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Wound Infection Rates and the Results of Antibiotic Susceptibility Tests in Severely Burned Patients

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Abstract

Infection of burn wound is an important cause of mortality in burns Units in hospitals. The types of bacterial isolates and rapidly emerging antibiotics resistance are important factor in treatment of patients. The aim of this study was to demonstrate the types of bacterial isolated from burns and antibiotics resistance. A cross –sectional case control study included 220 Iraqi Arab Muslims patients who had burn (third degree) and admitted in the burn Department at Al-Kindy Teaching Hospital between January-June 2013. Age of the patients group was ranged from 1-70 years. Females were 124 and the rest were males. Swabs from burn area were collected and cultured on Blood Agar (Oxoid) and MacConkey Agar (oxoid) and other swabs were collected for Gram staining. Identification of bacteria and antibiotic susceptibility test were done using VITEK 2 Compact Device (Biomeruiex Company – France). This study showed that burn is more common in females than males and females with infected burn (28.63%) were more common than males (11.36%). Klebsiella pneumonia is the most frequent bacterial isolated from burn (44%) and in both sexes, females and males, 41% and 45.56% respectively from burn patients. Klebsiella pneumonia is the most frequent bacterial isolated from burn (80.9%). Pseudomonas aeruginosa is also resistance to these antibiotics (93.75%). Acinetobacter spp. and Bruckholderia spp.were also resistance to gentamycine, Ceftriaxone and Cefotaxime (100%). In case of Grame + bacteria, Staphylococcus aureus was resistance to impenime (90.75%) and Enterococcus fecalis is resistance to all antibiotics. Klebsiella pneumonia is the most frequent bacterial isolated from burn and it is the most frequent bacterial isolated from burn.

Key Words: Burn, infection, antibiotics

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Introduction

Burn is one of devastating type of trauma with high morbidity and mortality that required urgent hospitalization and quarantine. Each year many victims of burn resulted from motor car and airplane accidents, electrical injuries, chemical substance exposures, or splitting of hot-liquid [1]. The future risk of burn is septicemia that leads to death which is the most commonly occur in patients with burns. This is influenced by nature and extent of the injured area, the type and quantity of microorganisms that colonize the burn wound [2]. Infection occurs due to a state of immunosuppression that predisposes burn patients to infectious complications by many microorganisms [3]. The main microorganisms that infect the wound are gram-positive bacteria such as methicillin-resistant Staphylococcus aureus (MRSA) and gram-negative bacteria such as Acinetobacter baumannii-calcoaceticus complex, Pseudomonas aeruginosa, and Klebsiella species due to their resistance to a wide range of different antimicrobial antibiotics [4]. Amikacin is the most effective drug against gram negative bacteria, on the other hand, resistance to it was significantly increased. For other bacteria like S. aureus and P. aeruginosa, netilmicin and piperacillin were found to be the most effective drugs [5]. Nosocomial infection by fungal infection like Candida krusei had also showed a resistance to many drugs [6]. The site of patients in the hospital wards is also affects the type of the bacteria and susceptibility to antibiotics for example, patients with burn in ICU and patients with common burn units had great implication for bacterial infection and control [7].

In our study, we try to demonstrate the type of bacteria that was isolated from burn patients and determination the type of antibiotics that resist to it in a sample of patients from Baghdad.

Patients and Methods

A cross –sectional case control study included 220 Iraqi Arab Muslims patients who had burn (third degree) with a total body surface area ranged from 30-75% and admitted in the burn Department at Al-Kindy teaching Hospital between January – 2013 to June – 2013. Age of the patients group was ranged from 1-70 years. Females were 124 and the rest were males.

The Scientific and Ethical Committee of Al-kindy medical college and Al-Kindy Teaching Hospital had approved the study. Informed consent was obtained from all patients and control group.

Swabs from burn area were collected seven to ten days after admission and cultured on Blood Agar (Oxoid) and MacConkey Agar (oxoid) and other swabs were collected for Gram staining. Identification of bacteria and antibiotic susceptibility test were done using VITEK 2 Compact Device (Biomeruiex Company –France).

Statistical analysis: Data was analysed for descriptive statistics. It was done by using the software of MiniTab version. 3.0.

Results

This study showed that burn is more common in females than males and females with infected burn (28.63%) were more common than males (11.36%) as demonstrated in Table 1. Burn is more common in young (21-30) years in both sexes Table 2. Klebsiella pneumonia is the most frequent bacterial isolated from burn (44%) and in both sexes, females and males, 41% and 45.56% respectively from burn patients as shown in Table 3.

It is most resistance to Ceftriaxone and Cefotaxime (80.9%). Pseudomonas aeruginosa had resistance to these antibiotics (93.75%). Acinetobacter spp. and Bruckholderia spp. showed resistance to gentamycine, Ceftriaxone and Cefotaxime (100%) as shown in Table 4. In case of Grame + bacteria, Staphylococcus aureus was resistance to impenime (90.75%) and Enterococcus fecalis is resistance to all antibiotics (Table 4).

Table 1. Number and percentages of patients with and without infection

With Infection		**Without Infection**	
Female	**Male**	**Female**	**Male**
100 45.45%	63 28.63%	24 10.90%	25 11.36%

Table 2. Age distribution of patients with burn.

Age (year)	**Male**	**Female**
1-10	14	21
11-20	15	21
21-30	22	50
31-40	20	20
>40	17	10

Table 3. Bacterial Isolates according to Patient's Sex.

Bacterial Isolates	Male	Female	Total
	n (%)	n (%)	n (%)
Klebsiella pneumonia	38 (41)	72 (45.56)	110 (44)
Pseudomonas aeruginosa	31 (33.6)	49 (31.01)	80 (32.4)
Proteus spp.	6 (6.2)	13 (8.22)	19 (7.6)
Staphylococcus aureus	8 (8.6)	8 (5.06)	16 (6.4)
Acinetobacter spp.	7 (7.6)	8 (5.6)	15 (6)
Bruckholderia spp.	1 (1.08)	4 (2.53)	5 (2)
Escherichia coli	1 (1.08)	2 (1.26)	3 (1.2)
Enterobacter spp.	--	1 (0.63)	1 (0.4)
Enterococcus fecalis	--	1 (0.63)	1 (0.4)
Total	**92 (100)**	**158 (100)**	**250 (100)**

Table 4. Resistant Pattern to Common Antibiotics

Organism, n (%)	Imipenim	Ciprofloxacin	Gentamicin	Ceftriaxone	Cefotaxime	Meropenim	Amikacin	Total
Klebsiella pneumonia	65 (59)	84 (45.4)	84 (76.4)	89 (80.9)	89 (80.9)	72 (65.5)	85 (77.3)	110
Pseudomonas aeruginosa	29 (36.3)	47 (58.8)	60 (75)	75 (93.8)	75 (93.8)	60 (75)	65 (81.3)	80
Proteus spp.	14 (73.7)	3 (15.8)	12 (63.2)	16 (84.2)	16 (84.2)	9 (47.4)	7 (36.9)	19
Acinetobacter spp.	12 (80)	12 (80)	15 (100)	14 (93.3)	14 (93.3)	14 (93.3)	13 (86.9)	15
Bruckholderia spp.	4 (80)	3 (60)	5 (100)	5 (100)	5 (100)	4 (80)	1 (20)	5
Escherichia coli	1 (33.3)	2 (66.7)	2 (66.7)	3 (100)	3 (100)	2 (66.7)	2 (66.7)	3
Enterobacter	--	--	1 (100)	1 (100)	1 (100)	--	--	1
Staphylococcus aureus	9 (47.4)	9 (47.4)	9 (47.4)	9 (47.4)	4 (23.5)	5 (29.4)	15 (93.8)	16
Enterococcus fecalis	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1

Discussion

Microbial infection in patients with burn is an obstacle of treatment. However, little knowledge is available on what types of microbial infection dominate in the burn word in discrete rejoin in Baghdad (Al-Kindy Teaching Hospital) and how the dynamic change in antibiotics resistance of those microorganisms. In our study burn is more common in females than males and females with infected burn (28.63%) were more common than males (11.36%). Klebsiella pneumonia is the most frequent bacterial isolated from burn (44%) and in both sexes, females and males, 41% and 45.56% respectively from burn patients. It is most resistance to Ceftriaxone and Cefotaxime (80.9%). Pseudomonas aeruginosa is also resistance

to these antibiotics (93.75%). In case of Grame + bacteria, Staphylococcus aureus was resistance to impenime (90.75%) and Enterococcus fecalis is resistance to all antibiotics. Other studies showed that pathogens and their antibiotic resistances are significantly different according to site of burn patients (ICU and common burn units) that affect infection control in burn patients, they found that microorganisms isolated from patients in common burn units were S. aureus (103, 27.6%), P. aeruginosa (46, 12.3%), K. pneumoniae (38, 10.2%) and Escherichia coli (32, 8.6%). Antibiotic resistance pattern of bacteria isolated from clinical samples of burn patients from ICU was significantly higher than those from common burn units [8]. Other report demonstrated that the common isolated bacteria is Acinetobacter sp. and P. aeruginosa were showed higher resistant to almost all antibiotics tested which is inagreement with our results and more frequent Acinetobacter sp. isolates appeared to be resistant to amikacin, gentamicin, tobramycin, ceftazidim, piperacillin, tazobactam, levofloxacin, and ciprofloxacin and more frequent Escherichia coli isolates were resistant to ceftazidime and aztreonam and P. aeruginosa and E. coli isolates were sensitive to less used ciprofloxacin and piperacillin/tazobactam [9]. The increased rates of drug-resistant isolates nowadays might be associated with regular uses and prophylactic therapy with antibiotics treatment. Other study in Iran showed that Pseudomonas aeruginosa and Staphylococcus aureus are the most important pathogens and are a causative agent in burn wound infections and the frequency of P. aeruginosa resistance to ciprofloxacin, amikacin, and gentamicin was over 85% and rate of S. aureus resistance to cloxacillin and cephalexin was 90% [10]. Aother study from Syria showed that the main bacteria causing infection were S. aureus, E. coli, and other Enterobacters; and later on Pseudomonas and Candida were the dominant organisms [11].

In many developing and developed countries such as South Korea [12], Jordan [13], Libya [14], India [15], Turkey [16], USA [17], France [18], and Italy [19] have reported P. aeruginosa as an important microorganism in burn centers. The main cause that favor infection is environmental factors like moisture is a dangerous factor in hospital reservoirs of P. aeruginosa, as in respiratory equipment, medicines, disinfectants, sinks, food, and vegetables.

The antibiotic resistance pattern was performed usually by disc diffusion method and other one by molecular method.Different staphylococcal cassette chromosome mec(SCC mec)

types were determined by specific primers and by a disc diffusion method, no resistance pattern was observed to vancomycin and fosfomycin while using a multiplex PCR assay, there are five different SCCmec types were detected [20]. The antibiotic resistance isolates from beta-lactamase producing Staphylococci from wounds and burns patients are either plasmid-borne and few are chromosomal-borne. The plasmid-mediated resistance observed among various antibiotics poses difficulty in treatment for clinicians [21]. The main infection control measures in burn canters are early referral to burn units, early excision and grafting procedure, improved barrier nursing, and regular microbiological analysis of the hospital's environment and staff members.

Competing and conflict of interests: The authors have declared that no competing and conflicting of interest exists.

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