

Frostbite in Homeless Patient: Case Report and Review

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Frostbite is a common problem most frequently encountered in homeless patients who are stranded outside in the winter. There are many factors that may limit a patient's ability to respond to the stress of the cold including mental illness, malnutrition, alcohol abuse and drug abuse. Given the potential complications associated with misdiagnosis and mistreatment, frostbite, along with homelessness, substance abuse and mental illness, are important subjects for students, residents, and clinicians alike.

In this case report we discuss how a homeless patient with superficial frostbite resulted in deep frostbite, gangrene and amputation.

Key words: frostbite, homeless, gangrene, toes, amputation, mental illness, cocaine abuse, alcohol abuse, substance abuse

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Frostbite is a severe, localized cold-induced injury due to freezing of tissue. Areas most frequently affected by frostbite include the ears, nose, cheeks, chin, fingers, and toes. Patients often complain of coldness, numbness, and clumsiness of the affected area [1]. Before rewarming, the skin is insensate, white or grayish-yellow in color, and hard or waxy to touch. Bullae containing clear or bloody fluid may develop after thawing, depending on the depth of the injury. In cases of delayed presentation to medical care, eschar or other signs of tissue necrosis may be observed. Exhaustion, dehydration, malnutrition, or

comorbidities such as peripheral vascular disease, diabetes, or mental illness may limit an individual's ability to respond to the stress of the cold.

Alcohol abusers predispose themselves to frostbite as a result of acute behavioral changes, increased heat loss from vasodilation, and chronic complications of alcohol consumption [2].

Homeless people are at high risk for exposure-related skin conditions such as frostbite and immersion ("trench") foot [3,4,5]. Although rarely fatal, these conditions may indicate an underlying vulnerability to worse health outcomes. In a study of homeless adults in Boston, individuals with a history of frostbite, trench foot, or hypothermia had 8-fold higher odds of death [6].

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The United States Department of Housing and Urban Development (HUD) estimated that over 578,000 people were homeless on a single night in January 2014.[7] Using data from the 1996 National Survey of Homeless Assistance Providers and Clients, researchers from the Urban Institute have estimated that 2.3 to 3.5 million people in the United States experience homelessness in a year.[8] Minority racial groups, particularly African Americans, are disproportionately represented among homeless people in the United States. [9,10]

Homeless persons have higher rates of medical and psychiatric hospitalization and emergency department use compared with the general population. [11-18]

The pattern of acute care use among homeless people may be related to the high prevalence of substance use disorders and mental illness in addition to poor access to primary and preventive care services. Over one-half of homeless adults lack a usual source of healthcare [19].

Available evidence has consistently suggested a higher burden of substance use disorders among homeless people than in the general population. [20] An estimated 68 to 81 percent of homeless adults are current cigarette smokers [21]. Homelessness is independently associated with 2-fold higher odds of being a current smoker [22], and homeless people have 3- to 5-fold higher rates of tobacco-attributable mortality [23]. Despite interest in quitting [22], quit rates among homeless smokers are about one-fifth the national average [24].

An estimated 29 to 63 percent of homeless individuals have a lifetime history of alcohol use disorder, contributing to 6- to 10-fold higher rates of alcohol-attributable mortality than in the general population [25,26,27]. An estimated 20 to 60 percent of homeless individuals have a lifetime history of a drug use disorder [25,26,27]. Marijuana, cocaine, and opioids appear to be the most commonly used substances in this population [26].

As with estimates of substance use disorders, mental illness prevalence estimates among homeless people have varied widely from 15 to 90 percent [28,29]. In a community-based probability sample of homeless adults in Los Angeles, the lifetime prevalence of severe and persistent mental illness was 28 percent, including a 14 percent lifetime prevalence of psychotic disorders and a 30 percent lifetime prevalence of major affective disorders [27]. Milder forms of mental illness are even more common, with one national study reporting that over two-thirds of homeless community health center patients had significant symptoms of psychological distress in the past month [30].

In this case we report on a homeless African American male who presented to the Emergency Department twice for frostbite. Patient not only was homeless but also suffered from schizophrenia, depression, and substance abuse (including alcohol, tobacco, cocaine and opioids), leading to partial amputation of digits 1-3.

Case Report

A 53-year-old African American male presented to the Emergency Department (ED) of an outside hospital (OSH) with pain in his left foot. At OSH patient reported a past medical history (PMH) of asthma and admitted to tobacco and alcohol abuse. Patient stated he had been sleeping in his car for the past 3 weeks due to issues with family. He also reported to wearing damp shoes. Patient admitted to difficulty bearing weight due to pain in left toes.

On physical examination, pedal pulses were palpable. Protective sensation was diminished in left foot. +1 pitting edema was noted to left foot and ankle. Small flaccid bulla was noted to left great toe. The remainder of the neurovascular and musculoskeletal examination was unremarkable.

Patient was given 600mg of Motrin in the Emergency Department for pain. He was also given a phone number for a homeless shelter to stay over night.

Patient was instructed to follow up with an orthopedic physician and was discharged.

At this time, Cleveland was experiencing record-breaking temperature lows. Temperatures ranged from -17 – 29 degrees.

Approximately 6 weeks later the patient presented to our Emergency Department with increased pain to the left foot. At this time, he admitted to a past medical history of depression, schizophrenia, alcohol abuse, and cocaine abuse. He was taking no medications and was still living out of his car. He admitted he did not follow up with orthopedic physician as advised. He admitted this was due to being off of his schizophrenic medications and his abuse of alcohol and cocaine.

His pain was significantly affecting his ability to ambulate therefore he presented to the ED. He had previously been treating his pain with cocaine and beer. He had been placing a piece of gauze to his toes and then applying a sock. Denies any purulent drainage but admits to bleeding. Denies any nausea, vomiting, fever or shortness of breath but admits to chills.

In the ED his pulse was slightly elevated to 105 bpm, all other vital signs were stable. Patient was admitted into the hospital.

On physical exam, pedal pulses were palpable. Sensation was absent to digits 1-3 of left foot. Distal aspects of digits 1-2 and to a lesser extent digit 3 were necrotic/gangrenous. Webspace 1 on left was macerated and malodorous. No erythema was extending from the digits. (Figure 1). The remainder of the neurovascular and musculoskeletal examination was unremarkable.

Radiographs of left foot were obtained (Figure 2). The read by the radiologist was “No focal soft tissue swelling, gas, or radiopaque foreign body. No destructive bony process such as acro-osteolysis. No fracture or dislocation”.

Labs were also drawn. CBC was grossly normal with WBC of 6.64. ESR was elevated to 32mm/hr. (normal range 0-10mm/hr). CRP was elevated to 3.9 mg/dL (normal range 0-1.0mg/dL). Albumin was 3.1g/dL (normal range 3.5 – 5.0 g/dL). Patient tested positive for opioids and cocaine.

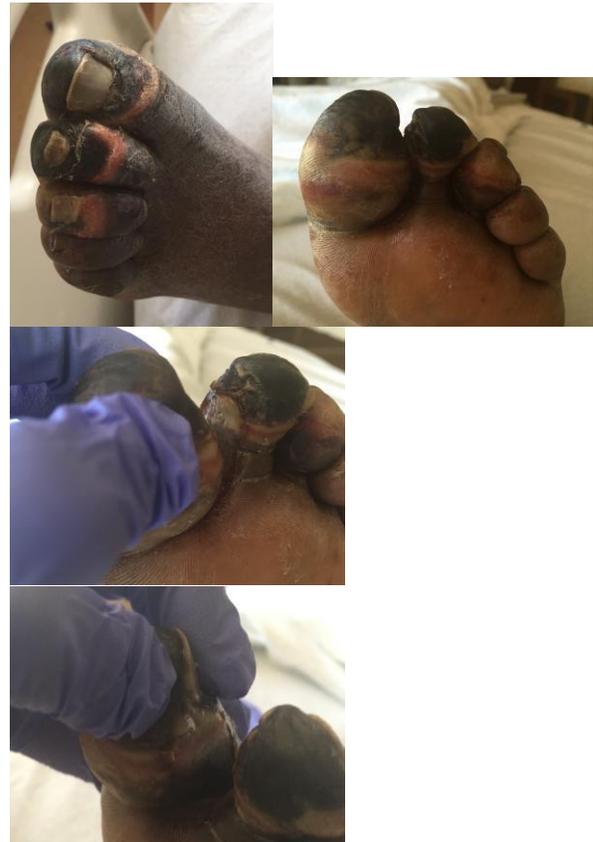


Figure 1. Clinical photos of gangrenous changes to digits 1-3 of left foot with maceration in the first webspace.



Figure 2. Radiology: AP, oblique and lateral views of left foot view.

Digits 1,2 of left foot did not appear to have chance of salvage of distal portion of toes. The 3rd digit was questionable. Plan was to partially amputate digits 1 and 2, as well as 3 in order to avoid excessive length of the 3rd digit. Even with patient's schizophrenia he was deemed capable of making medical decisions. Risks and benefits were discussed with patient and plan was to proceed with surgery the next day.

Patient proceeded with surgery the next day. Patient was placed under Monitored Anesthesia Care plus an ankle block using 50:50 mixture of 2% lidocaine plain and 0.5% Marcaine plain. A tourniquet was placed on the left ankle and inflated to 250mmHg. Three separate incisions were made for each toe in a fish mouth fashion just at the proximal edge of the nonviable tissue. The incision on the hallux was carried to the interphalangeal joint, which was disarticulated, and distal tissue removed. The sagittal saw was used to resect a portion of the proximal phalanges to allow for closure. In the same fashion, the second and third digits were addressed and a sagittal saw was used to resect a portion of the middle phalanx. The phalanges did not appear to be completely normal viable bone, but did not appear grossly infected. A decision was made to leave a

portion of the digits intact to help with balance and to not resect any additional bone. Irrigation was performed using pulsatile lavage and lactated ringers. Digits were closed using 3-0 Surgipro. Bone and tissue specimens were obtained and sent for culture. Patient was bandaged with betadine, adaptic, and dry sterile dressing followed by Ace bandage. Patient was readmitted to the hospital following the procedure.

The dressing was changed on post-operative day 2 and the sutures were intact with moderate edema of 1-3 digit stumps. There was no drainage or appreciable cellulitis. (Figure 3).



Figure 3. Postoperative day 2.

Tissue culture and stain grew *Klebsiella oxytoca*. Anaerobic culture grew *Bacteroides fragilis*. Culture and susceptibility was run on the *K. oxytoca* and Bactrim was susceptible so patient was placed on Bactrim DS BID for 10 days by primary team.

Throughout his stay patient was medically managed for alcohol withdrawal, cocaine withdrawal, schizophrenia and depression.

Due to patient's home situation we wanted him to be placed into a skilled nursing facility until he was healed. This delayed discharge and patient stayed in hospital for almost a week following surgery.

Patient was discharged to a skilled nurse facility where he stayed for approximately 4 weeks. Patient was instructed to take his medications, counseled on substance abuse, instructed to attend AA meetings, and told to follow up with podiatry and psychiatry.

Patient returned for his post-op follow-ups. After 4 weeks he had healed. At that time his family allowed him to return home and was no longer homeless.

Discussion

The treatment of frostbite is directed at reversing the pathologic effects of ice crystal formation, vasoconstriction, and the release of inflammatory mediators. It can be divided into three phases: pre-thaw field care phase, immediate hospital care phase, and post-thaw care phase, which continues for several weeks. The earlier the treatment begins the greater likelihood for recovery.

Timely pre-hospital and definitive hospital management are important to minimize final tissue loss and maximize functionality of the affected limb. Surgeons should not rush to early amputation; if managed correctly in the first few days, significant tissue can be salvaged, which is very important to the final functional outcome.

Patients who suffer from frostbite remain at increased risk for developing frostbite again [31]. Therefore cold exposure is contraindicated for six months after minor injury and for at least 12 months after any significant cold injury. Special precautions to protect previously injured tissue may need to be taken for several years if not indefinitely to prevent further damage.

A long-term follow-up study of 30 patients with significant frostbite injuries showed that 53% exhibited cold hypersensitivity, 40% numbness of the digits and 33% had reduced sensitivity to touch [32]. The study postulates that these side effects may be secondary to a thermo-physiological response with an increased tendency to vasospasm. With this cold sensitization, the individual may be unable to tolerate cold temperature upon the previously frostbitten area, even when other body areas are comfortable at that temperature [33].

Unfortunately in the presented case the patient began with superficial frostbite, and then went back out into

the cold. Due to the fact the patient was homeless, suffered from schizophrenia and substance abuse, he did not seek further care for an additional 6 weeks. This resulted in deep frostbite that became gangrenous, which ultimately led to an amputation.

The high burden of mental illness and substance use disorders among the homeless population makes screening for and treating these conditions an essential aspect of care. Our patient never informed the ED at the outside facility about his schizophrenia or cocaine abuse. Therefore, he left the hospital without medications and without any education of substance abuse. If the facility had knowledge of these conditions patients outcome may have changed.

The antibiotic choice of Bactrim DS may have been the appropriate choice for the initial aerobic cultures containing *K. oxytoca*. Once the anaerobic cultures returned the antibiotic should have been changed to cover *B. fragiles*. An oversight occurred when the patient was not switched to a more appropriate antibiotic. Fortunately for the patient, he healed without complications.

Conclusion

Frostbite is a common problem in the homeless population. As mentioned in the discussion the earlier the intervention or treatment, the greater chance for a better outcome. We received the patient after his frostbite had progressed past the initial stages and into gangrene. The decision was made to proceed with amputation of the non-viable tissue because demarcation had already occurred.

The progression to gangrene most likely could have been prevented if proper treatment had occurred after the initial presentation. The importance of investigating homeless patients for underlying mental illness or substance abuse is well demonstrated in this case. If patient had informed facility of conditions earlier, he may have received the proper treatment needed and ultimately the outcome could have been more favorable.

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