

## Spore Bearing Bacterial Infection in Burns

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### Abstract

Burn trauma remains a difficult problem because of the difficulties in treating the victims, prolonged treatment, the high mortality rate, and sometimes unacceptable results of treatment. Pediatric burns account to nearly a fourth of all the burn injuries around the world. Because of emphasis on early resuscitation, the mortality due to hypovolemic shock has come down drastically. Majority of burn related deaths are due to sepsis. There is a wide range of organisms that can lead to sepsis in burn patients. Burn sepsis due to spore bacteria is rare but one should keep the possibility as one of the causes of sepsis in pediatric burn cases.

**Keywords:** Burn; Sepsis; Spores

### Introduction

Burns are a serious public health problem globally, with over 300,000 deaths each year from fire alone. Fire-related deaths alone rank among the 15 leading causes of death of children and young adults aged 5–29 years. In addition to those who die, millions more are left with

lifelong painful disabilities and disfigurements, often living with the resulting social/personal stigma and rejection. Modern medicine has made considerable progress in lowering rates of burn deaths through combination of proven prevention strategies and improvements in the care of burn victims. In spite of great success achieved in burn treatment, a lethal outcome among severely burnt patients remains high even in specialized hospitals.<sup>1, 2</sup> Nearly a fourth of all burn injuries occur in children under the age of 16, of whom the majority are under the age of 5.<sup>3</sup> The treatment of pediatric burns requires a team of pediatricians, surgeons, anesthesiologists, intensivists, nurses, respiratory therapists, and other healthcare providers. The primary cause of death in burn patients who survive initial burn shock resuscitation is from multiple organ dysfunction syndrome (MODS), which is a direct response to sepsis. Despite these issues, there have not been enough efforts directed at improving the diagnosis and treatment of sepsis in burn patients especially in pediatric burn patients. Burn sepsis due to spore bacteria is rare. This article highlights the possibility of spore bearing bacteria as one of the causes of sepsis in pediatric burn cases.

### Case Report

Patient was a 2 year old male who sustained thermal burns accidentally while playing near a bon fire. He was rushed to the tertiary health facility by the family as soon as the injury occurred. Patient

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was shifted to burns ICU. At the time of presentation his vital parameters shown axillary temperature 98.4°F, pulse rate 110/minute, respiratory rate 22/minute and blood pressure 100/60 mmHg. Further assessment revealed singed nasal hair, reduce air entry bilaterally, with transmitted sounds, charred and edematous face. Wound assessment revealed mixed thickness burns with total burned surface area (TBSA) of 60%. He developed stridor within 1 hour of admission and was intubated. He was placed on mechanical ventilation. Intravenous line secured. Fluid resuscitation was commenced with lactated ringers based on calculations obtained using the Parkland formula. Continuous sedation and pain relief was achieved with IV fentanyl at 0.5 micrograms/kg/hour. A urethral catheter to monitor the adequacy of the fluid resuscitation was inserted. Blood samples including hemogram, hematocrit, renal function tests and Arterial Blood Gas (ABG) were sent. Collagen dressing was done to cover the burn wounds. On the second post burn day (PBD) a change in temperature pattern was noted and ranged from 100°F to 101°F. Hemogram including counts and blood for culture and antibiotic sensitivity was sent. Paracetamol rectal suppository was given for fever. The blood culture sent on PBD 2 showed no growth of any organism. After administration of IV paracetamol, the temperature dropped to 99°F. On PBD 3, a similar pattern of fever was noted and blood, urine and tracheal aspirate were sent for culture and sensitivity. Wound dressing was done and wounds on observation did not look infected. On PBD 4 the highest core body temperature was recorded as 104 F and tepid sponging of unburned areas was carried out with administration of IV paracetamol. On day 5, patient condition deteriorated rapidly and in spite of resuscitative efforts patient expired and couldn't be revived. Post-death all cultures were followed to find the cause of burn sepsis and death. The blood culture sent on PBD 3 showed aerobic spores in the specimen. All the other samples sent for culture didn't grow any organisms. Blood sample couldn't be repeated as the patient expired.

## Discussion

Burn patients due to injury to skin (which acts as primary barrier to infectious) are always at risk for sepsis and MODS as long as the wounds remain open. Major burn injury not only results in local damage from the inciting injury, but in many cases results in multisystem injury. Initial efforts are focused on resuscitation, maintaining hemodynamic stability, and airway management.

Intermediate efforts are focused on managing the multi-organ failure that results from systemic inflammatory mediators leading to diffuse capillary leak and surgical therapy. Finally, efforts shift to issues with chronic wound healing, pain management, restoration of functional capabilities, and rehabilitation. From a respiratory standpoint, burn injury results in a complicated picture, with initial management focused on securing a potentially edematous airway. It has been demonstrated that morbidity and mortality are high in burn patients with respiratory problems or inhalational injury.<sup>4</sup> The propensity to develop infectious complications in burn children is secondary to disruption of barrier function of skin and gut mucosa, coupled with the immunosuppressive effects of burn injury. In addition to the wound as an obvious source of infection, other sites which demand vigilance and consideration in the burn patient include bacterial translocation from the gut, intravenous catheter related bloodstream infection, urinary catheters, and ventilator-associated pneumonia.<sup>5</sup>

Sepsis is an extreme response to inflammation and has profound effects on all the systems of body. Sepsis is life-threatening organ dysfunction caused by a dysregulated host response to infection. Septic shock is a subset of sepsis in which underlying circulatory and cellular metabolic abnormalities are profound enough to substantially increase mortality.<sup>6-8</sup> Sepsis in the pediatric population should not be considered equal with sepsis observed in adults. In addition, the burn patient is profoundly immunosuppressed and is frequently colonized or infected with multiply resistant organisms. They are also prone to unusual infections such as viral or fungal infections. The pathogens that infect the wound are primarily 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. These latter pathogens are notable for their increasing resistance to a broad array of antimicrobial agents.<sup>9,10</sup> Fungal pathogens can also infect burn wounds. These infections occur more frequently after the use of broad-spectrum antibiotics. Among the fungal pathogens, *Candida albicans* is the most common cause of infection.<sup>11</sup> More recently, a trend toward nosocomially acquired, intrinsically resistant fungal infections (e.g., *Candida krusei*) has been reported.<sup>12</sup> Sepsis due to spore bearing bacteria is rare and usually secondary to contamination of sample, but once sepsis occurs then it can be fatal especially in pediatric burns due to low immunity. To prevent

burn sepsis due to spore bearing bacteria one should take all precautions while withdrawing blood samples to avoid contamination and may need prophylactic empirical antimicrobial therapy against spore bearing bacteria once sepsis sets in pediatric burn cases.

### Conclusion

Burn sepsis due to spore bacteria is rare but one should keep the possibility as one of the causes of sepsis in pediatric burn cases.

**Conflicts of interest:** None.

**Disclosure:** None

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