2006.
6- Mayhall CG. The epidemiology of burn wound infections: then and now.Clin Infect Dis. 2003; 37(4): 543-50.
7- Rastegar Lari AR, Alaghehbandan R, Akhlaghi L. Burn wound infectionsand antimicrobial resistance in tehran, iran: an increasing problem. Ann Burns Fire Disasters. 2005; 18(2): 68-73.
8- Avni T, Levcovich A, Ad-El DD, Leibovici L, Paul M. Prophylactic antibioticsfor burns patients: systematic review and meta-analysis. BMJ. 2010; 340: 241.
9- Chim H, Tan BH, Song C. Five-year review of infections in a burn intensive care unit: High incidence of Acinetobacter baumannii in a tropical climate. Burns. 2007; 33(8): 1008-14.
10- Lari AR, Alaghehbandan R. Nosocomial infections in an Iranian burn care center. Burns. 2000; 26(8): 737-40.
11- Sharma BR. Infection in patients with severe burns; cause and prevention thereof. Infect Dis Clin North Am. 2007; 21(3): 745-59.
12- Hodle AE, Richter KP, Thompson RM. Infection control practices in U.S. burn units. Mol Biol Rep. 2006; 27(2): 142-51.

13- Bayram Y, Parlak M, Aypak C, Bayram I. Three-year Review of Bacteriological Profile and Antibiogram of Burn Wound Isolates in Van, internat. J. Med. Sci. 2013; 10(1):19-23.

14- Huan JN, Tang JJ. Drug-resistance Acinetobacter baumannii infection in burn patients: current situation and countermeasure. Zhonghua Shao Shang Za Zhi. 2011; 27(2): 84-7.

الحساسية البكتيرية للمضادات الحيوية لمرضى الحروق والمقاسة بجهاز الفايتك –تو

محمد كمال امين

قسم العلوم التطبيقية – الجامعة التكنولوجية

الخلاصة

تم عزل **208** عزلة بكتيرية من مجموع **187** مريض مصابين بالحروق مراجعين لمستشفى الكندي التعليمي – بغداد – العراق . اظهرت النتائج بان اغلب العزلات موضحة كما يلي *Klebsiella pneumonia* (**37.5 %**) و *Pseudomonas aeruginosa* (**25%**) و *Acinitobacter baumannii* (**13.46%**) و *Escherichia coli* (**7.2%**) و *Proteus mirabilis* (**5.76%**) و *Staphyllococcus aureus* (**3.8%**) و *Enterobacter aerogenes*(**1.9%**) و *Burkholderia cepacia* (**1.4%**) . بينما كانت النسبة المئوية لكلا من *Enterobacter cloacae* و *Staphylococcus intermedius* (**0.96%**). واخيرا كانت اقل نسبة مئوية **0.48 %** للبكتريا *Aeromonas hydrophiliacaviae* و *Enterococcus faecalis* و *Enterococcus gallinarum* و *Providencia stuartii* على التوالي . اعتمدت الدراسة الحالية على المقاومة المتعددة لعدد من المضادات الحياتية المستخدمة في وحدة معالجة الحروق. كان العقاران **Ciprofloxacin** و **Levofloxacin** اكثر المضادات الحيوية فعالية ضد اغلب العزلات البكتيرية فيما كانت المضادات الحياتية كـ **Tobramycin** و **Sulbactam/Ampicillin** اكثر فعالية لبكتريا *Acinetobacter baumannii*. بينما كانت **Moxifloxacin** و **Tigecyclin** اكثر العقارات تاثيرا على البكتريا الموجبة لصبغة غرام.