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Research Article

Burn Sepsis, an 8 Years' Retrospective Analysis of Blood Culture Results at Tertiary Burn Specialty Hospital in Baghdad

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Keywords

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Abstract

Background: Burn is one of the most devastating traumas that someone can encounter in their life. Burn wound sepsis is still the leading cause of death in burned patients. Appropriate knowledge of causative pathogen in burn sepsis is important for successful patient management and for reduction of the incidence of antibiotic resistance

Patients and methods: A retrospective study conducted between 2010 to 2017 at burn specialty hospital in Baghdad. A total of 320 blood culture samples were obtained from patients with sepsis or suspected to have sepsis. Patients age were ranging between 9 months – 70 years with mean total burn surface area 45.26%

Results: The most common microorganisms were isolated from those patients who had sepsis or suspicion of sepsis were Klebsiella (48 cases) followed by pseudomonas (36 cases) Staphylococcus spp (26 cases) Enterococcus (8 cases) Acinetobacter (11 cases) E coli (11 cases) Candida (4 cases) Proteus (2 cases) and Salmonella, Streptococcus pneumonia, Monilia and Seriata one case for each. The commonly isolated organism was Klebsiella was sensitive to Imipenem followed by Amikacin Nitrofurantoin, Piperacillin, Ciprofloxacin, co-trimoxazole, Chloramphenicol, tetracycline, Azithromycin and Cefotaxime.

Conclusion: Microbiologic Surveillance of burn patients with sepsis or suspicion of having sepsis for 8 years in our hospital (Burn Specialty hospital in Baghdad) had shown that the most common microorganism isolated from their blood culture was Klebsiella, Klebsiella was sensitive to Imipenem mainly according to sensitivity test by using disk diffusion method.

ABBREVIATIONS

WHO: World Health Organization; WBC: White Blood Cells; SPP: Species; MRSA: Methicillin Resistant Staphylococcus aureus; MRSE: Methicillin Resistant Staphylococcus epididymis (MRSE).

INTRODUCTION

Burn can be defined as traumatic lesion that affects different layers of the skin and underlying layers. It can be caused by different agents like thermal, electrical and chemical causes. Up to 322000 person die annually from burn worldwide according to the World Health Organization (WHO) and large percent of deaths (> 95%) occurred in developing countries. Due to improvement in burn resuscitation, wound care, nutritional support and control of infection. The survival rate of burn has dramatically improved in recent years, however 75% of all death in burn patients is due to sepsis [1-3].

After few hours of burn the surface of burn will become contaminated with variety of bacterial types that gradually multiplies and grows. These bacteria due to impairment of immune system of burned patients will seed and multiply in other parts of body like kidney, lung and blood. Source of bacteria in burned patient could be either normal flora (endogenous) from the patient itself or exogenous from the environment or health care staff. In general, exogenous organism has more resistance than endogenous one. The organisms that linked to infection in burn patient could be either gram positive or negative bacteria and could be yeast or fungi or even viruses [4,5].

Microbiological analysis by using swab, quantitative culture and blood culture may be useful to diagnose burn wound infection and sepsis. the appropriate knowledge of causative pathogens in burn sepsis with established surveillance of the most prevalent bacteria in burn wards together with knowing its antimicrobial resistance is considered as one of the measures that successfully control infection in burn patient with reduced incidence of antibiotic resistance bacteria [6-8].

In this retrospective study we investigated the common pathogenic bacteria obtained by blood culture and its antimicrobial sensitivity among patients admitted to burn specialty hospital at medical city complex in Baghdad who had sepsis or suspicion of sepsis.

MATERIALS AND METHODS

This study is a retrospective study which was conducted at Burn Specialty Hospital of the Medical City in Baghdad. The data of this study was obtained from patient's medical records from first of January 2010 to 31 December 2017. Medical records for all patients were reviewed with specific attention on identifying the pathogenic bacteria that was isolated from blood culture obtained from patients who had sepsis or suspected to have sepsis. Sepsis is defined as systemic inflammatory response syndrome (SIRS) to an infectious process. SIRS was defined as following: -

1 – body temperature either more than 38° C or below 36° C

2 – heart rate more than 90/ minute

3 – respiratory rate more than 20 / minute or PaCo2 less than 32 mmHg

4 – white blood cells (WBC) more than 12000/mm^3 or less than 4000/mm^3 [4,9].

Blood culture used in this study was processed using standard microbiology techniques. The sample of blood culture obtained from peripheral vein under meticulous aseptic technique in order to prevent contamination of blood culture, where the site of venipuncture is prepared using antibacterial disinfectant like 2% iodine or 0.5 chlorhexidine in 70% alcohol. Disinfectant agent was allowed to evaporate before blood sample is withdrawn. In all cases reasonable quantity of blood was taken because of number of bacteria per milliliter of blood is low. At least 10 ml blood sample for adults, 2- 5 ml for children and 1 -2ml for neonates.

The blood taken in two tubes, the first tube is vented tube for recovery of aerobic organism culture, the second tube is non vented for anaerobic organism culture. In general no anticoagulant is needed in tube as the blood sample is immediately added to sufficient amount of broth (50 ml). The blood culture broth used in our laboratory is brain-heart infusion (5 ml of blood in 50 ml of broth). The blood culture bottles then incubated at 35± 1 C and inspected every day twice for signs of microbial growth. Growth is evidence by many characters for example: gas production, hemolysis, uniform or subsurface turbidity, coagulation of broth ...etc. when the visible growth appear, the bottle of blood culture then open in aseptic condition and by using a sterile loop or Pasteur pipette, a small amount of broth is removed and gram stained smear used to examine for the presence of microorganisms. Subculture used for specific microorganisms for example staphylococci using blood agar or mannitol salt agar. The antimicrobial sensitivity of microorganisms was determined by using disk diffusion method.

RESULTS

Retrospective study was conducted at Burn Specialty hospital in Baghdad between first of January 2010 to 31 December 2017. A total number of 320 blood culture samples were isolated from about 320 patients. patients age was ranging between 9 months – 70 years. There were 136 males and 184 females, the main causes of burn were flame (158 patients), scald (102 patients), electrical injury (46 patients) and chemical injury (14 patients). The mean total burn surface area was 45.26 %

All these patients had septic episode or suspected sepsis. 60% of patients had their septic episode between 3-14 days' post burn and about 40% had septic episode between 14-21 days' post burn. Blood culture was positive in 149 specimens and no growth was noticed in 171 specimens as in Figure 1

The most common isolated microorganism was Klebsiella (48 cases) followed by pseudomonas (36 cases) Staphylococcus spp (26 cases) Enterococcus (8 cases) Acinetobacter (11 cases) E coli (11 cases) Candida (4 cases) Proteus (2 cases) and Salmonella, Streptococcus pneumonia, Monilia and Seriata one case for each as shown in Figure 2.

The antibiotic to which the bacteria was susceptible as shown by sensitivity test was Imipenem followed by Amikacin, Nitrofurantoin, Piperacillin, Ciprofloxacin, Ceftazidime, Co-trimoxazole, Vancomycin, Chloramphenicol, Tobramycin, Ticarcillin, Tetracycline, Gentamycin, Ceftriaxone, Clindamycin, Ampicillin, Azithromycin and Cefotaxime. Isolated

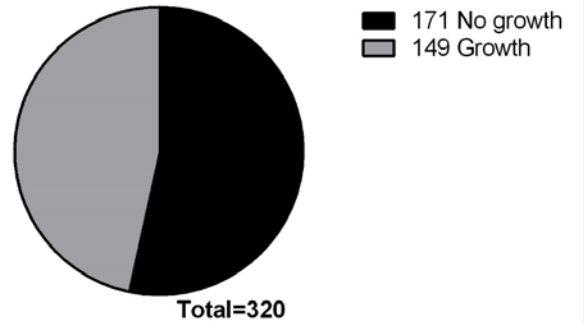

Figure 1 Specimens growth.

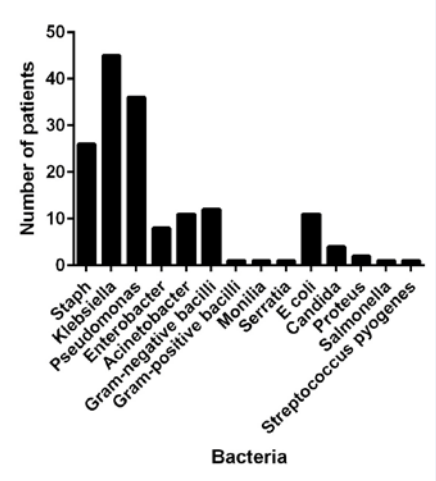

Figure 2 Common isolated microorganism.

microorganisms from the blood cultures and the sensitive antibiotic according to the sensitivity test distribution in all the study cases are shown in Figure 3.

Commonly isolated organism which was Klebsiella was sensitive to, Imipenem, Amikacin, Nitrofurantoin, Piperacillin, Ciprofloxacin, Co-trimoxazole, Chloramphenicol, Tetracycline, Azithromycin and Cefotaxime as shown in Figure 4 below

DISCUSSION

One of the major and devastating global health problems is the burn, this is especially grave in the developing countries. As a result of prolonged hospital stay and immunosuppression effect of burn together with direct nature of burn itself, all of these factors make patient with burn susceptible to infection. Both depth and size of burn with patient's age affected the incidence of burn wound sepsis. It's most likely occurs in young age group and rarely occurs in partial thickness burn.

Multidrug resistance is emergent problem in burn patients that occurred mainly due to prolonged course of broad spectrum antibiotic which makes infection treatment in burn patient challenging. Microbiological surveillance of burn, patient will facilitate knowing the microorganism and appropriate choice of antibiotic [6,10-13].

Positive blood culture in patient with suspected sepsis will guide us for appropriate treatment and by knowing the most prevalent microorganism that cause sepsis in our burn unit, this will facilitate the selection of appropriate and most selective antibiotic which reduce the cost and also reduce the multidrug resistance. In this retrospective study we review 320 blood culture between the period from 2010 to 2017 for burn patients who were admitted to our burn unit who developed septic episode or suspected sepsis during their treatment course in Burn Specialty hospital at Baghdad medical city complex. In this study females affected more than males (57.5% versus 42.5%)

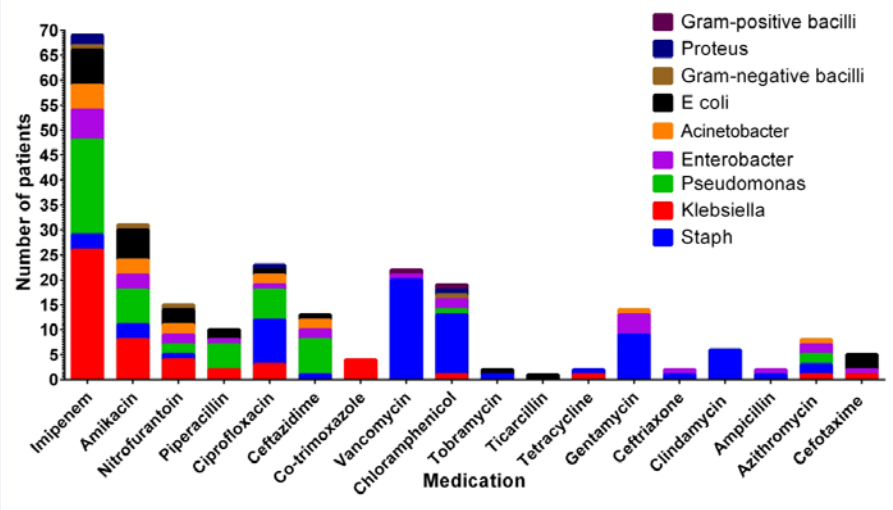

Figure 3 Isolated microorganisms from the blood cultures and the sensitive antibiotic according to the sensitivity test distribution in all the study cases.

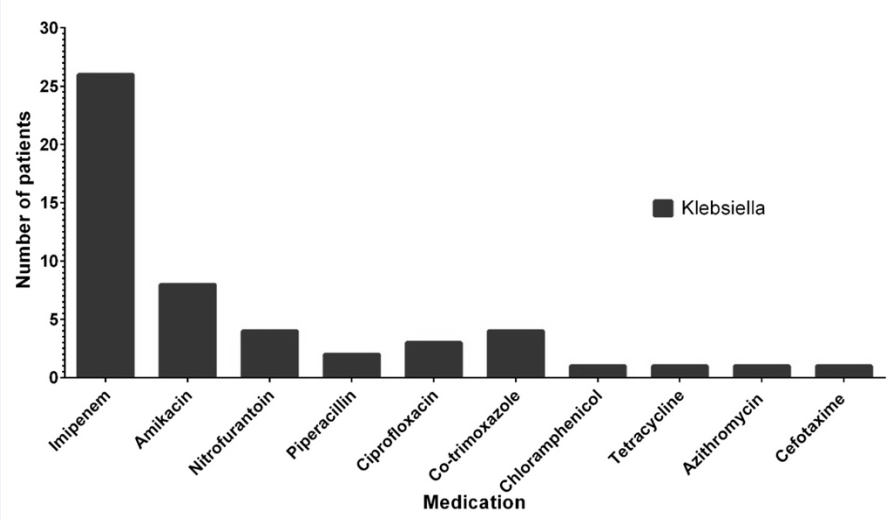

Figure 4 The commonly isolated organism which was Klebsiella and the antibiotic it was sensitive to according to blood culture sensitivity test.

this may be attributed to the fact that women spend more time near the fire when compared to males, this variation in sex was with agreement with Kaur et al. [14] were they investigated bacterial profile in 50 burn patient for blood and burn wound infection and they found that 68% of their patients were females and 32% of them were males, our study regarding sex variation of septic episode in burn patients was contradicted with findings of Bang et al. were they observed that septicemia occurs in 56% males more than females 44% this finding was noticed in study which was done between June 1992 to May 1996 for 943 patients at burn unit of Al-Babtain center for plastic and burns, were 79 (28%) out of 943 patients developed clinically and microbiologically confirmed septicemia. [15].

In our study the collecting sample of patients was restricted to those whom had sepsis or suspected to have sepsis and as we noticed above that female affected more than male. In other studies, which investigated burn wound infection in general, it showed results contradicting to our finding regarding sex distribution, where Gaffer et al. found burn wound infection more common in male (62.4) than females (37.6) Macedo and Santos had found also that burn wound infection more in males than females (59.1% versus 40.9%). Similar finding was noticed by Vostrugina et al., were male affected by burn wound infection more than female (76% versus 24%).Similar finding was noticed also by Bagdomas et al. [16].

In our study the majority of septic episode had happened in the first 2 weeks post burn. Which was consistence with Macedo et al were they noticed that the majority of septic episodes had developed in first two-week post burn [17].

Bang et al. had also observed that septicemic episode occurred within 2 weeks post burn (68%) with maximum number occurred between 6-10 days' post burn [15].

The flame burn was the leading cause among our patients whom had septicemic episode (46.87%) this was consistent with Macedo et al. [17], this attributed to the effect of flame burn which produce more extensive damage and more wound colonization. the mean total burn body surface area in our patients involved in this study was (45.26) the mean total burn body surface for patient with burn sepsis which was noticed by Macedo et al, was (37.7± 18.4%) ranging between 7 – 84%. [17]. Bang et al., had shown that their patients whom had burn sepsis had mean total burn surface area 46% (ranging between 10-90%) [15].

Of 320 blood culture sample, 171 cases (53.4%) revealed no microorganism growth while 149 cases (46.56%) showed positive microorganism growth. in general sepsis with culture negative could occur in 41.5% of cases according to Phua and colleagues base on their large prospective study on patients presented with sever sepsis. sepsis with culture negative represents extreme challenging issue for both the clinician and the microbiologist. It may be attributed to many causes, first may be due to antibiotic administration prior to blood culture sample being taken, secondly it may be due to insufficient or incomplete diagnostic microbiologic workup, lastly may be due to unusual organism that caused sepsis that cannot be identified. Some attributes culture negative sepsis due to non-infection causes of sepsis [18].

In our study the major causative organism in septicemic patients was the Klebsiella, followed by Pseudomonas then by Staphylococcus spp. Our results are inconsistence with Macedo et al. were they observed that most of septic episodes was due to the Staphylococcus spp [17], also our results are inconsistence with Bang et al. were they noticed that 62% of septicemic cases due to gram positive bacteria, 25% due to gram negative bacteria and 13% due to mixed organism. Bang et al showed that 48 episode of septicemia (41%) was due to Methicillin Resistant Staphylococcus aureus (MRSA) followed by 17 (14.4%) due to Methicillin Resistant Staphylococcus epididymis (MRSE). Bang et al in another study had confirmed that the majority of sepsis episode in scald (82.4%) and flame burn (56.7%) were attributed to gram positive organism, especially speaking MRSA [19]. Sanyal et al., found that 61% of septicemic attacks occur due to gram positive cocci (76% of these gram positive cocci was MRSA), while only 26% due to gram negative bacilli {mainly pseudomonas 38%,Acinetobacter 35%, followed by Coliforms in 25%}. However, our study consistence with Dasari et al. in finding that gram negative cocci is the major cause of septicemic episodes in burn patients, however in their study they showed that Pseudomonas aeruginosa was accounted for 31% of cases, while Klebsiella species were accounted for 24% of cases. Dasari et al showed that 11% of septicemic episodes due to staphylococcus aureus and 30% due to multiple organisms, in 9% of cases no isolated organism was revealed [20].

In another study which was done by Sharma et al. they found that 34% of isolated organisms in septicemic patients was Klebsiella followed by Pseudomonas aeruginosa in 30% which consistence with our study [21], both of Evol et al and Agnibouti et al. were reported similar findings consistence with our findings [20].

For those reports that showed that MRSA/MRSE are the most common cause of sepsis in burn, they attributed this to the fact that the burn unit is main source of MRSA and it regarded that MRSA being widespread in hospital environment. Same of the above mentioned reports attributed that low incidence of gram negative bacilli in septicemic burn patients to the topical antibiotic use and effective systemic antibiotic [15,17].

In our study, interestingly, we observed septicemic episodes due to Acinetobacter species. Acinetobacter was rarely observed in burn wound sepsis until 1970. This organism, since 1985 had been isolated frequently. It was the fourth most common organism being isolated from blood culture. Emergence of Acinetobacter species attributed to extensive use of broad spectrum antibiotic, Acinetobacter species are usually multi-resistance bacteria [15,17].

Commonly isolated bacteria in this study which was Klebsiella was sensitive to Imipenem followed by multiple drugs. Both Imipenem and Amikacin showed to be effective against most of isolated microorganisms from blood culture as shown by sensitivity test. Lastly Staphylococcus species showed to be highly sensitive to Vancomycin.

In our study, Candida species was isolated from blood culture. Septicemia due to Candida species is not uncommon in burned patients especially those with high total burn surface area (more

than 50%), prolonged usage of multiple antibiotics and in those patients with prolonged hospital stay [17].

CONCLUSION

The microbiologic surveillance of sepsis in burn patients is important to determine the causative pathogen and choosing of appropriate and effective antibiotic which reduce the chance of multi resistance drugs. This study had revealed that the most common microorganism that cause sepsis in our burn unit was Klebsiella. Klebsiella in our study was sensitive to Imipenem, Both Imipenem and Amikacin showed to be effective against majority of isolated microorganisms from blood culture as shown by sensitivity test by using disk diffusion method.

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AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

AUTHORS' CONTRIBUTIONS

The authors Arwa Kasim Almajidy, Ahmed Khalaf Jasim, Rand K. Almajidy all contributed equally to the conception and design and interpretation of data, Acquisition of data and its analysis done by Arwa Kasim Almajidy. All authors approved the final manuscript version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the institutional review board at The Burn Specialty Hospital in Baghdad.

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