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Evaluation of the Role of Systemic Antibiotic Prophylaxis in the Control of Burn Wound Infection

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Abstract: Background: Burn injuries constitute a major challenge in health care sector, Burns are produced by many etiologies such as chemicals, extreme heat (e.g., flame, hot surfaces and fluids), friction, radiation, or electricity and however the greatest common thermal injury are the scald burns in children less than 5 years of age. The most common complications of burns are involving infections with microorganisms, urinary tract infections, respiratory, wound, in addition to those accompanied with sepsis, whereas, deeper burns offer higher incidence of risk for inducing infections. In spite of, there are no guidelines or instructions for using of antibiotics as a prophylactic, systemic antibiotic usage in patients suffering from burns. Administration of systemic antibiotics must be given for selective cases with indication of infection. **Methods:** A prospective single arm study included patients admitted to Ain Shams specialized hospital-Burns department between the periods of Jan 2019 till Dec 2019. Patients will undergo swab and culture based antiobiotics for +ve cultures. **Results:** Pediatrics age group had worse outcome in terms of operative procedures when compared to adult age group whom had better spontaneous healing of their burns. Adult age group has significantly higher incidence of burn infection and positive swab culture than pediatrics age group. Adults had longer hospital stay than pediatrics, Swab culture results didn't correlate to definitive outcome of patients. **Conclusion:** Prophylactic antibiotics had a limited role in prevention of burns infections and development of fatal septic complications, nevertheless it contribute to emergence of new resistant strains that lead us to hinder us, returning us to pre-antibiotics era.
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1. Introduction:

Injuries due to burns represent a great contest in health care sector. Worldwide, the frequency and mortality are decreased, particularly in developed countries due to better firefighting systems and prevention protocols of domestic burns [1], In well-developed and developing countries the reports revealed that to an increasing in the frequency of burns in children [2], where it recorded a high rate among children which constitute about 50% of the population with severe burn injuries in Netherlands [3], and in the Czech Republic [4]. The incidence of burn injuries in the world were statistically analyzed from the data obtained from 22 European countries representing a total of more than 186,500 patients [5]. The burns were representing the 3rd leading etiology of unintentional injury and the mortality in children aging 1-9 years in US year 2006 [6], whereas in low income countries in 2007 reached 1,559 injured children, burns were representing the 3rdmaximumcommon (13%) etiology of injuries and had one of the uppermost (79%) admission percentage between all kinds of accidental injuries [7]. the overall child mortality due to burns is 2.5 per 100,000, basing on recent estimation all over the world, and it is inversely proportionate to economic level of the country, where it elevated greatly and averaged 9.5 per 100,000 in low income countries e.g. Rwanda, Togo and Mongolia [8]. Burns are due to exposure to chemicals, high heat (e.g., flame, fluids, and hot surfaces), friction, radiation, or electricity, however the most frequent thermal injury in children less than 5 years of age are the scald burns [5, 6], while flame burns are

the commonest in children their ages ranged from 5-16 years old [6]. Several factors influence the outcome among patients, including age, total body surface area (TBSA), depth of burn wound, occurrence of previous medical conditions, inhalation injury, pneumonia, infections, and septicemia (9). Classification of burns are depending on degree of damage to the skin layers and affected area of skin, judged by ratio of total area of body surface [10].

The most common complications of burns are the induction of infections, which involved urinary tract infections, respiratory infection, wound, in addition those accompanied with sepsis [11]. Sepsis is the main etiology of mortality in children patients, where burn injury, representing about 54% of deaths [12, 13], higher risk for infections with microorganisms was accompanied deeper burns [11, 14]. Although, there are no guidelines or instructions for using of antibiotics as a prophylactic, systemic antibiotic usage in children patients with burn injury. Cases with signs of infection, it is recommended to giving selective systemic antibiotic [10], however according to study published in 1995, in the United Kingdom around 60% of the burn centers did not have a formal policy on the application of prophylactic antibiotics, [15]. Recent survey indicated that standard operating measures were adopted in less than half of United Kingdom burn units [16], and a new investigation demonstrated important differences in guideline use for diagnosis and management of infections in burn patients [17]. Surprisingly undue usage of antibiotics in burn damages rise prob abilities for impediments [18], resulting in antibiotic resistance [19], henceforward it raises the health care expenditure to both patients and community [20]. The present trial study the role of excluding prophylactic antibiotics in burned patients and their effects on the definitive outcome of patients.

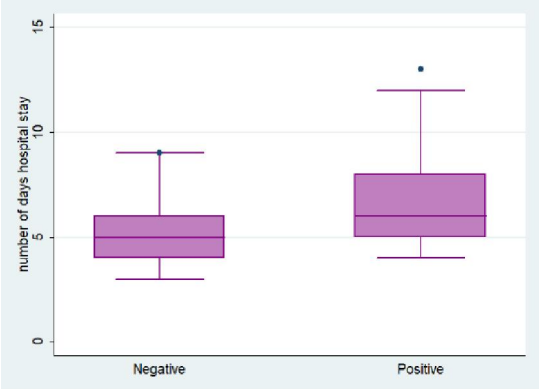
2. Patients and methods:

A prospective single arm study included patients admitted to Ain Shams specialized hospital-Burns department between the periods of Jan 2019 till Dec 2019, inclusion criteria was vitally stable patients, any age, any sex, percentage of burn <30% and no indications for ICU admission. All patients were admitted in ward, swab culture was taken in Day 1 of admission, only those who had positive culture received antibiotics based on their cultures while patients with negative culture didn't receive any type of antibiotics, while Adult age group has significantly higher incidence of burn infection and positive swab culture than pediatrics age group with p value 0.004.

3. Results:

Our sample formed of 78 patients mean age 12.8 ± 16.2 years with median 3.7 years, 43.6% (n = 34) were females, while 56.4% (n=44) were males, regarding percentage of body surface area (BSA) affected with burns had a mean of 11.7% ± 5.3% with median 10%.

Pediatrics age group had worse outcome in terms of operative procedures when compared to adult age group whom had better spontaneous healing of their burns, p value 0.035, while adult age group has significantly higher incidence of burn infection and positive swab culture than pediatrics age group with p value 0.004. Type of burn was found to be correlated with age group as pediatrics age group had higher incidence of scald burn while adults had same incidence of scald and flame burns with p value 0.001.



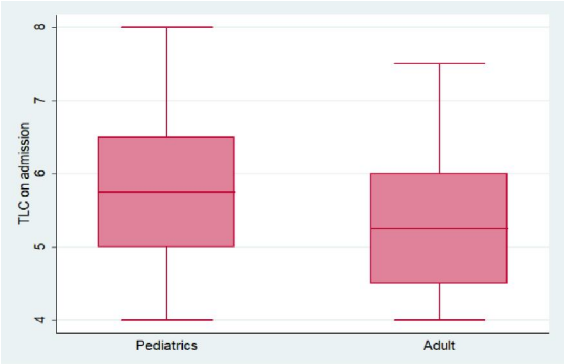
Hospital stay was significantly correlated age group as adults had longer hospital stay than pediatrics with p value = 0.046, as well as being correlated to results of swab cultures as patients who had positive culture had longer hospital stay than those who had negative culture results with p value 0.005, it is worth noting that patients who didn't have any operative intervention had a shorter hospital stay with significant p value 0.036.

Percentage of burned area of body was found to be correlated with length of hospital stay in days R^2 = 0.05, p value 0.007, however there was no significant correlation between percentage of burn and culture results nor antibiotics usage with p value 0.713, 0.713 respectively, knowing that type of burn was correlated to percentage of burned surface area as patients who had scalds tends to have higher percentage than those who had flame and contact burns with p value 0.04.

Swab culture results didn't correlate to definitive outcome of patients as p value = 0.54, in addition to using antibiotics based on culture had non-significant correlation with patient's outcome with p value = 0.54.

Total leucocytic count on admission was correlated to length of hospital stay with R^2 = 0.088 p

value 0.008, in addition there was significant difference in TLC between age groups as pediatric age group had higher TLC when compared to adult age group with p value 0.01.



4. Discussion:

Burns has been a global health issue that correlate to high rates of mortality, morbidity and lifelong disabilities. Burns are the fifth rank in non-fatal childhood injuries, during last decades as World Health Organization has estimated 180000 deaths reported annually, 2/3 of them are in low and middle income countries, nonetheless 18% of Egyptian children who suffer from severe burns live with permanent disabilities [21].

Females and children below age of 5 are the most exposed groups who experience burns, most of burns result from domestic reasons e.g. hot water, ovens and irons, burn caused deaths in children below 5 years are 2 times higher in African region than worldwide, not only due to lack of adequate supervision but also due to child burns poor medical management [21].

In the year 2002, Hemeda et al estimated has conducted an epidemiological study proving that women (53.1%) and male children (42.7%) had the highest incidence of burns which need hospital admission in contrast our study proved that pediatrics age group had the highest incidence of experiencing burns 71.8%, in addition females represented 43.6% of our sample, while our findings were in consistent with Lary et al, for an epidemiological study conducted in Iran [22, 23]

In our study 72% of our patients suffered from scald burn, which was significantly correlated to pediatric age group with p value 0.001, this came in consistence with (Hashmi et al, 2017), who conducted a systematic review including pediatric hospitals in Iran, another epidemiological study in Cairo university hospitals confirmed same results with pointing out a major point in child abuse in low socioeconomic level by inducing contact burns as a punishment for their children, as well as self-induced burns in patients suffering from depression [24].

Burn surfaces are firstly sterile, after that the wound is typically infected by Gram-positive bacteria (Staphylococcus spp.) after 48 h from injury, bacteria found in sweat glands or deeply inside hair follicles. Subsequently, wounds become colonized with endogenous Gram-negative bacteria (e.g. Pseudomonas aeruginosa and Klebsiella pneumonia) post 48-72 h from burn, from the patient's gastrointestinal and respiratory tract (25). In current study, 21.8% had positive swab culture including commonly colonized strains in infected burns e.g. staph aureas 37.5%, pseudomonas are genosa 31.2%, klebsiella 12.5%, enterobacter 12.5% and E-coli 6.3%, this was along with many authors who isolated same strains from infected burns [25, 26], adults were more predisposed for wound infection with virulent strains with p value 0.004, in literature adult burned patients had a prevalence of 50-75% of getting burn infections which is much more higher than pediatric age group [27]

Prophylactic antibiotics usage has been carefully discussed during past decades as Dacso et al, has proved that antibiotics should be used only pre of postoperatively in burned patients [28], Atkins et al, recommended usage antibiotics based on culture specifically, using linezolid for Vancomycin resistant staph aureas strain which made a revolution in improvement of burn healing in patients with positive VRSA culture [29], in our study patients who received antibiotics based on culture had same favorable outcomes for those who didn't receive any type of antimicrobial treatment who were subjected only for spontaneous burn healing with p value 0.87.

These results emphasize the General guidelines and principles for using systemic antibiotic, as antimicrobial agents should be administered for adequate period, usually burned patients are predisposed for various types of microorganisms which require antibiotic combinations, as well as unsupervised usage of antibiotics cause emergence of new strains as VRSA, MDR and KPC which became resistant to all known antibiotics nowadays [30, 31].

A large meta-analysis conducted by Avni et al, including 17 studies investigating the role of prophylactic systemic antibiotic administration for 4 - 14 days in admitted burned patients revealed that prophylactic antibiotics is recommended to be used only in perioperative settings and also not to be used in patients with severe burns as it cause elevation in resistance pattern of isolated bacteria [32].

A randomized clinical trial compared role of prophylactic antibiotic versus no antibiotics in children with burn had concluded that, centers with adequate nursing and medical care equipment can eliminate role of prophylactic antibiotics and even

reduce fatal septic complications that occur to children with high percentage of burns [33].

Conclusion:

Prophylactic antibiotics had a limited role in prevention of burns infections and development of fatal septic complications, nevertheless it contribute to emergence of new resistant strains that lead us to hinder us, returning us to pre-antibiotics era.

Antibiotics should be administered only after confirmation of bacterial infection with a known strain and pattern of sensitivity and resistance to available antimicrobials.

Using antibiotics based on swab culture made patients had similar favorable outcomes to those who have negative swab cultures in terms of spontaneous wound healing and avoid developing serious septic complications.

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