

Successful Treatment of Frostbite Lesions in Arctic Greenland

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Introduction

Frostbite may cause severe tissue damage and lead to tissue loss and limb amputations. Frostbite lesions occur in skin exposed to temperatures below zero degrees Celsius for a prolonged period of time. During frostbite, ice crystals are formed in affected tissue. After reheating of the affected areas, varying degrees of reperfusion injury and inflammation occur. This reperfusion injury and inflammation is mediated by prostaglandines [1,2].

Frostbite is classified in four stages [2]. First degree frostbite lesions present as white plaques with reduced sensitivity, erythema, and possibly mild edema. Second degree frostbite lesions are characterized by erythema, edema and bullae containing clear fluid. In third degree frostbite lesions, tissue destruction compromises the dermal layer. Third degree frostbite lesions are characterized by blood-filled small bullae, skin necrosis and blue-gray discoloration of the skin. Fourth degree frostbite lesions affect muscles and bones. These fourth degree lesions can present with edema, red or cyanotic skin that can later become dry and black [3]. Third and fourth degree frostbite may result in tissue necrosis and tissue loss. In addition, frostbite can cause long-term complications like chronic pain, neuropathy, hypersensitivity to cold and decreased sensitivity [3].

Risk factors for frostbite lesions include low temperatures, high wind chill factor, smoking and alcohol, as well as medical conditions such as diabetes, neuropathy, dementia and psychiatric disorders [2-4]. Most often, fingers, toes, cheeks, nose and ears are affected [3-6].

The occurrence of frostbite is increasing due to increased travel activity to arctic areas and mountain areas at high altitude. In Greenland, a large part of the population are hunters and fishermen and are therefore at risk of developing frostbite [6].

Medical history

A 64-year-old man from Maniitsoq in West Greenland was admitted to the hospital after falling in the snow the previous day. He fell during a snow storm with temperatures of -15 degrees Celsius and had difficulty getting up. He did not wear gloves. He had not been drinking alcohol. Clinical examination showed

second degree frostbite lesions with swelling and clear blisters on the 2nd, 3rd and 4th phalanx of the left hand and on the 4th and 5th phalanx of the right hand (figure A). He had impaired movement of the proximal and distal interphalangeal joints. He underwent needle aspiration of the blisters and movement impairment remitted. A dry dressing was applied. Three days later, he had smaller blisters, which were needle-aspirated (figure B). Six days after the onset of the frostbite lesions, the skin which



Figure A: Frostbite lesions, as present at admission at the hospital, day 1



Figure B: Frostbite lesions as present at control, day 3



Figure C: Frostbite lesions at follow-up, 1 month

had been wet became dry. He continued to have impaired mobility primarily in the distal interphalangeal joints of the affected phalanges. The patient was instructed in exercises by a physical therapist, and applying vaseline on the affected areas. After a month, the mobility in the affected joints had almost returned to normal (figure C).

Discussion

The treatment of frostbite should be initiated quickly [1-4]. Treatment aims at counteracting the detrimental effects of ice crystal formation in the affected tissue, vasoconstriction and release of inflammatory mediators. Pre-hospital treatment should prevent further exposure to cold. Hereafter, rapid rewarming is advised in a warm antiseptic waterbath of 37-39 degrees Celsius. Care should be taken not to use too hot water, as reduced sensitivity is present at the site of the frostbite, and burning lesions may occur [1,3,4]. Re-freezing of the affected areas after Re-freezing of the affected areas after reheating should be avoided as it can cause extensive damage. Elevation of the affected extremity is recommended to avoid edema formation. Hemorrhagic blisters should generally not be drained, but clear blisters can be emptied by sterile needle aspiration when these blisters limit joint movement [4.] Hereafter, cream, gauze, and daily wound dressings are recommended to avoid infection. Systemic antibiotics are only indicated when infection or major trauma occurs [1,6].

Non-steroidal anti-inflammatory drugs (NSAIDs) and aloe vera creams are often used to reduce inflammation and pain, though evidence for these treatments are lacking. Generally, not many randomized trials have been carried out in the treatment of frostbite injuries, and evidence for current treatment protocols is sparse [2]. Iloprost, an analogue to prostacyclin PGI₂, has been tested against thrombolysis in the only randomized clinical trial investigating treatment of frostbite injuries [2,6]. There were significantly fewer amputations in the Iloprost group in patients with 3rd and 4th degree frostbite, compared to the thrombolysis group [2].

When frostbite lesions occur, it is important to avoid premature amputation in order to maintain as much tissue as possible. Conservative treatment should be the standard, and most often the auto-amputation principle is used, in which treatment is deterred in favour of allowing the necrotic tissue to fall off. Early surgical amputation is only indicated when uncontrolled infection occurs [6].

In the present case, aspiration of bullae impairing joint mobility, application of dressings and fatty lotions, and early initiation of passive exercises of the fingers were used. This resulted in good healing, no signs of infection and good hand function two months after the incident. The case emphasizes the importance of conservative treatment and proper wound care when treating frostbite lesions.

Summary

Weather conditions in Arctic areas can be extreme, exposing the people to a high risk of acquiring frostbite injuries. Frostbite may cause tissue loss and present with loss of sensation, skin discoloration and blisters. We present a case of second degree frostbite injury occurring in a 64-year old man in Greenland. The patient received conservative treatment with wound care, and recovered without sequelae. In this article we summarize main treatment principles of frostbite injuries.

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