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Case Report

Necrotizing Soft Tissue Infection of the Upper Extremity as a Manifestation of Hansen's Disease

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Hansen's disease is a well-described, largely historic infection that is caused by *Mycobacterium leprae*. Lucio's phenomenon is an aggressive, rare form of untreated lepromatous leprosy characterized by diffuse cutaneous lesions and systemic symptoms. To date, cases of necrotizing soft tissue infection in the setting of leprosy have rarely been reported in the literature. We present the case of a 51-year-old man with no known past medical history who presented for the evaluation of acute-on-chronic left upper extremity ulceration, soft tissue swelling, and pain. The patient was diagnosed with necrotizing soft tissue infection of the left upper extremity and underlying multibacillary lepromatous leprosy with Lucio's phenomenon. He underwent dermatofasciectomy of the affected extremity, followed by staged soft tissue coverage, including dermal allograft placement. Proper antibiotic management was also undertaken. In this article, we describe a case of previously undiagnosed leprosy with Lucio's phenomenon manifesting as necrotizing fasciitis of the upper extremity.

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One of the most severe upper extremity infections is necrotizing soft tissue infection (NSTI) or necrotizing fasciitis (NF). Necrotizing soft tissue infection is characterized by rapidly expanding tissue necrosis along the hypodermis plane of the skin and fascia.¹ Strong signs of NF, such as pain out of proportion, notable skin involvement, rapid progression of lesions, and hemodynamic instability, should lead to an elevated level of suspicion for the diagnosis of NSTI.^{1,2}

Necrotizing fasciitis is a true surgical emergency; when left untreated, it can lead to substantial mortality rates.³ Treatment involves a multimodal approach with aggressive fluid resuscitation, proper antibiotic therapy, and urgent surgical debridement.⁴ Adequate surgical management is accomplished by debriding all grossly infected and necrotic tissue.⁵ Classic findings include

“dishwater” fluid, friable necrotic fascia that is detached from the underlying muscle, subcutaneous blood vessel thrombosis, and liquefaction of subcutaneous fat. Moreover, it is usually relatively muscle sparing.⁶ Definitive diagnosis is determined at the time of surgical intervention with histologic examination of the resected tissue, demonstrating thrombosis obliterans of the perforating vessels and massive infiltration of polymorphonuclear cells.^{4,5}

Immunocompromised patients are more susceptible to NF, with diabetes mellitus, long-term corticosteroid treatment, intravenous drug abuse, and acquired immunodeficiency syndrome being the most frequently reported predisposing factors.⁵ However, fulminant superinfection of the upper extremity in the setting of leprosy has rarely been described in the literature.⁷ In our report, we present a rare case of upper extremity NF secondary to previously undiagnosed and untreated lepromatous leprosy with Lucio phenomenon, and we discuss the pertinent diagnostic algorithm and management.

Case Report

The patient was a 51-year-old man who presented for the evaluation of left upper extremity pain, edema, and skin ulceration

S.B. and E.W. contributed equally to this manuscript.

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for a week following a ground-level fall. On presentation, the patient reported chronic, progressively worsening ulceration over his bilateral lower and upper extremities, torso, and back for 6 years. He had been receiving topical wound care by his primary care physician with various degrees of success. No systemic symptoms were reported. He denied any past medical or surgical history. The patient stated that he immigrated to California from Southern Mexico when he was 15 years of age. The initial clinical examination revealed diffuse edema and serous drainage of the left upper extremity, with extensive skin lesions (Fig. 1). Other pertinent examination findings included alopecia of the eyebrows; nasal bridge collapse; hyperpigmented macules and patches in the bilateral lower extremities; and scattered ulcerations with crusting in the chest, abdomen, right hand, and bilateral lower extremities (Fig. 2).

The patient was febrile, hypotensive, with leukocytosis (white blood cells: 15.4 K/cumm), lactic acidosis, hyponatremia (sodium: 117 mmol/L), and elevated C-reactive protein level (234 mg/L). The Laboratory Risk Indicator for Necrotizing Fasciitis score for NSTI was 9. Left upper extremity plain radiographs demonstrated soft tissue swelling and subcutaneous gas, without evidence of osseous involvement (Fig. E1, available on the *Journal's* website at www.jhsgo.org). Broad-spectrum antibiotic treatment with piperacillin/tazobactam, clindamycin, and vancomycin was initiated. Given the morphology of the lesions and the patient's clinical course, the differential diagnosis included an infectious process, pyoderma gangrenosum, ulcerations due to skin picking, vasculitis versus vasculopathy, and less likely neutrophilic dermatoses or leprosy with Lucio's disease. A punch biopsy was performed and demonstrated epidermal ulceration with dense neutrophilic inflammation with group A *Streptococcus* extending past the dermis, suggestive of an acute infectious process. The patient remained hypotensive, despite adequate resuscitation and antibiotic treatment, with persistent skin lesions. Because of the persistent hemodynamic instability and biopsy and culture findings, we decided to proceed with urgent operative intervention.

In the operating room, a considerable amount of pus was noted in the volar forearm with extensive skin and soft tissue necrosis. On the volar aspect of the lesion, dishwasher fluid and easily dissectible fascial planes consistent with NF were encountered. Dorsally, the fascia was adherent to the muscle, consistent with a more chronic infectious process. Dermofasciectomy was performed and was extended proximally to the normal-appearing soft tissue (Fig. 3). Samples were sent for frozen sections and cultures. Pathology was positive for an acute necrotizing inflammatory process, with clean margins (Fig. 4A). Initial Gram staining demonstrated gram-positive cocci, with cultures returning positive for *Streptococcus pyogenes* the following day.

The Infectious Disease team updated treatment recommendations to clindamycin and ceftriaxone, based on culture sensitivities. On postoperative day 6, the patient was noted to have acute kidney injury. He also started developing additional skin lesions, including scrotal and penile edema with the ulceration of the foreskin, right knee hyperpigmented patches with new onset ulceration, and few erythematous, hypertrophic nodules on his right ankle. A number of services were consulted for the acute-on-chronic skin ulcerations with concomitant acute kidney injury, anemia, hypoalbuminemia, and hypocalcemia. Additional punch biopsies of the lesions demonstrated scar with sparse lymphoplasmacytic infiltrate, foamy macrophages, and rare acid-fast bacillus–positive forms consistent with Hansen's disease (Fig. 4 B, C). The patient was diagnosed with Hansen's disease with Lucio's phenomenon and was started on antimycobacterial treatment with rifampin, minocycline, clofazimine, and prednisone.

The patient's reconstruction was performed in a staged fashion, given the burden of disease and his poor nutritional status. After

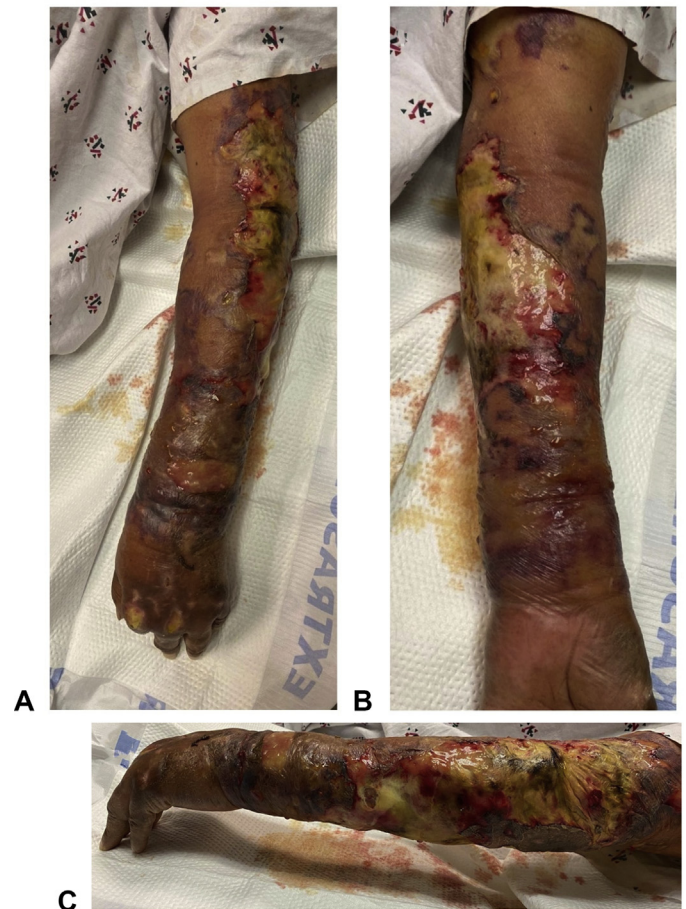


Figure 1. Initial clinical examination reveals diffuse, mildly tender edema and serous drainage of the left upper extremity, with dorsomedial and anterior ulceration, violaceous/purpuric rim, and surrounding retiform purpura from the distal arm to the midforearm. Hemorrhagic bullae are distributed throughout the lesion. Draining serous fluid is also present.

initial dermatofasciectomy, he underwent multiple irrigation and debridement procedures. Five weeks after the initial presentation, the patient was taken to the operating room for the placement of a meshed bilayer dermal allograft (Integra Life Sciences) over the entirety of the arm (approximately 1,000 cm²) (Fig. 5 A, B). Three weeks later, he underwent allograft removal, debridement, and wound coverage with split thickness skin grafting at the proximal arm from an anteromedial thigh donor site and forearm/hand grafting from a back donor site. The grafts were meshed in a 2:1 fashion (Fig. 5C). The patient continued hand therapy after his discharge from the hospital. At 1 year after surgery, the patient's grafts were well healed, with approximately 90% graft take (Fig. 6). There was a region noted over the olecranon with wound breakdown; a rotational flexor carpi ulnaris flap was recommended to the patient, but he chose to continue with daily at-home wound care. The patient was able to achieve full and painless range of motion of his shoulder, elbow, and wrist and complete return of function of his affected extremity. At his 22-month telemedicine follow-up visit, his visual analog scale score was 0/10 and Disabilities of the Arm, Shoulder and Hand score was 2.3.

Discussion

In this case report, we present a patient with NF of the upper extremity in the setting of underlying leprosy. The connection

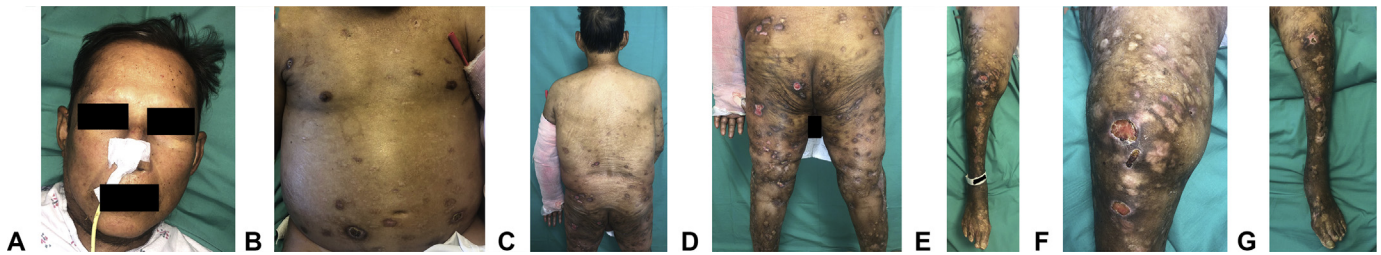


Figure 2. Patient presents with additional clinical findings that are suggestive of a systemic disorder. This includes **A** alopecia of the eyebrows and nasal bridge collapse; **B, C** multiple scattered ulcerations with crusting in the chest, abdomen, and back; and **D–G** hyperpigmented macules and patches in the bilateral lower extremities.



Figure 3. Left upper extremity status after dermofasciectomy and extensive debridement extending proximally to the shoulder to normal-appearing skin and soft tissue.

between NSTI and systemic conditions that predispose the host to immunosuppression, such as diabetes mellitus, corticosteroid treatment, intravenous drug abuse, and HIV infection is well established in the literature.³ However, NF associated with leprosy has rarely been reported. Teng et al⁷ recently described a case of NF of the right hand and forearm in the setting of marked hypoesthesia as a complication of leprosy.⁷ In their study, the authors attempt to elucidate the challenge in diagnosing NSTI in patients with underlying hypoesthesia. They discuss how decreased sensation can mask some of the most common clinical features of NF, and they recommend the use of the Laboratory Risk Indicator for Necrotizing Fasciitis score in such cases to ensure early diagnosis. The index patient had a known history of leprosy, cured 20 years prior to presentation. Leprosy in this report was only relevant as a

component of the patient's past medical history to explain his compromised sensation and not as an undiagnosed, concomitant, active skin condition that could pose a diagnostic dilemma and complicate management.

In contrast, in our study, previously undiagnosed and untreated active lepromatous leprosy with superimposed NF of the upper extremity is discussed. Our patient presented with left upper extremity pain, skin ulceration/necrosis, and hemodynamic instability. At the time of presentation, he was also noted to have diffuse, chronic, progressively worsening ulceration, as well as alopecia of the eyebrows and nasal bridge collapse. His left upper extremity clinical picture was suggestive of NSTI; however, his acute-on-chronic skin ulcerations with concomitant acute kidney injury, anemia, hypoalbuminemia, and hypocalcemia could not be

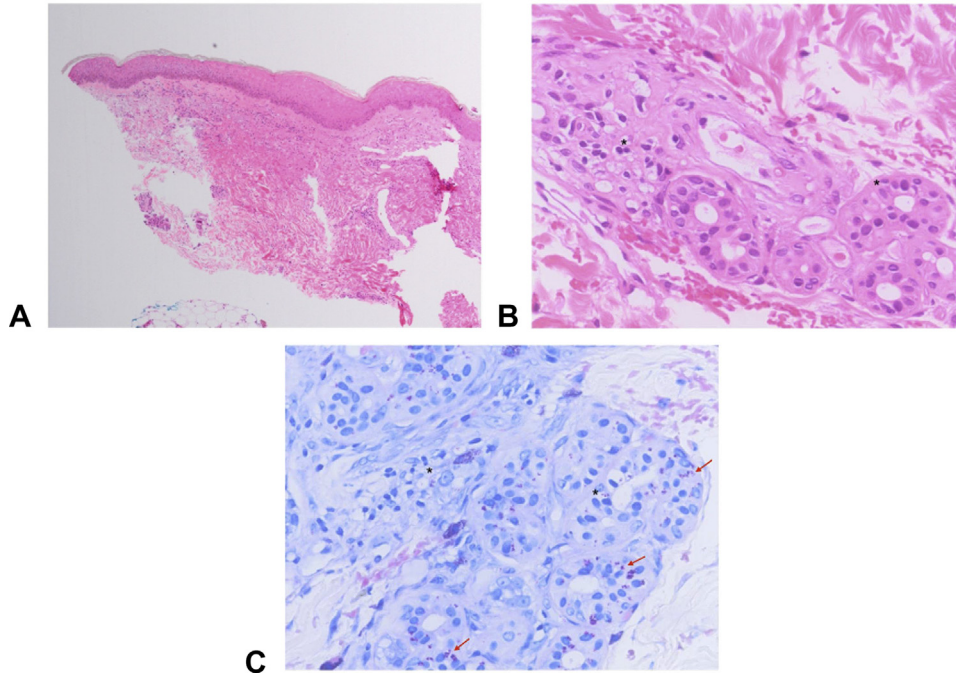


Figure 4. Samples of the debrided tissue and punch biopsies were sent to pathology for histologic evaluation. Histology demonstrates a necrotizing inflammatory process. **A** Skin histology viewed on low power. **B** Skin adnexa with histiocytes with bubbly-clear cytoplasm. **C** Acid-fast bacilli are noted within the histiocytes. The histiocytes are noted with an asterisk (*). Intracellular acid-fast bacilli are noted with a red arrow.



Figure 5. Left upper extremity coverage following repeated surgical debridement procedures. **A, B** Allograft placement over left upper extremity, followed by **C** split thickness skin grafting 3 weeks later.

explained by NSTI alone. Thus, we suspected a dual pathology for his manifestations, which prompted further investigation to exclude usual causative agents. Multiple services were involved in

this patient’s care. Psychiatry ruled out skin picking, trichotillomania, or anxiety-related behavior. Vasculitis was also considered unlikely, given the chronicity of dermatologic symptoms and punch



Figure 6. A–C Patient at the 1-year follow-up evaluation after skin grafting. The patient's grafts are well healed, with approximately 90% graft take. A region of wound breakdown is noted over the olecranon; the patient has been offered a flexor carpi ulnaris rotational flap and repeat skin grafting but has chosen to proceed with wound care only.

biopsy findings. Additional punch biopsies of bilateral upper extremities and the right lower extremity demonstrated scar with sparse lymphoplasmacytic infiltrate, foamy macrophages, and rare acid-fast bacillus–positive forms consistent with Hansen's disease. Thus, the patient was diagnosed with NF of the left upper extremity in the setting of previously undiagnosed leprosy with Lucio phenomenon.

Individuals with leprosy have variable clinical presentations. Patients with robust T-cell–mediated immunity against *Mycobacterium leprae* are predisposed to the polar tuberculoid type, and those with ineffective immune responses are predisposed to the lepromatous type. Lucio's phenomenon is a rare manifestation of untreated diffuse lepromatous leprosy.⁸ The disease is seen almost exclusively in Mexico and Central America, although rare cases have also been reported in other countries.⁹ Similarly, our patient had a history of immigrating to the United States from Mexico 35 years prior.

Lucio's leprosy is considered a reactionary type of phenomenon and is seen particularly in those infected with the strain *M lepromatous*.⁹ Although its exact pathogenesis remains unclear, it seems to involve uninhibited multiplication of bacilli leading to diffuse infiltration of the dermis in an immunocompromised host.^{7,8,10} Other authors have hypothesized that Lucio's is a hypersensitivity reaction to high titers of circulating antigens resulting from a synergistic reaction between *M leprae* and gram-positive or gram-negative cocci causing superimposed skin infections.¹¹ Lucio's leprosy has also been compared with vasculopathies, with obstructive microthromboembolism and presence of antiphospholipid glycolipid IgM antibodies and immune complexes in blood vessels of the skin and/or other organs.¹⁰

The treatment for Lucio's phenomenon comprises antileprosy antibiotics, often including rifampicin, corticosteroids to control the massive immune reaction to *M leprae* antigens, and sometimes thalidomide and clofazimine.⁷ Despite aggressive management, mortality has been reported. Mortality is most commonly associated with superimposed infection and subsequent sepsis because of the presence of a compromised skin barrier, poor overall nutritional status, and delay in diagnosis or misdiagnosis.¹⁰ In our case, the patient was managed with multiple surgical debridement procedures followed by soft tissue coverage for his left upper extremity NF. For the Lucio's phenomenon itself, the patient was treated with rifampin, minocycline, clofazimine, and prednisone. Prednisone was discontinued 2 months following the diagnosis of leprosy. The patient is still actively being treated with rifampin, minocycline, and clofazimine as per the leprosy clinic

recommendations (22 months to date). Supportive measures, including high protein diet, frequent wound dressings, and hand therapy, have also been undertaken.

Although rare, leprosy can present in unique ways to the practicing hand surgeon. Diagnosis and treatment can be challenging, often requiring a multidisciplinary team of providers. Early diagnosis of Lucio's phenomenon and identification of severe superimposed infections are critical, as they can improve the outcome. It is imperative that life-threatening and limb-threatening complications should be addressed early. For suspected superimposed necrotizing soft tissue upper extremity infections, the threshold for surgical intervention should be low. Complications of delayed or inappropriate treatment can lead to compromised extremity function, loss of limb, or even death. This case report describes the work-up and management of a rare case of upper extremity NSTI secondary to untreated Lucio's leprosy.

Statement of Informed Consent

Consent was obtained from the patient for acquisition of clinical pictures and pathology slides prior to publication.

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