Necrotizing Fasciitis of Lower Extremity Caused by *Haemophilus influenzae* in a Healthy Adult With a Closed Lisfranc Injury

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Abstract

Necrotizing fasciitis is a rare bacterial infection with an incidence of approximately 0.4 cases per 100,000 population. Although the majority of cases of necrotizing fasciitis are polymicrobial, a systematic review of the literature found only 7 reports of *Haemophilus influenzae* as the causal agent, and only 1 incidence of *H influenzae* causing the infection in a healthy adult.

This report documents the unusual case of necrotizing fasciitis in a healthy adult with a history of smoking as her only risk factor. The patient presented with a seemingly innocuous low-grade Lisfranc injury. Our case illustrates the importance of early diagnosis and aggressive surgical management and medical treatment of necrotizing fasciitis.

Necrotizing fasciitis is a rare bacterial infection with an incidence of approximately 0.4 cases per 100,000 population.[1] A predisposition to it can be augmented by alcohol abuse, liver disease, intravenous (IV) drug use, obesity, or an immunocompromised state.[2-4] Typically, the bacteria is contracted as a result of a cut or scrape that becomes infected with a member of the *Streptococcus* family.

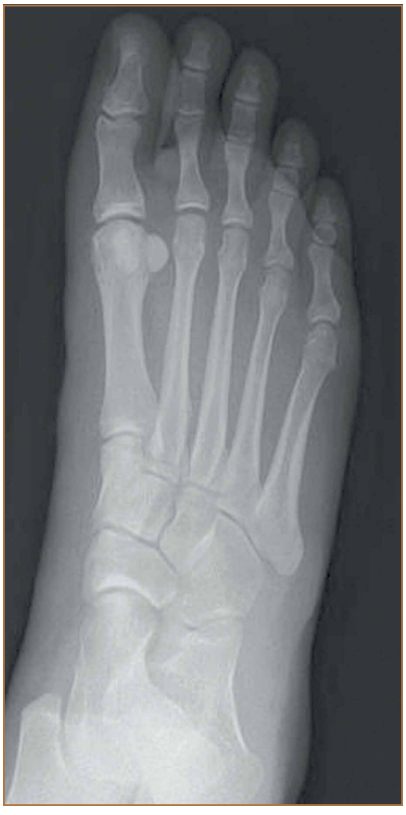
Although the vast majority of cases of necrotizing fasciitis are polymicrobial, a systematic review of the literature revealed only 7 reports of *H influenzae* as the causal agent,[5-11] and only 1 incidence of *H influenzae* causing the infection in a healthy adult.[7]

The patient provided written informed consent for print and electronic publication of this case report.

Case Report

A 35-year-old woman presented to our orthopedic practice because of continuing pain in her right foot and ankle that resulted from tripping and falling on steps 3 days prior to presentation. On examination, she was noted to have substantial dorsal soft-tissue swelling and early fracture blister formation; there was no break in the skin, evidence of compartment syndrome, or puncture wound. Radiographs revealed a barely perceptible Lisfranc fracture with no diastasis between the first and second metatarsal bases, and a short leg non–weight-bearing padded splint was provided for stability and edema control (**Figure 1**). Aside from smoking daily, the patient was healthy with no history of diabetes or immune suppression.

Figure 1. Oblique radiograph of the non–weight-bearing foot shows a subtle lateral second metatarsal base fracture.



Eight days after injury and 5 days after her initial visit to our practice, the patient returned afebrile with increasing pain, loss of appetite, and substantial fracture blisters over the dorsal area of the foot that extended to the lateral leg (**Figure 2**). Mild erythema extended to the level of midcalf, and distal leg, ankle and foot swelling was apparent. Further examination revealed malodorous draining abscesses consistent with deeper infection at the medial and dorsolateral foot, lateral ankle, and leg region. The patient was immediately admitted to the hospital to undergo extensive debridement of the afflicted area under general anesthesia. During initial excisional debridement, the

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presence of necrotic fascia and a tremendous loss of subcutaneous tissue confirmed the diagnosis of necrotizing fasciitis; after samples were cultured, IV vancomycin was given. A dorsolateral ankle arthrotomy was performed to ascertain that the ankle was free of infection. Lateral leg and medial, lateral, and dorsal foot fasciotomies revealed no muscle necrosis. Postoperatively, the patient was admitted to the intensive care unit. Intravenous cefepime, clindamycin, and imipenem/cilastatin were given to provide a broader spectrum of antibiotic coverage.

Initial laboratory assessment yielded the following results: white blood cell count (13.8×10^9/L), 84.9% neutrophils (11.7×10^9/L), 10.7% lymphocytes (1.5×10^9/L), 3.5% monocytes (0.5×10^9/L), 0.4% eosinophils (0.1×10^9/L), 0.5% basophils (0.1×10^9/L); erythrocyte sedimentation rate, 100 mm/hr; C-reactive protein level, 19.7 mg/L; and albumin, 2.2 g/dL. A test for the human immunodeficiency virus was negative. The culture report included heavy growth of β-lactamase–negative *H influenza* sensitive to ampicillin; serotype was not obtained. Antibiotics were changed to ampicillin and sulbactam based on the organism's susceptibility.

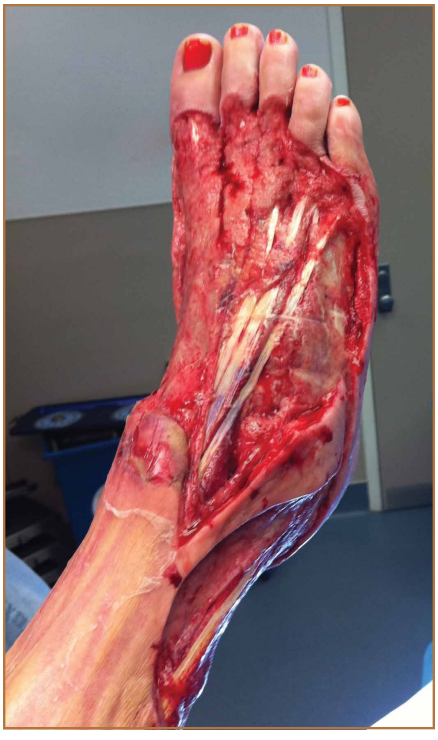

Figure 3. The right foot after 5 debridements for severe necrotizing fasciitis shows extensive loss of skin and fascia from the distal leg to the dorsal toes.

The patient underwent 4 more debridement procedures during which skin and fascia were excised from the interdigital spaces to the posterior lateral ankle and Achilles tendon to control the infection (**Figure 3**). While this effectively controlled the spread of the disease, it also left numerous complex wounds. The 2 largest wounds measured 18 cm long × 12.5 cm wide on the anterior foot and ankle, and 15 cm long × 8 cm wide on the lateral aspect of the posterior ankle. Ten days after the first debridement procedure, skin grafts harvested from the left and the right thighs were applied to these areas after being meshed with a 1.5:1 grid expander. All graft and wound sites healed without complication. Intravenous antibiotics (ampicillin/sulbactam) were administered for 3 weeks and then changed to amoxicillin/clavulanate orally for 1 additional week.

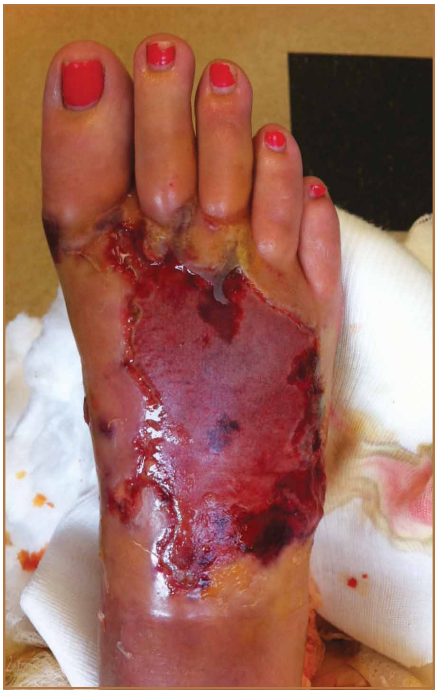

Figure 2. The right foot 8 days after low-grade Lisfranc injury shows swelling, ecchymosis, and blister formation.

Eighteen months after the initial surgery, there was no recurrence of infection (**Figure 4**). The patient reported decreased dorsal foot sensation and pain consistent with sural and superficial peroneal neuromas. Examination confirmed decreased sensation at the sural, superficial peroneal, deep peroneal, and saphenous nerves. Percussion of the sural and superficial peroneal nerves produced pain and paresthesias. The midfoot was stable and nontender with normal alignment. Weightbearing radiographs of the foot confirmed normal midfoot alignment without arthritic changes.

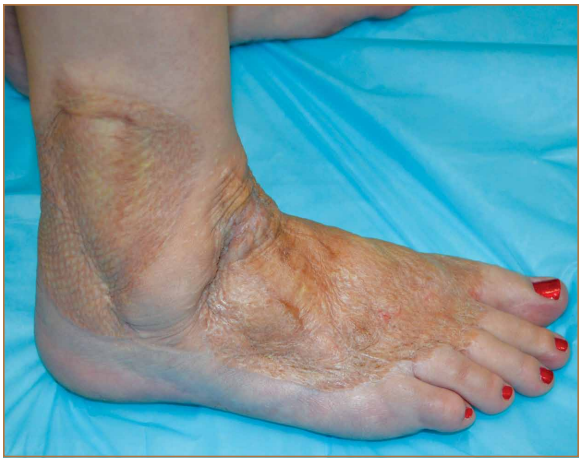

Figure 4. Clinical photograph of right foot 18 months after successful split thickness skin graft.

Discussion

Necrotizing fasciitis is an uncommon, rapidly spreading bacterial infection that causes extensive necrosis of subcutaneous tissues and deep fascia while leaving underlying muscles unaffected.[2] Our case is entirely consistent with these classic findings. Excessive pain disproportionate to the apparent injury is a key indication of the infection, as is swelling, borderless erythema

Table. **Documented Cases of *H influenzae* Causing Necrotizing Fasciitis**

Author	Age of Patient	Initial Site of Infection	Amputation	Length of Hospital Stay	Death	*H influenzae* Type/ Encapsulation
Kotrappa et al[3]	13 mo	Right foot	No	Minimum 17 d	No	Serotype b
Heath et al[15]	45 y	Right buttock	No	Minimum 31 d	No	Unencapsulated
Saito et al[10]	65 y	Left thigh	Above the knee	14 hr	Yes	Serotype f
Gurlek et al[13]	81 y	Lower left leg	No	135 d	No	Serotype b
Kaul et al[1]	52 y	Right foot	No	4 d	Yes	Encapsulated
Robinson et al[9]	44 y	Right buttock	No	47 d before final skin graft	No	Serotype b
Childers et al[12]	17 y	Right forearm and thigh	No	20 hr	Yes	Serotype e
Present case	35 y	Right foot	No	30 d	No	N/A

Abbreviations: d, days; hr, hours; mo, months; N/A, not available; y, years.

with smooth, shiny skin, and blister or bullae formation.[2,4]

A 14-year study published in 2002 of 163 patients specified several factors that contribute to the morbidity rate of necrotizing fasciitis.[12] These included age (< 1 year old or > 60 years old), history of drug or alcohol abuse, comorbid conditions (eg, renal or liver disease, diabetes mellitus, immune suppression, cancer), smoking, and obesity.[4,12] Our patient had a family history remarkably free of medical affliction and had no major ailments herself, but she smoked. In the study, 58% of patients diagnosed with necrotizing fasciitis were smokers.[12]

Prompt, aggressive, and radical operative debridement of the infected area is essential to improved survivability rates.[2,3,4,12] This is a widely accepted treatment in the medical community.[2-4,12] Our case demonstrates the need for emergent surgical debridement of all necrotic tissue, repeat surgical debridement, antibiotic therapy, and the strategic use of internal medicine, infectious disease, and plastic surgery consultants.

Although the large majority of necrotizing fasciitis cases appear in patients who have sustained a degree of antecedent trauma involving an open wound, the condition can appear in persons without prior injury or surgery.[12] When there is no prior trauma, the bacterial infection is often associated with diabetes mellitus,[13] but our patient did not have this condition. Although there is at least 1 documented case in which necrotizing fasciitis occurred after a closed foot injury with an associated blister,[5] the circumstances of our patient developing necrotizing fasciitis from a closed Lisfranc fracture remains highly anomalous. It is likely that the fracture blister was the portal for infection in our case.

As a result of the widespread implementation of the *H influenzae* serotype b (Hib) vaccine in 1990, *H influenzae* has been nearly eliminated in the United States. In 2008, the Centers for Disease Control and Prevention estimated the number of afflicted individuals to be less than 1 per 100,000 citizens.[14] If children are not vaccinated, the organism lives largely unnoticed in the nose and the throat, even in healthy individuals. However, Hib remains the primary source of meningitis in children and is often seen in patients with pneumonia.[15] It is unusual to see the disease in persons older than age 5 years,[16] but our 35-year-old patient acquired it, perhaps as a result of her growing up prior to the era of the Hib vaccine (**Table**).

Conclusion

This report documents the unusual case of necrotizing fasciitis in a healthy adult with a history of smoking as her only risk factor. The patient presented with a seemingly innocuous low-grade Lisfranc injury. Although *H influenza* is a rare cause of necrotizing fasciitis, 3 of 7 cases reported in the medical literature were lethal. Our case illustrates the importance of early diagnosis and aggressive surgical management and medical treatment of necrotizing fasciitis.

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