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Bacterial Infections of Second-Degree Burns and their Antibiotic Resistance Patterns with Residence Time in Al-Hilla General Teaching Hospital, Iraq

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Abstract

A healthy skin barrier is substantial to protect from infection, maintain body liquid balance and regulate heat. A burn lesion damages the external barrier and allows bacterial infection, thus delaynig the healing of burn's wound. The aim of this study is to characterize the bacterial flora in second degree burns in a time period of 4 weeks and testing the sensitivity of the isolated bacteria to antibiotics . Samples were collected from burned patients in Al-Hilla General Teaching Hospital over a four-month period from June 2020 to September 2020. The colonization of bacteria to burns wounds was noticed weekly from the time of entry until the fourth week of hospitalization. Periodic swabs from burns were collected in the first, second, third and fourth weeks of hospital stay. Through the four months of the potential study, a total of 25 patients with a new burn accident at the burn department were investigated . The *Enterobacter* sp. and *Pseudomonas aerugionsa* accounted for 33% and 22% respectively of bacteria isolated from burn wounds followed by *Klebseilla* sp. 12% and *Bacillus* sp. 38 (17.7%). It was observed that *Pseudomonas aeruginosa* was predominant among the bacterial isolates in both single and mixed infections during the examined time. *Pseudomonas aeruginosa* was the dominant bacteria throughout the study period in particular and most of them were resistant to antibiotics. Amikacin was the selected antibiotic for almost bacteria and was present to have an effectiveness against almost of the isolated bacteria. Current research appears to be useful in supplying beneficial advice for selecting an efficient antibiotics against bacterial isolated from patients with burns

Keywords: Bacterial flora, Burns, Antibiotics Resistance, Tested Time.

Introduction

The skin is a fundamental element of the innate immune system, conserving the host from possible environmental pathogens (Wardhana *et al*.,2017). Thermal burns in the skin due to any exterior heat exporter; other kinds of burns inclusive chemical burns, rays burns, and electrified burns(Zahra *et al.,* 2016). Burns remains an important public health matter in terms of disability , morbidity and death rate around the world , particularly in economically evolving countries (Rashid *et al*., 2019) .Despite significant progress in the nursing of burned patients, infectious complexities stay a significant agent of illness and decease (Zahra *et al*., 2016).Moreover, wound infestation remains the leading source of infection in burns intense care centers. Burned patients are at a high hazard of infection as an outcome of the kind of the burn, the immune impacts of burns, extended stays in hospitals, and extensive screening and treatment protocols (Mir *et al*., 2017).

Burned patients have to remain in the hospital for prolonged time, and many devices are placed into the vessels and others. Thus they are more likely to acquire hospital-acquired infections(El-Kased *et al*., 2017). The organism that prevail as causal agents of a burn infection in whatever burn treatment easiness vary over time. Gram positive bacteria at first spread through a hospital indwelling for patients (El-Kased *et al*., 2017), and then it is progressively substituted by an opportunistic Gram negative bacteria which sound to have a higher tendency to invasive. Burns are not just crucial to be accountable for the dying but as well an essential agent in prolonging stay in hospital and delaying skin treatment (El-Kased e*t al*., 2017). Thus, each burning establishment must determine time -linked shifts in the dominant normal flora and the sensitivity to antibiotics antimicrobial sensitivity (Akhtar *et al.,* 2017).

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The information regarding changes in the microbial profile of burned wounds concerning time are limited. The newly emerging and immediately emerging hospital and community pathogenic bacteria and the issue of multidrug resistant require a recurrent check for isolation and antibiotic patterns in the incineration ward. Although eliminating infection in burned patients is impossible, good monitoring is being done; program for infections management and preventing can help decrease mortality , prolonged hospitalization, and correlated costs(Rathod & Kasturi, 2017) . This study was conducted to detect time linked change in microflora in wounds of burns from patients in Al-Hilla General Teaching Hospital and testing the sensitivity of an isolated bacteria to antibiotics.

Methodology

The samples were collected through a period of a four-months from June 2020 to the end of September 2020 from burned patients in Al-Hilla General Teaching Hospital. The colonization of bacterial to burns was detected weekly from the time of entry until fourth week of staying in the hospital. Cyclic swabs from burns' wounds have been collected in the first, second, third and fourth weeks of hospital indwelling . Therefore, through the total interval, the samples' number was 100 samples from 25 patients. Whereas, the procedures of sampling achieved by a set of cotton swab from the deep rejoin of the burn's wound.

The procedures followed in sampling were first by take off the bandages, followed by removing the residues of local antibiotic and then wiping the burns before washing them and applying new topical antimicrobial agents. Finally, the samples were transferred immediately to a sterile test tube. If a sample was collected from the dry surface, the smears were wetted by using sterile normal saline. After collection of samples , they were tagged adequately with patient's Name, age, and Gender. The samples then were processed at the hospital laboratory. The collected samples were grown in blood agar and MacConkey agar and incubated at 37˚C for 18-24 hours. Bacterial isolates were initially diagnosed by colonial morphology and their properties with biochemical identification as shown in Table 1. Also, the antibiotic sensitivity test for bacterial isolates has been carried out during the study period using Kirby –Bauer disk diffusion method using Kirby –Bauer disk diffusion method ,as clarified in figure(1) .

Results and Discussion

Through the four months of the study, the overall of 25 patients who have a recent burn accident in the burn department were investigated. The range of patients' age was from 20 to 51 years (mean 28.9, average 23.5, 15.9 SD). The occurrence of burns was most common in females (55%) in contrast to males (45%), and the study of the location of the burns on patient's body showed the highest incidence of burns was in the arms and chest (44%). Burning of the total surface area of the body were range between (20- 92)%.

The burns that caused by flame, found in (70%) cases, and electrical burns were (16%), and then burns reported with rate of (14%) . The overall percentage of positive cultures was 91% compared to no growth of 9 % from 100 purulent swabs:

The *Enterobacter* sp and *Pseudomonas aeruginosa* accounted for 33% and 22% respectively of bacteria isolated from burns followed by *Klebseilla* sp., 12% and *Bacillus* sp., 38 (17.7%). It was noted that *Ps. aeugionsa* was the dominated isolate in both of individual and mixed infections among the total bacterial isolates for the tested time (Table 2).

Pseudomonas aeruginosa and *Enterobacter* sp were the most common isolates in the first week culture with 55% and 31% respectively. There was a little rise in the number of *Ps.aeruginosa* (60%) ,Whereas the number of both *Klebseilla* sp. and *Bacillus* sp. stays almost stable during the study period. *Enterobacter* sp. decreased significantly in the following weeks, but *Ps. aeruginosa* remained the dominant bacteria during the first to fourth week period (Table 3).

The susceptibility of *Ps. aeruginosa* isolated from samples of patients to antibiotics was least among other isolates, it was resistance to almost of the tested antibiotics. The sensitivity profile of most of the tested antimicrobial agents

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reduced from the first to the fourth week of culturing ,and at the ending of the fourth week, most of *Ps. aeruginosa* isolates were resistance to all used antibiotics excluding cefixime and chloramphenicol (Table 4).

The pattern of sensitivity for *Enterobacter* sp. to antimicrobial agents indicated that almost of isolates were very susceptible to Chloramphenicol (32%) ,Ciprofloxacin (33%) and Levofloxacin (50%). Likewise, almost most isolates of *Enterobacter* sp. were found to be susceptible to Amikacin (66%). On the other hand, *Enterobacter* sp. was less sensitive to Cotrimoxazole (20%), gentamicin (11%) (Table 5).

Klebseilla sp. were less susceptible to about half of the tested antibiotics through the first week of culturing. As well, it was entirely resistance for three quarters of the antimicrobial agents that included Gentamicin, Cefotaxime ,Cefixime ,Cotrimoxazole ,Ciprofloxacin and Levofloxacin at the ending of the fourth week. Amikacin was the most efficient antibiotics for *Klebsiella* sp. isolates following by Chloramphenicol ,as shown in Table(6).

Cefixime antibiotic was the less efficient contra most of *Bacillus* sp. isolates from the total samples. Whereas ,Vancomycin ,Oxacillin ,Levofloxacin, and Chloramphenicol were the efficient antibiotics against most of *Bacillus* sp. isolates . There was a significant difference in the patterns of the antibiotics sensitivity through the four weeks at P value, 0.05 (Table 7).

Pseudomonas aruginosa appeared less sensitive to Cefotaxime, Amikacin ,Cotrimoxazole, Ciprofloxacin ,Gentamicin and Levofloxacin. The susceptibility pattern gradually reduced from the first to the fourth week of culturing, that may belong to *Pseudomonas'* capability to acclimate the environment of hospital or may be due to the inappropriate treatment. This finding was agreed with that reported by(Mohamed, 2016 and Jasem *et al*.,2018). Also, it was identical to findings of study by Dasharatha *et al*.(2017) who observed depressed levels of susceptibility to most antibiotics, as well reported in another study by (Bora and Dhar, 2018). Nearly all of the *Pseudomonas aerugionsa* isolates were utterly resistance to most of the antibiotics tested in the fourth week of culturing.

Wardhana *et al*.(2017) mentioned that vancomycin proved to be a very effective antibiotic as it showed the sensitivity of 97.6% of *Staphylococcus aureus*, *Enterobacter* sp. were sensitive to other antibiotics; Levofloxacin and Chloramphenicol with a rate (80.5%) for each of them and sensitivity rate for Ciprofloxacin was (61.0%). Additionally, in other studies, the high sensitivity rate of an internal bacteria to Levofloxacin was (66.7%) and for Ciprofloxacin was (58.3%) ,and there was no significant difference in the patterns of antibiotic sensitivity by *Bacillus* sp.

Conclusion

Study results indicate that multidrug-resistant Gram-negative organisms are the most isolates from burn wounds and *Pseudomonas aeruginosa* was the dominant bacteria throughout the study period in particular. Amikacin was the selected antibiotics for almost bacteria and it was present to be the efficient antibiotics contra most of the isolated bacteria. In conclusion, Current research appears to be useful in supplying beneficial advice for selecting an efficient antibiotics against bacterial isolated from patients with burns

Table 1 .Biochemical identification of the isolated bacterial samples

Biochemical Test	***Bacillus* sp.**	***Enterobacter* sp.**	***Klebseilla* sp.**	***Pseudomonas aeruginosa***
Catalase	+	+	+	+
Oxidase	+	+	+	+
Coagulase	-	-	-	-
Litmus milk decolorization test	-	+	+	-
Hydrogen sulphide (H_2S)	+	–	+	+
Voges-Proskauer	-	+	+	+

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(VP)				
methyl-red (MR)	+	+	_	+

+:Postive -: Negative

Table 2 .The prevalence rate of isolated bacteria with infection type

Types of infection			
Mixed Infections	**No.(%)**	**Individual Infection**	**No.(%)**
Ps. aeruginosa + *Bacillus* sp.	22(24.2)	*Pseudomonas aerugionsa*	24(26.4)
Ps. aeruginosa + *Enterobacter* sp.	13(14.3)	*Enterobacter* sp.	16(17.6)
Psaerugionsa + *Klebsiella* sp.	4(4.4)	*Klebseilla* sp.	4(4.4)
Enterobacter sp. + *Bacillus* sp.	1(1)	*Bacillus* sp.	5(5.5)
Enterobacter sp.+ *Klebsiella* sp.	1(1)		0(0)
Klebsiella sp.+ *Bacillus* sp.	1(1)		0(0)
Total	**42(46.2)**		**49(53.8)**

Table 3. Percentage of bacterial isolates through the time of experiment

Bacterial Isolates	**Sampling Time (Week)**				
	First	**Second**	**Third**	**Fourth**	**P value**
	%	**%**	**%**	**%**	
Pseudomonas aeruginosa	55	56	58	60	0.05
Enterobacter sp.	31	29	28	26	
Klebseilla sp.	6	7	6	6	
Bacillus sp	8	8	8	8	

Table 4. Pattern of Antibiotics sensitivity of *Ps.aeruginosa*

Antibiotics	**Sampling Time(Week)**			
	First (%)	**Second (%)**	**Third (%)**	**Fourth (%)**
Amikacin	0	0	0	0
Gentamicin	0	0	0	0

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Cefixime	3	4	10	15
Cefotaxime	0	0	0	0
Chloramphenicol	0	0	13	15
Co-trimoxazole	1	0	0	0
Ciprofloxacin	4	0	0	0
Levofloxacin	3	3	0	0

Table 5. Pattern of Antibiotic sensitivity of *Enterobacter* sp.

Antibiotics	**Sampling Time(Week)**			
	First (%)	**Second (%)**	**Third (%)**	**Fourth (%)**
Amikacin	60	70	80	66
Gentamicin	0	0	0	0
Cefixime	0	0	10	0
Cefotaxime	1	1	24	0
Chloramphenicol	7	5	3	32
Co-trimoxazole	7	3	12	0
Ciprofloxacin	1	1	31	0
Levofloxacin	4	4	0	0

Table 6: Pattern of Antibiotics Sensitivity of *Klebsiella* sp.

Antibiotics	**Sampling Time (Week)**			
	First (%)	**Second (%)**	**Third (%)**	**Fourth (%)**
Amikacin	60	70	80	66

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Gentamicin	0	3	6	11
Cefixime	0	0	10	0
Cefotaxime	1	1	24	0
Chloramphenicol	7	5	3	32
Co-trimoxazole	7	3	12	20
Ciprofloxacin	18	16	31	33
Levofloxacin	44	48	50	50

Table 7: Pattern of Antibiotics sensitivity of *Bacillus* sp.

Antibiotics	**Sampling Time (Week)**			
	First (%)	**Second (%)**	**Third (%)**	**Fourth (%)**
Amikacin	22	32	21	52
Gentamicin	4	12	14	21
Cefixime	0	0	0	0
Cefotaxime	56	64	66	76
Chloramphenicol	66	68	80	85
Co-trimoxazole	18	32	33	54
Ciprofloxacin	65	67	62	43
Levofloxacin	76	74	76	88
Vancomycin	88	89	90	90
Oxacillin	65	45	77	99

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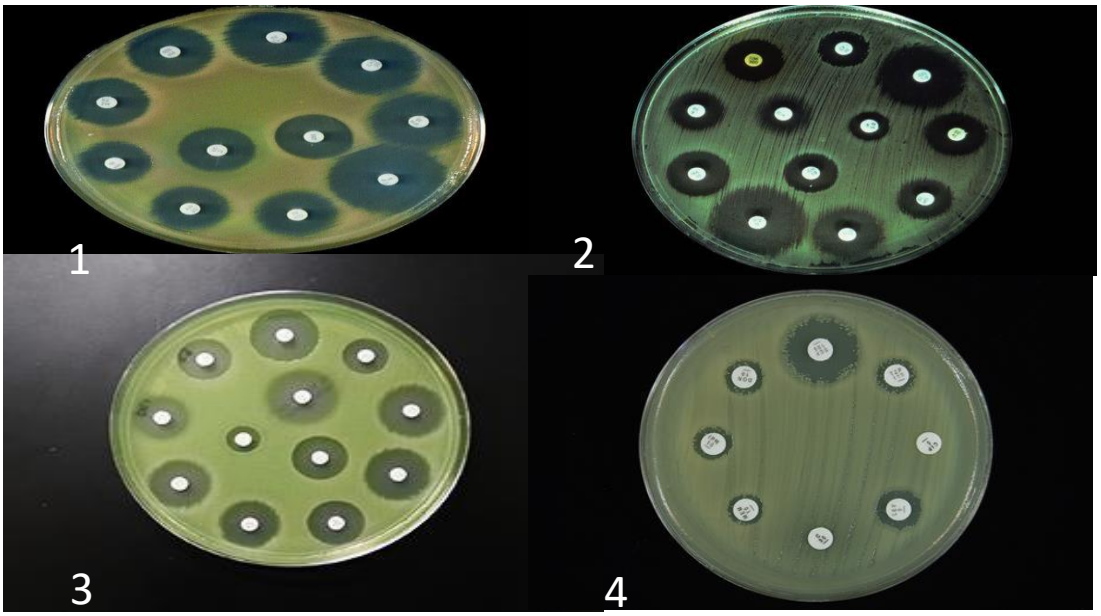

Figure (1) . Image of antibiotic sensitivty test for iolated bacteria; 1. *Ps. aeruginosa*, 2. *Enterobacter* sp. , 3. *Klebsiella* sp. and 4. *Bacillus* sp.

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