

# Life-threatening Necrotizing Fasciitis Due to ‘Bath Salts’ Injection

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## abstract

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Necrotizing fasciitis is an orthopedic emergency. The ability to quickly and accurately diagnose this rapidly spreading disease can save a patient’s life and limb. However, the diagnosis is complex because necrotizing fasciitis usually manifests as a less severe cellulitis or abscess while the majority of the damages rage beneath the surface of the skin. Although the diagnosis is not new, the potential causes and vectors continually change. This article reports a new source of necrotizing fasciitis in an intramuscular injection of “bath salts,” a rapidly emerging street drug that is legal in some states and evades authorities with its innocuous name.

The patient presented 2 days after injection of bath salts with extensive cellulitis extending to the mid portion of her upper arm. The cellulitis initially responded to broad-spectrum intravenous antibiotics, but rapidly deteriorated 48 hours later, leading to a forequarter amputation with radical mastectomy and chest wall debridement to obtain healthy tissue margins and control the disease. The patient made a full recovery after further minor debridements, negative pressure dressings, directed antibiotic therapy, and skin grafting.

The recent emerging popularity of this highly obtainable, injectable substance may lead to an increase in cases of necrotizing fasciitis. Orthopedic surgeons should be vigilant in diagnosing this process early and should perform an extensive debridement.



Figure: Photograph after debridement.

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The term necrotizing fasciitis originates from a report by Wilson<sup>1</sup> in 1952. However, what we know now as necrotizing fasciitis was described initially by Hippocrates as early as the fifth century BC. The term was repopularized by Confederate Army surgeon Joseph Jones as “hospital gangrene.” In 1924, Meleney again renamed it “hemolytic streptococcal gangrene.”<sup>2</sup> Despite the changes in nomenclature, the disease known as necrotizing fasciitis is the same spectrum of infections, ranging from superficial cellulitis to rapidly spreading myonecrosis. The pathogenesis of the disease has remained constant over time. This article describes a form of necrotizing fasciitis, a rapidly progressing streptococcal myositis, originating from an intramuscular injection of “bath salts.”

Bath salts, or synthetic cathinones, have gained increasing worldwide popularity in the past few years.<sup>3</sup> Despite its name, bath salts have no legitimate use for bathing and are intended only for substance abuse. Its recent popularity, initiating in Western Europe in 2009, has alarmed both authorities and health care providers with its rapid emergence.<sup>4</sup> The first cases of bath salts intoxication were reported in August 2010 in Louisiana (n=1) and Kentucky (n=1).<sup>3</sup> These intoxications create a deep paranoia and recurrent delusions in users.<sup>5</sup> More cases have followed over the past 2 years. Unlike common illicit drugs such as cocaine, heroin, lysergic acid diethylamide, phencyclidine, and ecstasy, the dangers of bath salts are unknown and only beginning to emerge. At least 16 states so far this year have placed emergency bans on the products, which are marketed under false pretenses to evade authorities.<sup>3</sup>

However, as the drug’s use evolves from an oral, smokable, and snortable form to an injectable version, communities need to become aware of the implications of an increase in injectable illicit substances.<sup>5</sup> Studies in the past outlined the dangers of dirty needle use from illegal substances ranging from anabolic steroids to heroin.<sup>3,6</sup> Injection risks range from local pain

and swelling to peripheral nerve palsies. However, the most severe consequence is necrotizing fasciitis infection, which can initially appear innocuous but later manifest as a severe infection, culminating frequently in loss of limb and even death.<sup>7</sup>

The diagnosis of necrotizing infections of both muscle and subcutaneous tissue can be difficult and time sensitive. The only effective treatment is extensive debridement with intravenous antibiotics to prevent loss of life and limb. This article reports the danger of injecting bath salts intramuscularly and the difficult subsequent diagnosis and treatment.

### CASE REPORT

A 34-year-old woman presented with a 2-day history of increasing right forearm pain and erythema. She reported the redness and pain began the morning after a party. She reported no subjective fever or chills and had no documented temperatures >100.4°F. She was hemodynamically stable and well appearing with an anxious affect. She reported no symptoms other than her right arm complaints. Her erythema extended from the middle of her upper arm to her metacarpophalangeal joints. She had mild swelling compared with the contralateral extremity, and no crepitus was palpable. She was able to move her shoulder, elbow, and wrist with moderate pain. She had 1 small red puncture wound that she later admitted was a needle stick. She had no neurovascular deficits, and initial radiographs revealed no fracture, dislocation, or apparent gas or foreign body. The areas of erythema were marked with a sterile skin marker, and she was started on broad-spectrum intravenous (IV) antibiotics for cellulitis.

The next morning, the patient’s erythema had receded to approximately 50% of the previous physical examination and markings. The patient reported mild resolution of pain. On further questioning, she reported injecting bath salts 2 nights prior to developing symptoms. She also reported the injection was intramuscular



Figure 1: Patient at time of operative incision.

because she could not obtain intravascular access. The patient initially denied illicit drug use, but then reported cocaine, opiate, and benzodiazepine use in addition to the recent bath salts injection.

The patient remained on broad-spectrum IV antibiotics with close monitoring. She continued to be afebrile with no tachycardia. Her white blood cell count was 17.9, her erythrocyte sedimentation rate was 125, and her C-reactive protein count was 20. All other laboratory values were within normal limits. She tested positive for cocaine, opiates, and benzodiazepines prior to iatrogenic administration of those medications.

The following morning, the erythema only surrounded the needle injection site. However, the patient reported pain at the site of the injection, so an ultrasound was ordered to delineate any nonradiopaque foreign bodies and the presence of fluid or gas.

Hours later, when the patient was re-examined, she was found to have progressive erythema that had developed past the earlier skin markings and an area of skin sloughing around the injection site with a malodorous drainage. The diagnosis of a fast-spreading infection, such as necrotizing fasciitis, was assumed, and the patient immediately underwent emergent surgical debridement and exploration. She was placed on penicillin G and clindamycin for antibiotic coverage (Figure 1).

By the time surgery began, the erythema had spread farther proximally, and bullae were beginning to form at the injection mark on the dorsal forearm. An inci-

sion was made over the dorsal forearm in the Thompson approach. A large amount of pink, thin, purulent fluid was expressed with a foul odor. As the debridement continued, a large area of dark, noncontractile muscle surrounding the area of injection was present. After full dissection of the forearm, 30% of the skin and subcutaneous tissue remained viable, along with the contents of the volar forearm (Figure 2).

No clear margins proximally of healthy muscle were available, so an incision was made in the anterolateral approach to the shoulder. In the time it took to expose the anterior upper arm, muscle in the forearm that had previously been contractile and pink had turned dusky and noncontractile. We disarticulated the shoulder to obtain clear margins of the disease to prevent disease progression. The general surgery team was placed on standby to aid with further chest wall and neck debridement as indicated, and massive blood transfusion protocols were instituted.

To prevent the spread of disease and obtain healthy viable tissue, a complete forequarter amputation was performed, removing both scapula and clavicle while debriding all noncontractile, unhealthy muscle. The general surgery team also elected to perform a right radical mastectomy and further chest wall debridement to prevent further progression of the disease. All bleeding vessels were ligated, and we obtained disease-free tissue throughout the wound bed. Sterile dressings were applied, and the patient was transferred to the intensive care unit for monitoring (Figure 3).

Bacterial isolates included alpha-hemolytic *Streptococcus*, *Streptococcus viridans*, *Peptostreptococcus micros*, *Gemella morbillorum*, and *Actinomyces odontolyticus*. Recent studies indicated that 82% of these infections were polymicrobial, with the most common organisms including Gram-negative enteric bacilli, enterococci, staphylococcal, and streptococcal species.<sup>8</sup>

The patient underwent further debridement and negative pressure dress-



Figure 2: Photograph during forearm debridement.

ing changes in the following days and remained disease free, afebrile, and hemodynamically stable. She then underwent extensive split-thickness skin grafting after healthy granulatory tissue covered the expanse of the wound. She is currently undergoing rehabilitation and is in excellent health (Figure 4).

#### DISCUSSION

As bath salts gain popularity, medical centers of all disciplines must be prepared to identify the signs of intoxication while treating the potential side effects.<sup>3</sup> The associated trauma brought on by the drugs' psychogenic effects may lead patients to orthopedic surgeons through more common routes.

In addition to the effects of the drug, injecting these illicit substances can cause a rare, often-fatal infection. Past reports linked the injection of illicit drugs, including anabolic steroids, with similar devastating clostridial myonecrosis.<sup>6</sup> These infections are usually associated with crush traumas and farm injuries, but now one must also be prepared and vigilant when presented with a cellulitic patient who has a history of needle use. Even patients with their own clean needles are not immune, as evident in a report of an asthmatic patient developed necrotizing fasciitis from an injection of subcutaneous epinephrine.<sup>9</sup>

The key to treatment in this population is early recognition and immediate extensive surgical debridement coupled with penicillin G and clindamycin IV antibiot-



Figure 3: Photograph after debridement.



Figure 4: Photograph after skin grafting.

ics. The diagnosis may be delayed due to the nature of the disease. According to a 1995 study of 65 patients, initial symptoms included fever in 60% of patients, skin blebs or bullae in 38% of patients, and minor pain in 27% of patients at presentation.<sup>8</sup>

Deep muscular necrosis is often masked by a nonerythematous overlying tissue bed, and surgical intervention is often delayed after hospital admission. Vigilant monitoring of patients with cellulitis who present with a history of needle use with a low threshold to an extensive debridement is the only means for treatment to cure the patient. One study noted an average time to operative procedure after admission of 45 hours (range, 1.7-312 hours), with the average time to surgery for survivors being 25 hours, whereas nonsurvivors had an average time to surgery of 90 hours.<sup>8</sup>

Necrotizing fasciitis has a rapid timeline to tissue destruction and loss of life. A 1995 study found the survival rate of those diagnosed with necrotizing fasciitis to be as low as 50% (range, 6%-76%). However, wide ranges of mortality exist depending on a multitude of factors.<sup>8</sup> Therefore, the treating orthopedic surgeon must be able to perform a full, extensive debridement

in extreme cases, in which a forequarter amputation may be indicated to prevent delay in treatment and infection progression and, ultimately, death. A similar extensive debridement was documented in a report by Brzozowski and Ross,<sup>10</sup> in which a rapidly progressing *Escherichia coli* forearm infection was treated by forequarter amputation to save a patient's life before the patient succumbed to the disease.

To our knowledge, our article is the first to report streptococcal necrotizing fasciitis and myonecrosis from intramuscular injection of bath salts, which are currently only banned in some US states. Despite the drug's legal status, it must be treated as illicit, and one must be suspicious when examining a patient with this clinical history because the diagnosis of flesh-eating bacteria can masquerade as abscesses and cellulitis.<sup>7</sup> Treatment for this virulent disease remains a swift diagnosis with extensive surgical debridement to obtain complete control of the organism and prevent death. However, the best treatment is prevention with public, street-based education and early detection.

A large retrospective study performed in California between 1984 and 1999 showed a sharp increase in necrotizing fasciitis between 1994 and 1999 in conjunction with the rise in popularity of the intravenous drug black tar heroin.<sup>11</sup> Hopefully, this rise in popularity of bath salts does not preclude a similar rise in necrotizing fasciitis, but surgeons must be ready to diagnose and perform extensive debridements in association with general surgeons in some instances to obtain limb salvage and function and prevent death. ©

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