

Comparison between bacteremia in burned and nonburned patients

Suham Shakoor Obaid¹, Qanat Mahmood Atiyea², Shaimaa Mustafa Qattal³

¹ Biology Department, College of Science, Kirkuk University, Kirkuk, Iraq

² Biology Department-College of Science-Tikrit University, Tikrit, Iraq

³ Medical laboratory techniques department, Technical college, Northern technical university, Kirkuk, Iraq

Abstract

In this study (186) samples of bacteremia (Burns and Non burns) included (81) samples were positive and (105) samples were negative. The patients age of (1-10) years are the more number and frequency of patients while the patients age (41-50) years were the lowest number and frequency of patients. The large number of bacteremia in age (1d-30d), while the less number of bacteremia in age (41-50) years. There were 24 patients with bacteremia (12)male ;(12)female which represents the large number of bacteremia according to gender and age, and the smallest number of them is (2) in age (41-50)years .Staphylococcus aureus is the largest number of identified bacteria that isolated from blood samples ,then Serratia marcescens and Pseudomonas aeruginosa .The isolates in this study were studied in their ability of Resistance (R) or Sensitive (S) or Intermediate (I) against Imipenem, Cefazidime, Cefotaxone, Cefotaxime, Cefixime, Cefalothine, Gentamicine, Pipracilline, Ampicilline, Ticarcillin, Ciprofloxacin and Amoxicilline +Clavulanic acid (AMC). The conclusion's in presents study indicates females higher than males as well as the age (1-10)years from other ages, but Bacteremia (+) alternated in different ages.

Introduction

Bacteremia is one of the most important causes of mortality and morbidity in burnwards and major reason of death .

A major problem in many parts of the world is a Burn injury,as it is not only associated with delayed wound healing and scar formation, but may also lead to sepsis related morbidity and mortality[1].

Several reasons make burns victim predisposed to infections,such as Necrotic tissues presence ,widen of burn area, Inability of blood to reach the affected environment ,Immunocompromising effect of burn wounds and moist area in wound (which is susceptible for proliferation and colonization) [2,3,4]. The microorganisms can originate from the patient's own skin (hair follicles and sweat glands), gut and respiratory flora (endogenous), as well as from contact with health care personnel and environment (exogenous) [5].Invasion of microorganisms into the tissue layers below the dermis lead to bacteremia, sepsis and multiple organ dysfunctions. Bloodstream infection and the subsequent development of sepsis are among the most common infection complications occurring in burn patients in the intensive care unit [6]. Bacteremia and infection can release toxins into the blood that leads to sepsis and cause systemic inflammatory response [7]. Thermal destruction of the skin barrier and concomitant depression of local and systemic host cellular and humoral immune responses are pivotal factors contributing to infectious complications in patients with severe burns[8,9,10]. The burn wound surface (in deep partial-thickness and in all full-thickness burns) is a protein-rich environment consisting of avascular necrotic tissue (eschar) that provides a favorable niche for microbial colonization and proliferation[9,11].

Gram-positive bacteria that survive the thermal insult, such as Staphylococci located deep within sweat glands and hair follicles, heavily colonize the wound

surface within the first 48 hours unless topical antimicrobial agents are used.[9,11] These wounds are subsequently colonized with other microbes including Gram-positive bacteria, Gram-negative bacteria & yeasts derived from the host's normal gastrointestinal and upper respiratory flora and/or from the hospital environment or that are transferred via a health care worker's hands [10,11,12,13].

Materials and methods

1_ Study Population:

One hundred and eighty six blood samples were collected from patients (infants/adults) under aseptic conditions. Admitted to Azadi teaching hospital in Kirkuk City from the period of (30/1/2014) to (1/7/2015) ,where (84) male and (102) female, the age was from 1 day _98 years.

2-Sample collection:

In all cases blood was obtained by peripheral vein puncture. At least 1 ml of blood was used from children under one year age, 2 ml from children above 1 year and 5 ml for adult patients .The blood samples were inoculated into culture bottle contained brain heart infusion (9, 18, 45 ml) respectively then transferred immediately to the laboratory to incubate it at 37 C for 2-7 days [14].

3-Identification

After the incubation period, the signs of growth appeared in the blood culture e.g.; gas production, turbidity, hemolysis and flocculation. 0.1 ml was taken from the blood culture then subcultured on media blood agar, chocolate agar put in candle jar for recovering of microaerophilic bacteria, other 3 plates put directly incubated at 37 C for 24 hours. The colonies identified depending on microscopic and biochemical tests [15,16,17].

4-Antibiotic sensitivity

Antibiotic sensitivity was performed on Mueller-Hinton agar according to Kirby-Bauer disc diffusion method [18].Sensitivity was read after incubation for

24 hours at 37 C. Isolates were regarded as sensitive or resistant according to NCCLS criteria [19].

Results and Discussion

In This study we are focus the light on the studying the patients with Bacteremia (Burned & Non burned) and comparison between them of the age and gender,

we are observed the female higher than the male because of the nature of work and as many as currency which will be the reason of burns it was not correlated with [20] They showed that the females less than males whereas agreement with [21,22,23,24]. As in the Table(1) & (2).

Table(1): Blood culture results and proportion of bacteremia

Cultured result	Male	Female	Total
	No.%	No.%	No.%
Positive	34 (40,47%)	47 (46,07%)	81 (43,24%)
Negative	50(59,52%)	55(53,92%)	105(56,45%)
Total	84(45,16%)	102(54,83%)	186

Table(2): cultured result according to gender and type of patients

Cultured result	Total NO.	Burned patients		Non- burned patients	
		Male No. %	Female No. %	Male No. %	Female No. %
Positive	81(43,54%)	3 (37,5%)	13 (80%)	31 (40%)	34 (40,22%)
Negative	105(56,45%)	5(62,5%)	2(13,33%)	45(59,21%)	53(60,91%)
Total	186	8(4,30%)	15(8,06%)	76(40,86%)	87(46,77%)

When comparison the age we are observed that the age (1-10) years was 45 (24,19%) the highest number of patients because of being this period represent the activity of the child and his movements contact with the environment without knowlege of its dangerous of its dangerous which correlated with [25] followed

by age (1 d-30 d) 36(19,35%) because of the weakness of the immunity system in this age. thus (2-11)m was 24 (12,90%) then graduated in the other ages in smaller number to limit above of (60)years , it was not correlated (20) as in Table (3).

Table(3):Total number and frequency of patints according to gender, age and type of patients

Patients age	Total NO.	Burned patients		Non- burned patients		Total NO.	
		Male No. %	Female No. %	Male No. %	Female No. %	Male No. %	Female No. %
1d-30d	36(19,35%)	0	0	19(25%)	17(19,54%)	19(22,61%)	17(16,66%)
2 -11m	24(12,90%)	1(12,5%)	0	9(11,84%)	14(16,09%)	10(11,90%)	14(13,72)
1-10 y	45(24,19%)	5(62,5%)	1(6,66%)	21(11,29%)	18(20,68%)	26(30,95%)	19(18,62%)
11-20y	23(12,36%)	2(25%)	9(60%)	6(7,89%)	6(6,89%)	8(9,52%)	15(14,70%)
21-30 y	14(7,52%)	0	4(26,66%)	6(7,89%)	4(4,59%)	6(7,14%)	8(7,84%)
31-40y	10(5,37%)	0	1(6,66%)	4(5,26%)	5(5,74%)	4(4,76%)	6(5,88%)
41-50y	8(4,30%)	0	0	1(1,13%)	7(8,04%)	1(1,19%)	7(6,86%)
51-60y	11(5,91%)	0	0	5(6,57%)	6(6,89%)	5(5,95%)	6(5,88%)
Above 60y	15(8,06%)	0	0	5(6,57%)	10(11,49%)	5(5,95%)	10(9,80%)
Total	186	8(4,30%)	15(8,06%)	76(40,86%)	87(46,77%)	84(45,16%)	102(54,83%)

We were notice bacteremia was (+) according to age and gender ,the highest percentage was 24 (29.6%) for children in age (1d-30d) infants because of theresnot maturity for the immunity system and followed by 17(20.9%) for cheldren in age (1-10 y) because of the contineous movement of human beings in this stage of age (more dangerous) then age(11-20y)12(14.8%) which followed by bacteremia (+) in age(2-11 m) 9(11.1%) in all this states the(Non burned patients) were the largest number of the

Burned patients except of age (11-20 y) this results were correlated with [20]. The Burns were deep and dagerous because of diffecult work of this people in this period of age,at last bacteria reach to the Blood stream to cause Bacteremia ,it was not correlated with [23] and [20]. The role of different bacterial species in burn pathology varies from mere colonization, interference with healing and grafting, to invasion of the blood stream with subsequent septicemia, local tissue sepsis and death [26]..as in Table(4).

Table (4): Distribution of bacteremia (+ ve) according to gender and age

Patients age	Total NO.	Burned patients		Non- burned patients		Total NO.	
		Male No. %	Female No. %	Male No. %	Female No. %	Male No. %	Female No. %
1d-30d	24(29.6%)	0	0	12(50%)	12(50%)	12(50%)	12(50%)
2 -11m	9(11.1)	0	0	3(33.3%)	6(66.6%)	3(33.3%)	6(66.6%)
1-10	17(20.9%)	3(17.6%)	1(33.3%)	7(41.1%)	6(35.2%)	10(58.8%)	7(41.1%)
11-20	12(14.8%)	0	6(50%)	3(25%)	3(25%)	3(25%)	9(75%)
21-30	7(8.6%)	0	3(42.8%)	3(42.8%)	1(14.2%)	3(42.8%)	4(57.1%)
31-40	4(4.9%)	0	2(50%)	1(25%)	1(25%)	1(25%)	3(75%)
41-50	2(2.4%)	0	0	1(50%)	1(50%)	1(50%)	1(50%)
51-60	3(3.7%)	0	0	1(33.3%)	2(66.6%)	1(33.3%)	2(66.6%)
Above 60	3(3.7%)	0	0	0	3	0	3(100%)
Total	81	3(3.7%)	12(14.8%)	31(38.2%)	35(43.2%)	34(41.9%)	47(58%)

The high number and percentage of bacteria was *Staph.Spp* 42 (50.6%) because it was being the normal flora then become opportunistic in the acute infection because of being those patients were immunocompromised individuals, followed by *E.coli* 11(13,25%) which represent the distinct pathogen of

skin and bacteremia then *P.aeruginosa* 7(8.43%) then *Staph.aureus* was 6 (7.22%) were main pathogens of of burns and wounds and it was the basis of bacteremia, where as the other genera occurrence in the smaller number, This results were not correlated with [20,27,28,29].as in the Table(5).

Table(5): Number and percentage of identified bacteria isolated from blood samples

Bacterial name	Patients no. (81)		Burned (16)		Non-burned (65)	
	NO.	%	Male No. %	Female No. %	Male No. %	Female No. %
1. <i>Staphylococcus aureus SA</i>	6(7.22%)		--	--	2(33.3%)	4(66.6%)
2. <i>Staphylococcus ssp.* SS</i>	42(50.6%)		--	3(7.14%)	19(45.2%)	20(47.6)
3. <i>Enterococcus faecalis</i>	1(1.20%)		--	--	--	1(100%)
4. <i>Streptococcus ssp.**</i>	4(4.81%)		--	--	1(25%)	3(75%)
5. <i>Escherichia coli E</i>	11(13.25%)		--	3(27.2%)	3(27.3%)	5(45%)
6. <i>Serratia marcescens SM</i>	1(1.20%)		1(100%)	--	--	--
7. <i>Klebsiella pneumoniae Kp</i>	4(4.81%)		--	2(50%)	2(50%)	--
8. <i>Klebsiella terrigena Kt</i>	1(1.20%)		--	1(100%)	--	--
9. <i>Citrobacter freundii CF</i>	1(1.20%)		--	1(100%)	--	--
10. <i>Pasteurella pneumotropica PP</i>	1(1.20%)		--	--	1(100%)	--
11. <i>Pseudomonas aeruginosa P</i>	7(8.43%)		2(28.5%)	3(42%)	1(14.2%)	1(14.1%)
12. <i>Acinetobacter baumani A</i>	3(3.61%)		--	2(66.6%)	1(33.3%)	--
13. <i>Moraxella catarrhalis M</i>	1(1.20%)		--	--	1(100%)	--
14. Total bacterial number	83***		3(3.6%)	15(18%)	31(37.34%)	34(40.9%)

* Coagulase –ve, ** alpha streptococci, *** 2 patient infected with two pathogens

On the other hand the results of antibiotic showed *E.coli* was Resistance (R) for all usage antibiotic because of being own the transfer plasmids of the genes by conjugation where as the *Citrobacter freundii* was sensitive (S) for all of them this result

correlated with [23]. But *P.aeruginosa* was Resistance (R) for the majority of the usage antibiotic because this bacteria was own distinct genetic properties (we will mention it subsequently) which agreed with [27,24], but disagreed with [30].as in the Table (6).

Table (6): Results of Antibiotic sensitivity for *E.coli* & *Citrobacter freundii*

Antibiotics symbol and coccentration	Bacterial name: <i>E. coli</i> and <i>Citrobacter freundii</i>											
	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	CF
Imipenem IPM(10)	S	S	R	R	R	R	S	S	S	S	S	S
Ceftazidime CAZ(30)	R	R	R	R	R	R	R	R	R	R	R	S
Ceftriaxone CRO (30)	R	R	R	R	R	R	R	R	R	R	R	S
Cefotaxime CTX(30) or CTR	R	R	R	R	R	R	R	R	R	R	R	S
Cefixime CFM(5)	R	S	R	R	R	R	R	R	R	R	R	S
Cephalothin KF OR CEP	R	R	R	R	R	R	R	R	R	R	R	S
Gentamicin GM(10)	I	R	S	S	S	R	R	S	S	S	S	S
Pipracillin PI (100)	R	R	R	R	R	R	R	R	R	R	R	S
Amoxicillin + Clavulanic acid AMC	R	R	R	R	R	R	R	R	R	R	R	S
Ampicillin AMP (10)	R	R	R	R	R	R	R	R	R	R	R	S
Ticarcillin TIC(75)	R	R	R	R	R	R	R	R	R	R	R	S
Ciprofloxacin CIP(5)	S	S	S	S	S	R	S	S	S	S	S	S

as well as, *Pasteurella pneumotropica* was Resistance (R) for the majority of antibiotic. While *Acinetobacter bauranti* was alternated between sensitive and Resistance for the usage antibiotic in our study which correlated with [31].as in the Table (7).

Table (7): Results of Antibiotic sensitivity for *P.aeruginosa* & , *Pasteurella pneumotropica*, *Acinetobacter baumani*, *Moraxella catarrhalis*

Antibiotics symbol and concentration	Bacterial name: <i>Pseudomonas aeruginosa</i> , <i>Pasteurella pneumotropica</i> , <i>Acinetobacter baumani</i> , <i>Moraxella catarrhalis</i>											
	P1	P2	P3	P4	P5	P6	P7	PP8	A1	A2	A3	MC
Imipenem IPM(10)	S	S	S	R	S	R	S	R	R	S	S	S
Ceftazidime CAZ(30)	S	S	R	R	R	R	R	R	R	S	S	S
Cefixime CFM(5)	R	R	R	R	R	R	R	R	R	S	S	R
Tobramycin TOB (10)	R	R	S	R	S	R	R	S	I	R	S	S
Amikacin AK (30)									I	R	S	S
Pipracillin PI (100)	R	R	R	R	R	R	R	R				S
Amoxicillin + Clavulanic acid AMC	R	R	R	R	R	R	R	R	R	R	R	R
Penicillin P								R	R	R	R	R
Ciprofloxacin CIP(5)	R	R	S	S	S	R	S	S	I	S	S	S

While *Klebsiella* was Resistance(R) except one of the isolates was Sensitive(S).as in the Table (8).

Table (8): Results of Antibiotic sensitivity for *Klebsiella* & *Serratia*

Antibiotics symbol and coccentration	Bacterial name, klebsiella, and serratia				
	Kp1	Kp2	Kp3	Kt	Sm4
Imipenem IPM(10)	S	R	R	R	R
Ceftazidime CAZ(30)	S	R	R	R	R
Ceftriaxone CRO (30)	S	R	R	R	R
Cefotaxime CTX(30)	S	R	R	R	R
Cefixime CFM(5)	S	R	R	R	R
Cephalothin KF	S	R	R	R	R
Gentamicin GM(10)	S	R	R	R	R
Amoxicillin + Clavulanic acid AMC	R	R	R	R	R
Ciprofloxacin CIP(5)	S	S	R	R	R

In such this case the reason of some bacterial isolates was Resistant(R) to antibiotics may be due to development new resistant genes or by mutation through previously exposure to these antibiotics.. and this acorrelated with [27]. *Staph. spp* and number of isolates of *Staph.aureus* was alternate between Resistance (R) and Sensitive(S) as well as for *E.faecalis* which was not correlated with [23] were all the isolated *Staphylococcus aureus* and Coagulase negative *Staphylococci* were susceptible to Vancomycin and all the isolates of *Staphylococcus*

aureus except one were Resistant (R) for Oxacillin (Methicillin) which correlated with [32]. Methicillin-resistant *Staphylococcus aureus* (MRSA) is also called oxacillin resistant *S. aureus* (ORSA) which has long been associated as a major agent of nosocomial infection and is a prominent reason for higher morbidity and mortality in burn patients causing a variety of infections such as bacteremia, pneumonia, septic arthritis, endocarditis, and surgical site infections [33,34].as in the Table(9),(10),(11) and (12).

Table (9): Antibiotic sensitivity of *Staph.aureus*

Antibiotics symbol and cocentration	Bacterial name, staph sp.									
	SS 1	SS 2	SS3	SS 4	SS 5	SS 6	SS 7	SS 8	SS 9	SS 10
Gentamicin GM(10)	S	S	S	S	S	S	S	S	R	SS 42 سقط سبور مجموع
Erythromycin E (15)	R	R	R	R	R	S	S	R	R	
Tetracycline TC or TE(20)	R	R	R	R	R	S	S	R	R	
Penicillin	R	R	R	S	S	R	R	R	R	
Ciprofloxacin CIP(5)	S	R	S	S	S	S	S	S	S	
Vancomycin VA (30)	S	S	S	S	S	S	S	S	S	
Oxacillin OX	R	R	R	R	R	R	R	R	R	
Clindamycin CD	R	S	S	S	S	S	S	R	S	

Table (10): Antibiotic sensitivity of *Staph.aureus*

Antibiotics symbol and cocentration	Bacterial name: <i>staph. spp.</i>													
	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24
Gentamicin GM(10)	S	S	S	S	S	S	S	S	S	S	S	S	S	R
Erythromycin E(15)	S	S	S	R	S	R	S	S	R	R	R	S	S	S
Tetracycline TC (20)	S	S	S	S	S	S	S	S	S	S	R	R	R	R
Penicillin	R	R	R	R	R	R	S	R	R	R	R	R	R	R
Ciprofloxacin CIP(5)	S	S	S	R	S	S	S	S	S	S	S	S	S	S
Vancomycin VA (30)	S	S	S	S	R	S	S	R	S	S	S	S	S	S
Oxacillin OX	R	S	S	R	R	R	S	R	R	R	S	R	R	R
Clindamycin CD	S	S	S	S	S	S	S	S	R	R	S	S	R	S

Table (11): Antibiotic sensitivity of *Staph. aureus*

Antibiotics symbol and cocentration	Bacterial name: <i>staph. spp.</i>													
	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38
Gentamicin GM(10)	R	R	S	S	S	S	S	S	S	R	S	S	S	S
Erythromycin E(15)	S	R	R	R	R	R	S	S	R	R	R	S	R	R
Tetracycline TC (20)	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Penicillin	R	R	R	S	R	S	S	R	R	R	S	R	S	R
Ciprofloxacin CIP(5)	S	S	S	S	S	S	S	R	S	S	R	S	S	R
Vancomycin VA (30)	S	S	S	S	S	R	S	S	R	S	S	S	S	S
Oxacillin OX	S	R	S	R	I	R	S	R	R	R	R	R	S	R
Clindamycin CD	S	R	S	R	S	S	S	S	S	S	R	S	S	S

Table (12): Antibiotic sensitivity of *Staph. aureus*

Antibiotics symbol and cocentration	Bacterial name: <i>staph. spp.</i> and <i>staph. Aureus</i>											
	S39	S40	S41	S42	S43	SA 1	SA 2	SA 3	SA 4	SA 5	SA 6	
Gentamicin GM(10)	S	S	S	S	S	S	S	S	S	S	S	
Erythromycin E(15)	S	S	R	R	S	S	R	R	R	R	S	
Tetracycline TC (20)	S	S	S	S	R	S	S	S	S	S	S	
Penicillin	R	R	R		R	R	R	R	R	R	R	
Ciprofloxacin CIP(5)	S	S	S	S	S	S	S	I	R	S	S	
Vancomycin VA (30)	S	S	R	S	S	S	S	S	R	S	S	
Oxacillin OX	R	R	R	S	R	S	R	R	R	R	R	
Clindamycin CD	S	S	S	S	S	R	S	S	S	S	S	

The spread of MRSA has an enormous impact on patients as well as in the country because it dramatically increases the health-care expenditure [35]. Infection of burn wound patients with MRSA and pathogen causes higher morbidity and mortality which may contribute death in about three fourths of the burn wound infected patients [23,36]. Burn wound infections in some countries be-come of more concern due to lower socioeconomic status and tropical weather that intensify the occurrence and spread of various pathogens. Due to imprudent uses and suboptimal doses of antibiotics, common

pathogenic microorganism develops antimicrobial resistance against commonly used drugs. It increases the burden of patient as well as national cost in the health care sectors which was in agreement with the findings of [37] as they reported 28% frequency of MRSA in hospitalized burn patients. Methicillin resistant *S. aureus* can spread from one patient to another patient during their nursing, and the hospital personnel may promote the transmission [38]. All the Gram negative bacterial isolates were Resistance and sensitive to Imipenem, Ciprofloxacin then followed by Piperacillin + Tazobactam and ceftazidime. In

most cases, patients initially take antibiotic without consulting an expert. As a result microorganisms get suboptimal pressure at which they are not killed conversely, they acquire their ability to withstand the antibiotic pressure and emerge as antibiotic resistant strain. [38,39]. There are three mechanisms of antibiotics resistance including: reduced uptake or decreased cell permeability, production of modifying enzymes, or alterations at the ribosomal binding sites [40] All this results does not correlated with [41] were majority of them isolats were Sensitive (S) and the rest (most few) were Resistance (R). Still, management of burn patients remains a specialized burn units and challenge with respect to availability of dedicated as well as increasing drug resistance [26]. In our studying we were found that *S. viridans*

was sensitive (S) for all of the antibiotic all the results were disagreement with [25].

Statistical Analysis:

Table(1): There is not significant difference.

Table(2): Burned patients: There is significant difference at level 0.01

Non burned: There is not any significant difference.

Table(3): Burned patients: There is significant difference at level 0.05

Non burned: There is not any significant difference.

Table(4): Burned patients: There is significant difference at level 0.05

Non burned: There is not any significant difference.

Table(5): Burned patients: There is significant difference at level 0.05

Non burned: There is a significant difference at level 0.01.

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المقارنة بين تجرثم الدم بين المرضى المحروقين وغير المحروقين

سهام شكور عبيد^١ ، قناة محمود عطيه^٢ ، شيماء مصطفى قتال^٣

^١ قسم علوم الحياة ، كلية العلوم ، جامعة كركوك ، كركوك ، العراق

^٢ قسم علوم الحياة ، كلية العلوم ، جامعة تكريت ، تكريت ، العراق

^٣ قسم التقنيات المخبرية الطبية ، الكلية التقنية ، الجامعة التقنية الشمالية ، كركوك ، العراق

الملخص

في هذه الدراسة (١٨٦) عينه من تجرثم الدم (المرضى المحروقين وغير المحروقين) تتضمن (٨١) عينه كانت موجبه و(١٠٥) عينه كانت سالبه. المرضى بعمر (١٠-١) سنوات كان هو الرقم الاكبر والاكثر تكرارا، بينما المرضى بعمر (٤١-٥٠) سنة كانوا هم الاقل رقما وتكرارا بين المرضى. الرقم الاكبر لتجرثم الدم (+) وجد في عمر (١-٣٠) يوما ، بينما الرقم الاقل لتجرثم الدم (+) كان في عمر (٤١-٥٠) سنة. هنالك ٢٤ مريض مصابين بتجرثم الدم وهم (٢٤) من ضمنهم (١٢) من الذكور و(١٢) من الاثنا، حيث كان الاثنا هم الاكثر عند المقارنة حسب الجنس والعمر. ان بكتريا المكورات العنقودية الذهبية *Staphylococcus aureus* هي الاكبر عددا بين البكتريا المشخصة والمعزولة من الدم. ثم بكتريا *Serratia marscens* وتلتها بكتريا الزوائف الزنجارية *Pseudomonas aeruginosa*. ان العزلات في هذه البحث درست على اساس قابليتها على المقاومة او الحساسية وغيرها ضد كلا من المضادات Imipenem, Ceftazidime, Cefotaxime, Cefotaxime, Cifixime, Cefalothine, Gentamicine, Pipracilline, Ampicilline, Ticaracillin, Ciprofloxacin and Amoxicilline +Clavulanic acid (AMC).

المؤتمر العلمي الثالث