H187 Fatal Clostridial Necrotizing Fasciitis Resulting From Skin Popping in Heroin Abusers

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Learning Overview: After attending this presentation, attendees will gain a basic understanding of the production techniques of Black Tar Heroin (BTH) and its potential for bacterial contamination, examine the clinical presentation and autopsy findings of three cases of clostridial necrotizing fasciitis, and evaluate the pathophysiology of and risk factors associated with Necrotizing Soft Tissue Infections (NSTIs) in Injecting Drug Users (IDU) of heroin.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by illustrating the relative predominance of clostridial species in necrotizing fasciitis associated with subcutaneous or intramuscular injection of BTH. The relative prevalence of spore-forming bacteria in IDU-related NSTIs has been reported, but accounts of postmortem examination and pathologic findings in the forensic literature are sparse.

BTH has been the predominant form of heroin in the United States west of the Mississippi River since the 1980s. The initial production of BTH from opium requires boiling at temperatures of 150ºC in acidic conditions, likely destroying any clostridial spores that may be present. Given this fact, contamination with bacterial species or spores most likely occurs via the addition of adulterants or during transport. Of note, during preparation for injection by the user, dissolution of heroin in an acidic solvent and heating to near-boiling temperatures effectively kills most bacteria, but these methods are ineffective at neutralizing clostridial spores.

Three adult individuals with histories of Intravenous Drug Abuse (IVDA) each presented to the hospital with severe soft tissue infections of their extremities secondary to skin popping of BTH. The nidus of infection in two cases was the shoulder, while that of the third case was the right thigh. Each individual was given intravenous antibiotic therapy and underwent surgical debridement of their wounds. One individual arrested mid-procedure and expired; the other two individuals succumbed to hypotensive shock less than 24 hours after surgery. Antemortem blood and tissue cultures of two cases grew *Clostridium sordellii*; the third case grew two species of Clostridium, not *C. perfringens*, which were unable to be further classified. Autopsy findings of all cases included at least one abscess of the extremity with surrounding erythema. Histologically, the lesions exhibited edema, acute inflammation, and necrosis of the skin, soft tissue, and muscle. Death in each case was attributed to *Clostridium sordellii* sepsis or necrotizing fasciitis and sepsis.

The major risk factor associated with the development of soft tissue infections caused by anaerobic spore-forming bacteria is skin popping. This leads to inflammation and devitalization of tissue, while also circumventing the bloodborne immune system that may otherwise thwart infection. Simultaneous injection of heroin with a vasoconstrictor such as cocaine generates tissue ischemia. All these factors promote anaerobic conditions for spore germination and toxin production.

Necrotizing fasciitis due to BTH injection appears to be primarily a clostridial disease, whereas the more typical pathogens are *Staphyloccocus aureus* and *Streptococcus pyogenes*. *Clostridium sordellii* is among the most commonly isolated, in addition to *C. perfringens* and *C. novyi*. *C. sordellii* produces two cytotoxins that cause severe soft tissue edema, often without gas or purulence, marked leukocytosis, and rapidly fatal hypotensive shock. Interestingly, it has been isolated from BTH samples in prior studies.

Clostridial infection should be considered in an individual with a history of chronic narcotism and evidence of intramuscular or subcutaneous injection of heroin, the main risk factor associated with this disease. It should be noted that the region of inflammation may be subtle yet still cause death by a toxin-mediated illness. Care must be taken not to misdiagnose such a case as acute overdose if elevated drug concentrations are present. Postmortem cultures may not yield results due to the fastidious nature of certain anaerobic organisms, or they may be non-contributory due to prior antibiotic therapy during hospitalization. Therefore, correlation with antemortem blood or tissue cultures is imperative.

While there are many articles in the clinical literature on the subject of IDU-related clostridial soft tissue infections, a review of the forensic literature showed only one study which discussed necrotizing fasciitis due to spore-forming clostridial agents in connection with BTH. This presents three further cases of a rare but significant association between clostridium species and soft tissue infections in injecting heroin abusers.

Heroin, Clostridium, Necrotizing Fasciitis