Self-inflicted finger cold injury leading to amputation: Report of a case

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Abstract

A cold injury can result in devastating outcomes, leading to significant morbidity and loss of distal extremities. Amputations are common after severe frostbite injuries with delayed presentation, often mediated by post-injury arterial thrombosis. Ischemic injuries are managed according to the ischemia time. The most controversial aspect of treating a salvage injury is the time of surgical intervention, which used to be based on the previous management dogma *freeze in January, amputate in July*. Recently, the paradigm has shifted to early surgical management if the level of viability of the deep structure can be ascertained using 99mTc pertechnetate scintigraphy (99mTc bone scans). We present a case of a finger amputation resulting from a cold injury secondary to a crush injury.

Introduction

A cold injury is most common in the fingers, toes, nose, ears, cheeks, and chin. Of all the body regions, digits of the periphery are at a greater risk for suffering freezing cold injuries (frostbite), especially in alpine and subzero environments.[1,2] The populations affected by cold injuries are diverse. These injuries are commonly seen among soldiers on military campaigns.[3] Civilians are also affected by cold injuries, hence the term urban frostbite. In an urban environment, most patients suffer frostbite injuries as a result of psychological issues, intoxication, or homelessness.[3]

Historically, frostbite injuries were classified like burns, as a range of first- to fourth-degree injuries. Mills and Whaley divided tissue injuries into the following spectrum: frostnip, superficial frostbite, and deep frostbite.[4] The severity of frostbite can vary within an extremity, with some areas exhibiting superficial injury and others being deeper.[3,5] Irrespective of the population affected by frostbite, the early management of cold injuries relies primarily on the principles of rapid rewarming, watchful waiting, and delayed amputation,[6,7] following the adage *freeze in January, amputate in July*.[3,8]

The management of ischemia secondary to cold injuries is determined based on the time of ischemia. Acute injuries with proper revascularization have a lesser risk of amputation than those with a delayed presentation. Under ideal circumstances, severely frostbitten extremities are rapidly warmed and treated with thrombolytic therapy within 6 to 24 h.[3] Use of Technetium-99m bone scans or single-photon emission computed tomography/computed tomography to predict tissue demarcation within 48 h allows for the determination of level of amputation or limb salvage.[3,9]

Cold injuries are rarely reported from tropical and Middle East countries with hot environments. Thus, the purpose of the paper is to report a case of a self-inflicted cold injury in Saudi Arabia that resulted in finger amputation.

Case Report

A 25-year-old male soldier presented to the emergency room with a painful and discolored small finger. He had no other relevant medical, surgical, and allergic history. The patient reported that one week prior, he had an accidental crush injury caused by a metallic door that traumatized his small finger. Immediately following the injury, the patient submerged the affected finger in *ice-cold* water for more than 5 min and reported to the local primary health care hospital and received a dressing. The patient was also prescribed antibiotics and analgesics for a period of 5 days, with the advice of follow-up after a week. The patient gradually noticed a color change over the affected finger, as well as moderate pain that would subside after analgesic use. The patient reported to the primary health care center where he was diagnosed with the cold injury of the small finger, and he was immediately referred to our hospital for further management.

Examination of the small finger revealed a circumferential bluish dark discoloration extending from the proximal phalanx to the fingertip, with epidermolysis (Figure 1), decreased range of motion (ROM), and decreased neurosensory response over the small finger. The vascularity pulse oximeter showed 70% oxygen saturation, and no fracture was elicited on X-ray (Figure 2).

Based on the clinical examination, the patient was provisionally diagnosed with a cold injury of the small finger followed by a crush injury. The patient was admitted, and he was started on an intravenous antibiotic and given daily silver sulfadiazine dressings. There was no improvement in ROM and or in the vascularity of the finger. A clear demarcation with mummification was noticed 1 cm distal to the metacarpophalangeal joint (MCPJ) of the small finger, with no improvement after one month of follow up. Under general anesthesia, with the help of tourniquet control and loop magnification, the patient was operated on for debridement of the wound.

Intraoperatively, it was noted that the digit was necrotic, clearly demarcated, and mummified 1 cm distal to the MCPJ. In addition, the tendons and bone were found to be necrotic. A curved fish mouth incision was made 1 cm distal to the MCPJ at the level of the demarcation, and amputation of the necrotic digit was performed. Postoperatively, the wound healed uneventfully shows the affected hand 1 year after the revision amputation, further the patient

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Figure 1. Initial picture of the affected finger, 7 days after trauma.

Figure 2. X-ray of the affected hand showed no fracture and normal anatomical alignment of the bones and joints.

Figure 4. One month after injury.

Figure 3. Three days after dressing.

Figure 5. Picture shows the finger 1 year after revision amputation.

offered resection of the metacarpal head for correction of the shoulder deformity but he refused and preferred to go for silicone prosthesis (Figures 3-5).

Discussion

Cold injury is a composite term applied to a variety of hypothermic traumas that result in similar clinical and pathological manifestations.[10] The principal environmental factors leading to tissue injury are wetness and cold. Thus, frostbite is caused by exposure to the freezing cold. The extent to which actual tissue freezing occurs in frostbite is controversial,[10,11] except for the special circumstances of *high-altitude frostbite*,[10,12] where intensely cold, dry air freezes tissue within a few seconds. Cold injuries are relatively less common among civilians. The importance of racial susceptibility has yet to be clarified, but studies on the Korean War indicate an increased risk of cold injury in Black people.[13,14]

These injuries may result in ischemia, and they could result in amputation or impairment of the affected limb's function.[10] In the present case, the patient sustained a closed crush injury initially followed by frostbite. Crush injuries can present as open or closed, and they can occur when compressive forces damage the fingertip.[15] While injuries to the pulp and bone may occur, they are generally self-limited and not associated with significant *sequelae*.[15,16] However, a traumatized finger may eventually undergo necrosis if it is exposed to a subzero environment. In the present case, the crush injury potentiated frostbite, even though the cold exposure time was relatively small.

All patients with frostbite should be admitted to the hospital and ideally treated at a specialized facility, usually a burn center.[3] After rapid rewarming, a few interventions can alter the natural history of frostbite. A few retrospective studies and case reports suggest a decreased incidence of amputation when tissue plasminogen activator (tPA) is used within the first 24 h after rewarming.[3,7,8,18,19] One prospective study found a decreased amputation rate with rapid rewarming, aspirin, thrombolysis, and prostacyclin analogues, with the most impressive results in the prostacyclin analogues group.[3,19] Unfortunately, the present case was reported to our hospital one week after the injury without any of these prior treatments.

Conclusions

A cold injury is a silent assailant. It is a serious condition with potentially disastrous consequences that are often not apparent immediately after the injury. This fact should be thoroughly appreciated by the public. A lack of pain at the time of injury is part of the natural history of the injury. Conceptually, watchful waiting and delayed amputation were the tenets of cold injury management. A sound educational and public health program would be of some benefit to the majority of such patients. In addition, a crush injury with a history of field management by the patient or non-healthcare provider should be investigated properly and monitored closely.

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