Tragedy Strikes: Infant's Eczema Complicated by Fatal Septic Shock

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Abstract

Eczema herpaticum (EH) is a clinical emergency requiring immediate management with antiviral therapy, and systemic corticosteroids should be avoided. Corticosteroids can result in disseminated HSV infection in patients with atopic dermatitis. Secondary bacterial infections, particularly *Staphylococcus aureus* and *Streptococcus pyogenes*, are common. *Pseudomonas aeruginosa* bacteremia is rare in children with EH but should be considered. Here we report a fatal outcome of an 18-month-old healthy boy with atopic dermatitis who developed extensive EH after receiving systemic corticosteroids, and his course was complicated by *P. aeruginosa* septic shock. Despite antiviral therapy, supportive care, and broad-spectrum antibiotics, he passed away within few hours. *P. aeruginosa* infection should be considered and covered promptly with the appropriate antibiotics in patients with EH who have extensive skin lesions as soon as possible, especially if they become critically ill. Systemic corticosteroids should not be given if EH is not ruled out in patients with atopic dermatitis flare up without dermatology consultation.

Keywords: Eczema hepaticum, Pseudomonas aeruginosa, fatal, outcome, corticosteroids

Introduction

Eczema herpaticum (EH) is a potentially fatal medical emergency if misdiagnosed or untreated promptly.[1-3] It is caused by the Herpes simplex virus (HSV), either type 1or type 2 which are members of the Herpesviridae Family.[1,2] It is defined as a serious, extensive cutaneous viral infection that arises as a complication of a pre-existing skin disease, most commonly atopic dermatitis (AD).[4] The incidence among children with AD in not known but some studies suggest that it affects less than 3% in patients with AD.[5,6] The rising incidence of eczema herpicum in US hospitalized children, predominantly afflicting younger nonwhite populations and those with atopic dermatitis, is associated with substantial morbidity and healthcare costs, particularly for Asian patients.[7] Male sex, age below 1 year, fever, and systemic symptoms at onset were the main predictors of hospitalization among children with EH and hospitalized patients could experience recurrences of eczema herpeticum.[8] Immunocompromised and sub-optimally treated patients are at high risk of mortality due to EH.[2,3] Corticosteroids should be avoided to prevent HSV dissemination and secondary bacterial infections should be considered and covered with antibiotics whenever is required.[1] Herein is described a case of an 18-month-old who succumbed to EH complicated by septic shock to underscore the urgency of early diagnosis and adequate intervention.

Case Report

An 18-month-old boy, who had been diagnosed with atopic dermatitis at 4 months old, presented at a health center with worsening symptoms, including a two-day history of severe eczema flare-ups and a fever peaking at 38.5°C. Before falling ill, he had no prior localized or systemic infections. In response, the patient was initiated on oral co-amoxiclav and oral prednisolone at a dosage of 1mg /kg per day. In the following two days, his skin condition worsened and spread throughout his body. He was then admitted to the hospital with the impression of eczema herpaticum with possible secondary bacterial infection and started on intravenous (IV) acyclovir, and the IV co-amoxiclav continued. His fevers continued, and on day 3 of admission, he developed swelling and redness in his left knee and then went into septic shock [Figure 1]. He was then started on IV ceftriaxone and vancomycin, and he was managed with intravenous fluid boluses and inotropic support. Intravenous piperacillin-tazobactam was started within 4 to 6 hours of his deterioration after consultation with the pediatric infectious diseases team, which was then shifted to IV meropenem. IV clindamycin was added as an antitoxin but he continued to deteriorate and got transferred to our center for intensive care. On arrival at our center, he was on catecholamine refractory septic shock, and he was on maximum inotropic support (adrenaline 1mcg/kg/min, nor-adrenaline 1mcg/kg/min, vasopressin 0.4 milliunits/kg/min). In addition, he received a stress dose of hydrocortisone. He had multiple cardiac arrests, required chest compression, and developed multiorgan failure with an oliguric acute kidney injury. Intravenous human immunoglobulins of 2 g /kg were given, and he was reviewed by multiple subspecialties, including general surgery, dermatology, and infectious diseases. Skin examination showed widespread punch-out pitted ulcers and erosions all over the trunk and extremities [Figure 1]. Necrotizing fasciitis was thought to be less likely after a surgical review. He continued to have multiple cardiac arrests and passed away within 4 hours of admission to our intensive care unit despite supportive care, IVIG, and multiple broad-spectrum antimicrobial therapies including IV meropenem (40 mg/kg/dose 12 hourly), IV vancomycin (20 mg /kg/dose 6 hourly), and IV clindamycin (10 mg/kg/dose 6 hourly). His initial blood investigations at our center showed a hemoglobin of 9.4 g/dL, a total leukocyte count of 11.7 x 10^9/L, an absolute neutrophil count of 5.8 x 10^9/L, and a platelet count of 73 x 10^9/L. C-reactive protein level was 13mg/L, liver function test: Alanine aminotransferase was 291U/L (0 – 40 U/L), aspartate aminotransferase level of 1756 U/L (0 – 40 U/L), albumin level of 7 g/L (38 – 54 g/L), total protein level of 14 g/L (51-73 g/L), and normal bilirubin level of 7 umol/L. His renal function was normal. Blood culture results and skin swabs were obtained one day after his death. His skin and blood cultures grew pan-susceptible *Pseudomonas aeruginosa*, and his skin swab was positive for Herpes simplex-I.

A **B**

Figure 1: (a) A widespread punch out pitted ulcers and erosions over the trunk with necrotic borders. **(b)** Left knee swelling with punched out ulcers with fibrinous base.

Consent for publication was taken from the child guardians.

Discussion

HSV has a higher ability to replicate in a pre-disturbed skin barrier and immune system because of skin diseases like atopic dermatitis, psoriasis, irritant contact dermatitis, burns, and seborrheic dermatitis like our patient.[4,5] The pathogenesis of EH is unclear, but it is referred to as either an abrupt reaction or a pre-damaged skin barrier and immunity with imbalanced integrity.[5] Human β-defensin -2 (HBD-2), HBD-3, and cathelicidin are crucial in immune response, whereas inability to induce these antimicrobial peptides (AMP) in ADEH+ patients increase their vulnerability to *Staphylococcus aureus*, HSV infections, and eczema vaccinatum.[9] In addition, Atopic dermatitis complicated by eczema herpeticum has been linked to HLA B7 and a decrease in interferon-γ-producing CD8+ T cells.[10] Atopic dermatitis patients with eczema herpeticum (ADEH+) exhibit severe AD skin disease, increased Th2 responses, decreased filaggrin and antimicrobial peptide expression, associated with food allergies, asthma, early onset, and prior infections with S. aureus or molluscum contagiosum, suggesting a multifactorial etiology.[6]

EH tends to recur in patients with atopic dermatitis, even in patients who have asymptomatic shedding from oral mucosa.[3] It can disseminate and cause meningoencephalitis and severe keratitis, which can result in blindness if not treated on time.[4,11] Two multicenter studies from Europe and United states demonstrated that having active extrinsic AD significantly increases the risk of EH, particularly for recurrent cases associated with severe atopic distortion requiring active AD lesions for presentation, predominantly affecting patients with early-onset AD.[12,13]

Patients with EH can easily have a superinfection with bacteria, mostly *Staphylococcus aureus* and *Streptococcus pyogenes*.[11] Aronson et al. reported *S. aureus* infection among 30% of patients hospitalized with EH, of which 9% were caused by *methicillin-resistant S. aureus* (MRSA) strains. Bacteremia was reported in 4% of the same cohort of patients with *S. aureus*, mainly.[14] In children with EH, there are few reports of *Pseudomonas aeruginosa* bacteremia. *P. aeruginosa* bacteremia carries a high mortality rate among all age groups. Among children, the 30-day all-cause mortality was close to 50% in one study from Japan. They reported that septic shock and the need for intensive care were associated with higher mortality.[15] Our patient deteriorated rapidly into septic shock, and he required intensive care, which were risk factors associated with mortality. Pseudomonas infections should be suspected in patients with extensive wounds and hospital-acquired infections like our patient as he developed the secondary bacterial infection while he was inpatient.. *P. aeruginosa* infection should be considered and covered promptly with the appropriate antibiotics in patients with EH who have extensive skin lesions as soon as possible, especially if they become critically ill.

Timely and precise treatment depends on an accurate diagnosis. EH is characterized by vesiculopustular eruptions and hemorrhagic crusts, predominantly on the upper body, which can be accompanied by systemic symptoms, including lymphadenopathy, fever, and flu-like syndrome.[1,16] Secondary bacterial infections associated with EH can mask the underlying viral infection, resulting in delayed diagnosis.[3,16] Identifying EH from other viral infections is crucial for patients in this category. Molluscum contagiosum, a poxvirus-transmitted infection, manifests as eczema molluscatum with umbilicated, small, skin-colored eczema-like papules with central umbilications on inflamed skin.[17] In individuals with atopic dermatitis, eczema vaccinatum, a complication of smallpox vaccination, can result in an extensive outbreak of large blisters and pustules, accompanied by fever and systemic Symptoms.[17] To confirm the diagnosis of EH, polymerase chain reaction (PCR) to detect HSV is the preferred test because of its high sensitivity and specificity, whereas bacterial cultures are essential to identify the causative agents of secondary bacterial infections.[4]

Acyclovir has succeeded in significantly decreasing the mortality rates of EH, which reached up to 50% before its use.[16] Postponed and inappropriate treatment courses can result in more dissemination or sepsis and death.[1,16] Oral acyclovir is recommendable for mild cases, whereas the intravenous route and hospitalization for children with extensive lesions, immunocompromised patients, and seriously ill patients are indicated.[1,4] The intravenous route can be shifted to oral acyclovir if the patients show health improvement and the lesions begin to crust over. Besides, critically ill patients may require special care like intravenous fluid, electrolyte replacement wound care, and nutritional support.[4] The antiviral therapy is frequently accompanied by either intravenous or oral antibiotics for the secondary bacterial infection, mostly if clinically suspected.[4] Oral corticosteroids should not be used without consultation with a

dermatologist, as they may lead to worsening EH.[1,4,16] We think that our patient worsened initially because of the administration of oral corticosteroids with no antiviral therapy, and then the extensive skin lesions got colonized with *pseudomonas aeruginosa* while he was in the hospital and developed secondary septic shock, from which he died.

Conclusion

EH is a rare entity but a life-threatening condition if suboptimally treated, which can cause considerable morbidity and mortality. As a result, healthcare professionals must be aware of precise diagnoses that aid in immediate and proper treatment with antivirals and antibacterials (when required), which is a fundamental factor in dramatically decreasing severe complications and mortality.

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