Iraqi Journal of Biotechnology, December 2018, Vol. 17, No. 3, 61-66

Clinical Risk Factors for Nosocomial Infection Caused by *Acinetobacter baumannii* among Iraqi Patients suffering from differing burns

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Received: September 5, 2018 / **Accepted**: November 28, 2018

Abstract: This study aimed to evaluate risk factors and the role of *Acinetobacter baumannii* isolates in mortality due to burns since morbidity and mortality rates are considerably high. A total of 204 patients hospitalized in Burn Care Unit at Al-Diwanyia Teaching Hospitial, The Burn Specialist Hospital between January 2017 and February 2018 were reviewed retrospectively. Logistic regression analysis was used in order to predict the risk. RESULTS: From the collected notes, a total of 289 bacterial colonies were isolated of these patients and from them 22 isolates were identified as *A. baumannii.* Mortality rates were as follows: 10.5% in general, 4.9% for fewer than 17 years of age, and 5.6 % for between 18-64 years of age.

Key words: *Acinetobacter baumannii*, Nosocomial infection, Burn infection.

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Introduction:

Burns are one of the most common and devastating forms of trauma. Improved outcomes for severely burnt patients have been attributed to medical advances in fluid resuscitation, nutritional support, pulmonary care; burn wound care, and infection control practices. Seventy-five percent of all deaths are currently related to sepsis from burn wound infections or other infection complications in patients with severe burns over more than 40% of Total Body Surface Area (TBSA) (1). Seriously burnt patients have an increased risk for nosocomial infections (NIs) due to the nature of the burn injury itself and NI is the most common cause of death following burns (2). Although recent studies indicate increased role of *Acinetobacter* infection in mortality in burn patients, some controversy still remains about its exact impact (3). Due to the increased rate of worldwide resistance and infections, *Acinetobacter* isolates represent a challenge in the treatment of burns (4). The data of a total of four hundred and sixty five patients in our burn care unit were reviewed and patients' characteristics and outcome including burn data, infections encountered, pathogens and antibiotic susceptibility tests, infections caused by resistant organisms, risk factors for mortality, and the role of *Acinetobacter* isolates in mortality were evaluated.Over the last 10 years, the clinical significance of *A. baumannii* has increased through its ability to acquire multi-drug resistance and so reduce therapeutic options (5,6).

Materials and Methods:

This study was conducted at Al-Diwanyia Teaching Hospitial, The Burn Specialist Hospital, and Burn Plastic

Surgery Centre (BPSC) includes Burn Intensive Care Unit (BICU). The electronic medical records database of the (BICU) and the file records of Infection Control Committee were searched to identify all patients hospitalized from January 2017 to February 2018.

Hospitalization Criteria:

Patients at all ages with second and third degree burns with a TBSA higher than 25%, patients at all ages with third degree burns with a TBSA higher than or equal to 15%, burns located on face, ear, or hands and feet, burns of major joints, burns of genital and perinea regions, chemical burns, electrical burns, inhalation injuries, multitrauma accompanying burns, pregnancy and comorbidities (diabetes, hypertension, and cardiac disease) were accepted.

Patient Care:

Routine burn wound care consists of daily cleansing and twice-daily application of topical antimicrobial ointments. In superficial burns, dressings with chlorhexidine impregnated paraffin gauze were applied and changed daily by staff in sterile conditions. The following information was obtained for each admission: age, sex, type of injury, TBSA percentage, Injury Severity Score, comorbidities (including diabetes mellitus, epilepsy, mental retardation, chronic renal failure, hypertension, cerebra vascular accident), duration of stay in hospital and ICU, NI, causative pathogens, antimicrobial resistance, leukocytosis, albumin level, devices used (ventilator, central line, and urinary catheter days), and survival following hospital discharge. In addition, microbiology records were searched to determine which patients had cultures of *A. baumannii*. For the patients infected with *A.baumannii* recovered on culture. The bacteriological isolation and antibiotic susceptibility tests.

Antibiotic susceptibility test:

Antibiotic susceptibility test was performed by the method of disk diffusion according to the guidelines of the National Committee for Clinical Laboratory Standards (7). The culture of each *A. baumannii* isolate was diluted to have turbidity equal to 0.5 McFarland standard tubes, and then spread on Muller-Hinton agar plate (Difco, France). Antibiotic disks (Oxoid, France) were applied to each plate. After incubation at 37°C for 24 hrs, the zone of inhibition diameter was measured. Data analyses were performed using the susceptibility cut points according to the guidelines of National Committee for Clinical and Laboratory Standard Institute (8). Multiresistance of *A. baumannii* was defined as resistance to at least three antibiotics of the following antibiotic classes: penicillins, third-generation cephalosporins, carbapenems, quinolones and aminoglycosides.

Results and Discussion:

The records of a total of 204 patients were available. Age of the patients was 1-64 year’s and192 (94.1%) patients were younger than 20 years of age. Of the patients, 162 (79.4%) were female and 42(20.58%) were male. TBSA range was 0-94%. Percentages of TBSA distribution in patients below add over 20 years of ages. Cause of injury was recorded in

32 patients (15.6%). Of the patients, 128 (62.7%) had scald injury, 110 (53.92%) had flame injury, 60 (29.41%) had electrical injury, 29 (14.2%) had contact injury, and 160 (87.43%) had liquid injury (hot fluids, boiling jam). No Present relationship between burn type and *A. baumannii* infection was found (p>0.05). 22 patients (10.78%) had underlying diseases and 142 patients (69.6%) underwent surgical corrections. Hospitalization period was ringed 20 days to 2mouth. Of the patients, 105 (51.47%) were no infected; whereas; 39 (19.11%) did infections; 130 (63.7%) survived; whereas; 35 (17.15%) did infections. Mortality rates were as follows: 89.21% in general, 53.29% for under 20 years of age, 46.70% for >20 years of age (Figure 1). Twenty-two patients had *A. baumannii* infections and twelve of them (52%) died. In five of fifty-nine patients colonized with *A. baumannii*, infections caused by these bacteria (9.7%) emerged. No significant differences were found considering mortality in patients colonized with *Acinetobacter*. However, in patients having *Acinetobacter* infection, mortality was significantly higher. Of the patients with TBSA over 48%, 35.59% (n=21) died. As the burnt body surface area increased, higher mortality rates were detected. Logistic regression analysis revealed that *Acinetobacter* infections were not risk factors for mortality. Logistic regression analysis showed that burnt TBSA, older age, and albumin level were risk factors for mortality.

A total of three hundred and fifty-five bacterial isolates were obtained. Twenty-two was *A. baumannii* (6.19%). The most predominant bacteria isolate *Pseudomonas aeruginosa* 127 (48.45%) were multidrug resistant. Of the *Acinetobacter* isolates, fifteen had extensively drug-resistant and in *Pseudomonas* isolates nineteen had extensively drug-resistant; whereas, none had pandrug-resistant. In burn patients, existence of infection, especially sepsis, still remains the most prominent predictive factor affecting mortality and morbidity. Burn injury, reduced immunity, invasive therapeutic and diagnostic procedures, and longer duration of hospitalization are all responsible for serious complications in burn patients. However, NIs is solely the most common cause of death in burns. Evaluating risk factors by assessing microbiological analysis of pathogens and preventive measures, infection control and reducing the incidence of resistance are very important to lead treatment strategies(2). It has been apparently known that burnt skin serves as an environment for colonization and infection and subsequently sepsis and possible death. Despite the fact that NI was the most important risk factor for mortality in our study, Alp *et al.,* (2012) (9),reported infected patients had approximately three times higher mortality rates than uninfected patients. Moreover, advanced age, underlying diseases, and higher TBSA percentage were the most significant risk factors for mortality in the study National Nosocomial Infections Surveillance System (10), have found that non-work-related burns, burnt TBSA, and body surface area affected by second- third-degree burns are independent predictors of mortality. Although variables like age, type of injuries, TBSA percentage, co-morbidity, leukocyte, and serum albumin parameters may have affected mortality, TBSA percentage and serum albumin levels were found to be independent risk factors for mortality.

Church *et al*., have reported in an excellent review of burn wound infections that burns in the elderly population are more severe and result in a higher number of fatalities (2). In our study, mortality rates were found to gradually increase due to emerging multidrug-resistant organisms mainly as *Pseudomonas* and *Acinetobacter* species, infections are associated with significant morbidity and mortality in burn patients. Of special concern, *Acinetobacter* isolates have been increasingly reported in recent years and have emerged as a significant nosocomial pathogen (11). Chong *et al*., have reported *A. baumannii* in fifty-five of ninetyfour patients, and Bayram *et al*., (2, 12) have found fifty-nine of two hundred and fifty isolates to be positive for *A. baumannii. Acinetobacter* was first considered in the 1970s as an important nosocomial pathogen. Majority of the clinical isolates were susceptible to most antimicrobials in earlier periods; however, multi-drug resistant isolates have emerged due to extensive use of broad spectrum agents worldwide (4, 16). Our results revealed that MDR rates were also associated with increased mortality, not emerging as an underlying risk factor. Keen *et al.*, reported their experience over a 5-year period that more than half of *A. baumannii* isolates were multi-drug resistant (13). However, this was not regarded a risk factor for mortality "logistic regression analysis". Albrecht *et al*., have revealed that *Acinetobacter* infection is associated with burn related mortality and morbidity in a univariate analysis but was not independently associated with death (3, 18). Recent studies have had mixed results to indicate mortality attributable of *Acinetobacter*. Some authors reported increased mortality rates secondary to *Acinetobacter*. *A. baumannii* isolates common with relatively higher MDR rates may be due to habits of frequent prescribing or using wide spectrum antimicrobials in our country (14).

Figure (1): Invasive burn wound infection implies that bacteria are proliferating in eschar and invading underlying viable tissues. These infections are life-threatening.

Besides, some clinical characteristics of *A. baumannii* isolates, such as its presence in normal skin flora, easier transmissibility and viability in hospital environment due to being multi-drug resistant, may lead to increased incidences of Nis. Older age, higher TBSA percentage, and albumin level were found significant risk factors for mortality (15, 17). However, due to higher rates of mortality occurring in infections by causative microorganisms capable of developing multidrug resistance like *A. baumannii* and *P. aeruginosa*, these microorganisms play an essential role when considering mortality in general (20).

Conclusion:

Acinetobacter infections were found as risk factors for mortality. The burnt body surface area increase, it was associated with higher mortality rates were infection detected.

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