The Treatment of a Gangrenous Leg

To the Editor—Several of us have served in the military, and the recent cover of *Clinical Infectious Diseases* (The Treatment of a Gangrenous Leg, woodcut, 16th century) [1] intrigued us. We wondered how much aggressive surgical debridement and effective antibiotic regimens have improved survival of patients with gas gangrene since that time?

Clostridial myonecrosis (gas gangrene), a monomicrobial type of necrotizing fasciitis, progresses rapidly and can be a potentially fatal infection due to *Clostridium perfringens* (80% of cases), *Clostridium novyi* (40%), *Clostridium septicum* (20%), *Clostridium histolyticum*, *Clostridium bifermantans*, or *Clostridium fallax* [2].
Penetrating trauma or crush injuries predispose to infection—a true emergency requiring urgent debridement, as well as antibiotics that inhibit toxin production.

Historically, Hippocrates advocated amputation of gangrenous limbs. Gas gangrene has appeared during war. During the US Civil War (1861–1865), the devastating effects of 58-caliber miniballs made amputations the operation of choice. This war had an overall mortality of up to 60% for soldiers with gangrene [3]. An 1863 study by Goldsmith [4] in 330 patients with gangrene showed that antisepsis with topical bromide reduced mortality to 2.6%. The most common pitfalls in treatment include diagnostic delay and inadequacy of surgical debridement (from French, meaning to remove a constraint). Henri Le Dran in the 1700s first used this term to refer to an incision to promote drainage and relieve tension. Before World War I, wound care consisted of minimal exploration and use of antiseptic-suboptimal treatment for gas gangrene, which requires prompt wide debridement. Delay of surgery for >12 hours results in higher overall morbidity [5].

During World War I (1914–1918), the Belgian surgeon Antoine Depage reintroduced debridement and combined it with excision of devitalized tissue [6]. US surgeons during this war also adopted the practice of debridement and delayed primary closure. From World War I to World War II (1939–1945), mortality rates from gangrene decreased from 28% to 15%, respectively. In the Vietnam conflict, between 1966 and 1967, among 17,726 wounded American soldiers, none developed gangrene [6] due to rapid evacuation from the battlefield to a base hospital.

Altemeier and Fullen [7] analyzed 54 cases of gas gangrene. Primary treatment consisted of surgical decompression or amputation. Adjunctive treatment included intravenous penicillin G and tetracycline. This resulted in a mortality rate of 14.8%.

Other therapies for gangrene include the combination of penicillin G and clindamycin, which covers clostridia [8]. In addition, hyperbaric oxygen inhibits clostridial growth and arrests α-toxin production. Gas gangrene with bacteremia has a mortality rate >50%.

The National Surgical Quality Improvement Program participant use files defined risk factors for mortality in patients with necrotizing soft-tissue infections; 1392 such cases were found between 2005 and 2010, with a 30-day mortality of 13%. Seven independent variables correlated with mortality [9].

**Note**

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