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Ecthyma gangrenosum with a coinfection of methicillin-sensitive staphylococcus aureus and streptococcus pyogenes: a case report

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Abstract

Introduction: Ecthyma gangrenosum (EG) is a cutaneous infection characterized by gangrenous ulcers with erythematous borders seen in immunocompromised as well as immunocompetent individuals. Although *Pseudomonas aeruginosa* is the commonest pathogen isolated, several other bacteria and fungi contribute to the pathogenesis of EG. Identification of the microorganism is very essential to initiate early empirical antimicrobial therapy.

Case presentation: We present a case report of a 13-year-old boy with multiple recurrent ulcerative lesions in both lower extremities for the past 1 year. His blood parameters showed signs of inflammation but was negative for aerobic blood culture, suggesting absence of underlying bacteraemia. There were no features of immunosuppression. On examination of pus sample, Methicillin Sensitive *Staphylococcus aureus* and *Streptococcus pyogenes* were isolated from the ulcerative lesions. Amoxicillin- Clavulanate and Doxycycline was advised for 2 weeks along with surgical debridement of the lesion followed by aseptic dressing. Patient showed complete resolution after 2 weeks.

Discussion: *Staphylococcus aureus* and *Streptococcus pyogenes* were the causative agents in this case, suggesting a polymicrobial association of EG besides *Pseudomonas aeruginosa*. Underlying bacteraemia or any other immunodeficiency is usually seen in a case of EG, however there are cases reported where cutaneous manifestations show predominance.

Conclusion: A prompt diagnosis of EG is essential because there are instances when it has proven to be fatal. Ruling out any immunodeficiency disorders and underlying bacteraemia is of vital importance. Administration of proper antibiotic coverage (gram positive or gram negative) along with debridement and regular dressing can help in limiting the spread of infections and thus improving patient outcomes.

Keywords: Ecthyma, Staphylococcus aureus, Streptococcus pyogenes

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Introduction

Ecthyma gangrenosum (EG) is a cutaneous infection that causes crusted lesions beneath which ulcers develop. It has deeper dermal infiltration, leading to severe manifestations as compared to impetigo but both conditions have similar bacterial causative agents. EG occurs most commonly in immunocompromised individuals, however, healthy immunocompetent people are not always excluded. Common risk factors include neutropenia, leukemia, multiple myeloma, type 2 diabetes, malnutrition, and significant burn injury (1).

Gangrenous ulcers with erythematous borders generally characterize lesions. Primarily affecting the axillary and anogenital regions it can also involve the arms, legs, trunk, and face. The characteristic macroscopic appearance is caused by perivascular invasion and ischemic necrosis of the associated skin (1).

Pseudomonas aeruginosa is the most common bacteria found in EG. *P. aeruginosa* infection is rare in healthy children, but could occur in patients with croup syndrome and sepsis. In fact, EG may be the first sign of a *Pseudomonas* infection or might even develop in the later course. It usually appears before the results of the blood culture and help clinicians to choose appropriate antibiotics. *Methicillin-resistant Staphylococcus aureus* (MRSA), *Streptococcus pyogenes, Citrobacter freundii, Escherichia coli, Aeromonas hydrophila, Serratia marcescens, Aspergillus spp., Mucor spp.,* *and Candida spp.* are among the many other causes of EG (2).

This report suggests that besides *Pseudomonas aeruginosa*, EG due to coinfection with other microorganisms, such as *Staphylococcus aureus* and *Streptococcus pyogenes* even though rare, can prove to be a significant finding, especially in the absence of bacteraemia or any other immunocompromised status. Hence, prompt diagnosis with early initiation of appropriate antibiotics can prevent further complications and fatalities.

Case presentation

We present the case of a 13-year-old boy with complaints of multiple recurrent ulcerative lesions in both lower extremities for the past 1 year. The lesions were itchy and slightly painful. Throughout the past year, on application of topical ointments, there was temporary remission of lesions which later flared up. There was no history of any insect bite. Local examination revealed that the lesions were in varied stages of development. Some exhibited pustules, while others had punched-out ulcers with thick, brown-black crusts and surrounding erythema (Figure 1). His physical examination revealed mild anaemia but no local lymphadenopathy.

Figure 1. Multiple punched-out ulcerative lesions with thick, brown-black crusts and surrounding erythema over lower extremities.

His blood parameters revealed mildly raised WBC count of 13000/µL (reference value: 4000–11,000/µL), ESR 55 mm/hr (reference value: 0-15 mm/hr), CRP 150 mg/dl (reference value: ≤0.8 mg/dL), and procalcitonin 6.25 ng/ml (reference value: ≤0.10 ng/mL). (All reference values were taken from American Board of Internal Medicine Laboratory Test Reference Ranges− July 2023). All serological parameters were negative. Aerobic Blood culture was negative after 5 days of incubation in BD BACTEC™ FX40.

Skin biopsy was taken as well as pus collected from underneath the crusts. Gram stain of the pus revealed plenty of pus cells with gram-positive cocci in chains as well as in clusters. Ziehl-Neelsen staining with 20%

H_2SO_4 was negative for acid fast bacilli. Two cultures were done on Blood agar, one incubated aerobically at 37˚ C, and the other incubated in the presence of 10% CO_2. After overnight incubation, *Staphylococcus aureus* and *Streptococcus pyogenes* were isolated. Antibiotic susceptibility testing was performed by Modified Kirby Bauer Disc Diffusion method on Mueller Hilton agar for *Staphylococcus aureus* and Mueller Hilton agar with 5% Sheep blood for *Streptococcus pyogenes* as per CLSI 2023 guidelines. Zone diameters were measured (3). *Staphylococcus aureus* was Penicillin and Clindamycin resistant, intermediate susceptible to Ciprofloxacin and susceptible to Linezolid, Erythromycin, Cefoxitin, Doxycycline and Cotrimoxazole. *Streptococcus pyogenes* was resistant to Clindamycin but susceptible to penicillin, erythromycin, and linezolid. Skin biopsy revealed inflammatory cell infiltration, vascular proliferation, extensive keratinocyte necrosis along with cocci in clusters and in chains. However, no bacilli, amastigote forms (Leishman Donovan bodies) or fungal hyphae were found.

The patient underwent debridement of the ecthyma crusts along with a 14 day oral course of Amoxycillin-Clavulanate (625 mg thrice daily) and Doxycycline (100 mg twice daily). On follow-up examination of the patient after 2 weeks, no new lesions were seen and there was resolution of the debrided ulcers. The patient was advised to maintain strict hygiene of the affected sites and his parents were counselled to ensure proper nutrition of the child.

Discussion

Few differential diagnoses of EG includes other causes of necrotic wounds such as, cutaneous anthrax, cutaneous aspergillosis, cutaneous leishmaniasis, *Mycobacterium marinum* infection and pyoderma gangrenosum (4). However, absence of bacilli, amastigote forms of Leishmaniasis or septate hyphae fungal in the pus sample as well as skin biopsy eliminates the first three differentials. Acid fast stain was negative for Mycobacterial infections and absence of any relevant underlying conditions, such as inflammatory bowel disease excludes pyoderma gangrenosum. EG is also often confused with Ecthyma contagiosum which is characterized by solitary pustular lesions on hands and results from the direct contact of damaged skin with animals infected by a virus of Parapoxvirus genus: Orf virus (5).

The diagnosis of EG is not excluded even if blood culture yields a negative result. Pus, tissue, and exudate cultures could be used for identifying the organism causing the lesion. When both cultures show negative results, histopathological examination and KOH mount should be performed.

EG is usually due to *Pseudomonas aeruginosa* bacteraemia in patients with impaired immune systems. However, patients without any underlying immunodeficiencies may also suffer from this clinical situation and even without any features of bacteraemia (6,7,8). This is highlighted in our case where EG occurred in an immunocompetent patient without bacteraemia and with causative organisms besides *Pseudomonas aeruginosa* as Coinfection with Methicillin Sensitive *Staphylococcus aureus* (MSSA) and *Streptococcus pyogenes* was seen in this case. Ecthyma gangrenosum secondary to MSSA was also seen in a case reported by Ivanaviciene J et al. (9).

Here, the *Staphylococcus aureus* strain was resistant to penicillin, whereas the beta-haemolytic *Streptococcus pyogenes* was susceptible. Oral combination antimicrobial therapy with Beta lactam-beta lactamase inhibitor (BL-BLI) and a broad-spectrum antibiotic was required to manage this condition. Kudo Nagata Y et al. reported cases of EG with MRSA strains, which could be fatal, especially in patients with haematological malignancies due to concurrent bacteraemia. Although such a case is relatively uncommon, tissue cultures with an initial gram stain is essential for selecting appropriate empirical antimicrobials, including the coverage of *S. aureus* (10). Ulpiano Trillig, A et al. also reported two cases of coinfection by group A *Streptococcus spp.* and *Staphylococcus aureus* admitted to the hospital. The first patient had no risk factors nor any immunodeficiency, but the second case was a homeless man with drug and alcohol abuse and advanced HIV infection (11). A study in Japan showed that staphylococcal infection was responsible for 60% of cases of EG, while the remaining cases were attributed to *Streptococcal* and *P. aeruginosa* infections, in descending order of prevalence (12).

There are even two postulated mechanisms identified in the literature that describe the pathogenesis of EG. In the first form, bacteria from a primary infection originating in the genitourinary, respiratory, or gastrointestinal tract travel hematogenously, disseminating through the vasculature to the skin, or in the second scenario a cutaneous abnormality emerges and microbial infiltration takes place at the precise location of the abnormality (13). Lesions usually recover after surgical debridement of the ulcers with a complete course of antibiotics. Maintenance of proper hygiene is also required to prevent recurrence.

Conclusion

Ecthyma gangrenosum is a serious and sometimes fatal skin condition that initially manifests as a maculopapular rash, followed by a haemorrhagic bulla, necrotic ulceration, and surrounding erythema. The perivascular bacterial invasion of cutaneous blood vessels resulting in ischemic skin necrosis is the main pathology behind EG. A clinical diagnosis is often established by punched-out ulcers with thick, brown-black crusts. Lesions might be one or more, and, as seen in our case, they can be in different phases of development. There are several bacterial agents responsible for this condition and thus it might sometimes be polymicrobial. Proper antibiotic therapy along with hygiene maintenance is essential to treat this skin condition.

Ethical consideration and consent

Ethical clearance was obtained from Institutional Ethical Committee. Informed written consent was obtained from the patient to publish this case report (MGM/PRI/GEM-86/2024).

Author contribution

RDR was responsible for conceptualization and writing the original draft. **DD** contributed to the methodology, supervision and reviewing the manuscript. **SDG** helped in writing and reviewing the original draft and data curation.

Conflict of interest

The authors declare that they have no competing interests.

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