

Delayed management of paediatric burn sepsis resulting in limb loss

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Summary

Primary health care centres, community health centres and district hospitals often have medical staff that have minimal exposure to paediatric patients. This may contribute to the challenge of recognising a critically ill paediatric patient. It is already a difficult task as many clinicians are not comfortable or well equipped to manage burn patients, even in regional or tertiary facilities. Identification of the systemic inflammatory response syndrome (SIRS) versus sepsis is difficult in burns owing to the clinical presentation. Identifying the clinical signs determines the need for immediate treatment (i.e., fluid resuscitation) no matter the cause. Investigations will follow to determine the cause, further management and response to treatment. These two cases illustrate the deficit in skill and knowledge in the identification of the sick burn-injured child. Although telemedicine has made large advances in allowing access to expert advice in remote locations, its usefulness is dependent on the clinical signs being identified and adequately portrayed to the expert. The way forward is better undergraduate and postgraduate training in this area with an emphasis on clinical acumen.

Case report

Case 1

BM is a previously healthy 6-month-old who presented to a district hospital with 15% hot water scald of superficial partial depth to the feet, lower legs and thighs. He was appropriately resuscitated and transferred early to the regional hospital due to the age of the patient and the size of the burn. About a week later, he developed severe sepsis and septic shock. Resuscitation was commenced with referral to the paediatric intensive care unit (PICU), who advised obtaining source control prior to admission to PICU. The patient was taken to theatre for debridement by a burn naïve surgeon. The surgery was, in fact, not indicated for the superficial partial nature of the burn. The patient was severely under-resuscitated at the time of going to surgery and arrested post induction of anaesthesia. Return of circulation was achieved with transfer to intensive care for organ support. The patient subsequently developed gangrene of both feet that extended up to the knees, as well as a hypoxic ischaemic encephalopathy. He has subsequently had bilateral through knee amputations and skin grafting of the residual wounds, as well as a feeding gastrostomy and Nissen fundoplication due to inability to swallow. Nissen fundoplication is done in conjunction with the feeding gastrostomy due to the high incidence of associated reflux in these cases. The preoperative work-up for this case included a modified swallow that was assessed by the speech therapist and paediatric surgeon, where the need for Nissen fundoplication was determined.

The multidisciplinary team is involved as part of the rehabilitation process for mother and baby.

Case 2

A one-year-old girl presented to a regional hospital with 8% hot oil burns to the right leg and buttock 4 days prior. This was the first presentation to a health care facility. The patient was accompanied by the mother who had brought her in due to the development of diarrhoea. The child was unwell on presentation, and a referral to the burn service was made. Fluid resuscitation and antibiotics were advised and the child was transferred across the following day. On arrival at the burn service, the child was lethargic and unresponsive with a capillary refill time of 6 seconds, dusky hands, and severe metabolic acidosis. The degree of critical illness had not been portrayed to the accepting unit. The child was aggressively resuscitated and required organ support in ICU. Subsequent amputation was required two weeks later after demarcation of full-thickness necrosis of all fingers and distal hands bilaterally. The child remained on organ support and developed new sepsis that resulted in the demise of the child due to a multi-resistant organism.



Figure 1: Acute partial-thickness burn at presentation



Figure 2: Bilateral non-viable limbs

Discussion

Literature highlighting the identification of a sick child is scarce. Doctors need to be skilled in identifying ill children based on clinical factors. Kneyber et al. have shown that paediatric shock should ideally be recognised within 15 minutes and rapid infusion of fluids should be initiated to reverse this. Should fluids fail within 15 minutes, inotropic support should be initiated. The aim is to prevent hypoxia and consequently organ failure. The main symptoms of shock described are tachycardia and reduced consciousness.¹ Other identifying clinical factors include delayed capillary refill time, cold and cyanosed peripheries.

Once these are identified, the next step is to look for the underlying cause. Procalcitonin has been suggested as a means to differentiate between bacterial sepsis and systemic inflammatory response syndrome (SIRS) response in an effort to initiate early and appropriate administration of antibiotics. Lamping et al. have shown that factors such as length of PICU stay until onset of SIRS/sepsis, central line, core temperature, number of previous SIRS/sepsis episodes and biomarkers such as interleukin-6, platelet count, procalcitonin, CRP are accurate in determining if a child is ill from a bacterial sepsis vs a non-infective SIRS.^{2,3} However, specific investigations do not supersede the value of good clinical examination. It is critical to identify shock and initiate fluid resuscitation, and then identify the response to fluids. These cases demonstrate failure to do so. Attention to evolving burn depth is also important. Although the burn injury sustained in case 1 was circumferential, the nature of the burn depth was superficial partial and escharotomy is not

indicated for superficial partial burns even if circumferential. It is, however, possible that the adverse event led to burn depth conversion. If the circumferential burns then became deep in nature, this could have led to compartment syndrome. This may have been a contributing factor to the development of gangrene in both limbs in this case. The lesson here is that burn depth can change and the superficial partial depth on presentation may deepen over the next few days. The wounds should be re-evaluated frequently, especially after adverse events.

Telemedicine has greatly changed the way burn patients are managed. Patients in remote district hospitals managed by junior doctors now have greater potential for improved outcomes with the advent of smartphones and quick access to a higher level of care. Particularly in the Pietermaritzburg Burn Service, the referral system using the Vula Medical Referral application puts the referrer in direct contact with one of two burn specialist surgeons.⁴ Rapid consultation with experts has not only prevented inappropriate referrals but also prevents delayed admissions to higher centres. Furthermore, it enables ongoing medical education.^{5,6} This, however, is dependent on the clinical signs being identified and adequately portrayed to the expert.

These two cases illustrate a deficit in skill and knowledge in the identification of the sick burn-injured child. There is no local data to indicate the adequacy of burn care training in our setting. In England, Sadideen et al. have shown that undergraduate training in burns is lacking but postgraduate training using simulation strategies has been able to bridge that gap.^{7,8} We believe there is an urgent need to implement adequate undergraduate and postgraduate training in the field of burns and specifically the critically ill burn-injured child.

Teaching points

- Signs of a child in shock include tachycardia, decreased level of consciousness, delayed capillary refill time, cold peripheries and cyanosed peripheries.
- Paediatric shock has a small window period in which one needs to act in order to prevent hypoxia and subsequent organ damage.
- Training in clinical skills pertaining to paediatrics and burn patients is needed.

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