Management of Acinetobacter baumannii infection of burn wound with the evidence of sepsis

ABSTRACT

Introduction: Acinetobacter baumannii infection of a burn wound is a serious infection causing significant morbidity and mortality.

Clinical Presentation: Acinetobacter can cause wound colonization, infection, invasive sepsis, and with or without septic shock. We present a series of five cases and management. Prompt medical and surgical treatments are essential to improve the outcome.

Conclusion: Awareness of the presence of infection and detection of local sensitivity pattern of the organism will lead to initiation of the correct antibiotic.

Keywords: Acinetobacter baumannii, burn sepsis with Acinetobacter baumannii infection, burn wound infection

INTRODUCTION

Infection of a burn wound in children is a serious complication causing as much as 50% mortality. Acinetobacter baumannii, Pseudomonas aeruginosa, and Staphylococcus aureus are among the serious pathogens that are isolated from the burn wound. Prompt diagnosis and management with appropriate antibiotics are essential for favorable outcomes. We have analyzed a group of five cases treated in the burns ward between 2015 and 2018.

ACINETOBACTER SPECIES

Acinetobacter species are Gram-negative aerobic bacilli that are ubiquitous in freshwater and soil environments. These are also part of skin flora and may colonize the oral cavity and respiratory tract in addition to the skin. The risk of invasive infection is high in immunocompromised children and those with preexisting conditions, who become victims of burns.

Bacterial transmission occurs commonly through incubators and ventilation devices such as respirators. Human infection can occur through water distribution system and contaminated surfaces. Constant wound surveillance procedures in the hospital help in identifying the risk of infection. The common infection sites include major infected burns, urinary tract, respiratory, and brain infections including meningitis.

In our burns ward, we have seen two types of A. baumannii infection. One is a group of multidrug-resistant Acinetobacter (MDRA) where carbapenam, imipenem, and meropenem can be effective to treat the infection. The next group is the pandrug-resistant Acinetobacter, an infection which is sensitive only to colistine and tigecycline.

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**PATTERNS OF ACINETOBACTER INFECTION IN BURNS**

**Wound colonization**
Changes in the burn wound surface may be found with no surrounding erythema or cellulitis. Bacterial concentration on the wound surface is low, usually $<10^6$ colony-forming units.[4]

**Resistant burn wound infection**
The area of erythema extends beyond the injury site and there is clinical evidence of cellulitis. Bacterial concentration is high, above $10^6$ colony-forming units. There is often pain, tenderness, swelling, induration, and an increase in temperature indicating surrounding inflammation.

**Invasive infection**
Discoloration of the burn wound eschar is observed along with necrosis of the unburned area. Bacterial concentration is very high on the wound swab culture, but histopathological correlation is necessary to identify the organism.[4] It is a medical emergency requiring fluid resuscitation, antibiotics, and surgical debridement of the affected area.

**Severe sepsis and septic shock**
The definition of these terms is different in children with burns than in nonburns children because of the sustained and prolonged hyperinflammatory response the latter have. According to the American Burn Association Consensus Conference 2007,[5] severe sepsis in burns patients can be diagnosed if at least three of the following seven conditions are present: (i) temperature $>39°C$ or $<36.5°C$, (ii) tachycardia, (iii) tachypnea, (iv) thrombocytopenia, (v) hyperglycemia, (vi) feed intolerance, and (vii) culture positivity.

Figure 1a-e: Burn wound infection in 6 years old. The patient becomes very ill, and the symptoms of shock are aggravated with falling pressure.

As the condition of the patient was deteriorating, we escalated the antibiotics to meropenem and tigecycline. Repeated small whole fresh blood transfusions also were given as the hemoglobin (Hb%) had fallen to 8.

The patient slowly recovered, and small areas were skin grafted with available skin. Primarily we use collagen dressings because with hot humid condition prevailing in the city of Chennai (India), and if we get profuse purulent discharge, a bulky simple gauze dressing is given. Daily, the dressing is changed.

The child recovered slowly. The wound and blood became negative for invasive *Acinetobacter* and the antibiotics also were deescalated. Small areas of autografting were started, and all the areas were covered.

**What are the points learned from this child’s story?**
1. It is essential to identify the microorganism very early in extensive burns in children even if there is no purulent discharge
2. Once *A. baumannii* is identified as a sole infecting organism or *S. aureus*, it is advisable to start with the appropriate antibiotics in the appropriate dosage for the long duration till split-skin grafting is started and when wound is bacteria-free
3. It takes a very long time to reach success in developing countries. However, with proper identification and sensitive antibiotics, success is never too far. Cost is the problem we encounter.

**CLINICAL PRESENTATION IN BURN WOUND**

Initially, the burn wound may look pale or erythematous, but the redness progresses as the infection spreads. Black or brown discoloration of the burn wound often indicates that the local infection is spreading. Surrounding redness leads to pain, tenderness, and swelling. Purulent discharge from the wound or involvement of nonburnt tissue heralds serious infection and is associated with systemic signs such as lethargy, pyrexia, or feed intolerance. Close monitoring of the heart rate, respiratory rate, and blood pressure is essential to detect the signs of progression of sepsis in burn patients.

The following burn cases in children are looked after by us after detecting *A. baumannii* both multidrug-resistant and pandrug-resistant groups.

Figure 1: (a) Wound colonisation, (b) Wound infection, (c) Severe invasive infection, (d) Severe invasive infection with sepsis, (e) Beginning of epithelialisation
In addition to administering the appropriate antibiotics, surgical intervention is conducted. The procedures adopted are either split-skin grafting or rotation advancement flaps. The latter becomes useful when bone is exposed.

We describe a series of cases with *Acinetobacter* infection in the following [Figures 1-7].

While treating *Acinetobacter* infection, anticipation of serious events such as septic shock and fatality may happen. It is always better to treat with the highest antibiotics.

**MANAGEMENT OF ACINETOBACTER INFECTION**

**Medical management**

Meropenem and colistin are the drugs of choice in suspected *Acinetobacter* infection and these have to be in started appropriate doses according to the weight and renal function.[6] Older children need higher doses of antibiotics, according to the weight, but it is important not to exceed the maximum adult doses. Antibiotics may be changed according to the culture and sensitivity of the organism. It is important to remember that the yield of blood culture remains low, and therefore, clinical improvement has to be monitored. Coexisting infection may necessitate addition of other antibiotics and also antifungal agents. Fluid resuscitation may be required with 0.9% saline if there are signs of poor perfusion, tachycardia, or poor urinary output. Attention to nutrition is of paramount importance in improving the general condition of the child. The role of colloids such as 5% albumin is necessary when there is no response to crystalloids; this is debatable. Blood transfusions may be required if Hemoglobin is below 8 gm/dl. Dopamine, dobutamine, and other vasoactive agents are used in shock not responding to fluids. At this stage, the child should be managed in a fully equipped pediatric intensive care unit (ICU) with facilities for intubation and mechanical ventilation.

**Surgical management**

- If the area of burn is not very large and has no slough, meticulous local dressings with topical antibiotic creams of choice (T-Bact or silver sulfadiazine or soframycin) could be used after cleaning and the wound is closed. In healthy settings, collagen dressings can be applied.
- In our department, collagen dressings under the title “Kollagen” are used for wound coverage in small cases. If the wound is unhealthy with purulent discharge, closed dressings with antibiotic tulle are used and later grafted.
- If the area of the burn is over 30% deep or deep partial thickness, the patient is admitted in the ICU and antibiotics are started. Regular wound debridement is undertaken. When the condition is improved, split-skin grafting is done. The donor site is carefully selected, and the electric dermatome with small blades is useful in children; in the early phase, collagen dressing is also used to stop oozing and pain.
- The grafted area needs physiotherapy, splintage, and massage.

**SURVEILLANCE AND PREVENTION**

*Acinetobacter* infection is a major problem in clinical settings treating children with burn wounds. Quantitative culture of the surface of the burn wound is often the mainstay of the detection of *Acinetobacter* infection. A concentration of more...
Figure 4: In 30% mixed burns, collagen membrane application was done. This child had both pseudomonas and multidrug resistant *Acinetobacter* – survived with multiple antibiotics, including meropenem and augmentin were given. The child recovered fully.

Figure 5: 3 days old new born baby was brought to NICU, with 40% mixed burns. The etiology of this burn infection was identified as acinetobacter species. The grandmother threw hot water on the baby due to family feud. Baby could not be saved.

Figure 6: This child had a habit of playing with lighting match sticks. One day in the evening, as she was playing with lighted matches, her school uniform got burnt. Extensive involvement of the trunk with *Acinetobacter* infection took place later. Twenty-four percent deep partial thickness burns of the chest, shoulder, and upper chest occurred. Treated with meropenem to which the organism was sensitive. After the burn wound healed with good epithelialisation, the burnt area became hypertropic with extensive scarring.

than $10^{10}$ is taken as indicative of infection. However, this is not sufficient to identify invasive infection, and a biopsy is also required. Regular assessment of the isolates with drug sensitivity is useful in identifying resistance patterns within the unit, and this information is useful for deciding the choice of antibiotics.
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Conflicts of interest
There are no conflicts of interest.

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