CASE REPORT

Successful conservative treatment of severe frostbite lesions in a Greenlandic Inuit

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SUMMARY

Frostbite may cause lesions. The severity ranges from superficial wounds to severe cases with loss of limbs and tissue. Hence, proper treatment is of utmost importance. We present a case of an 18-year-old man from Arctic Greenland who was admitted with severe frostbite lesions involving both hands. The patient had fallen asleep outside during extreme temperatures. He was treated conservatively with proper wound care, antibiotics and intensive physical therapy. The patient made a full recovery without sequelae. The current report emphasises that non-operative treatment should be attempted for frostbite lesions, as conservative treatment often results in good outcomes.

BACKGROUND

Frostbite and non-freezing cold injuries (NFCI) are relatively rare in hospital settings.^{1–3} Today, several advanced medical treatments such as intravascular thrombolysis with tissue plasminogen activator, vasodilators (iloprost, buflomedil), hyperbaric oxygen therapy and nerve blocks have been proposed in the treatment of frostbite.^{2–5} Few clinical trials have been performed, and the literature consists mostly of case reports and observational and experimental studies.^{2–4} None have been large scale, and evidence-based treatment principles have not yet been fully clarified.^{2–4} Therefore, clinical decision making may become blurred, and clinicians should be informed and reminded that frostbite in general is a clinical diagnosis. Good results and avoidance of tissue loss can be achieved with conservative treatment.

CASE PRESENTATION

We present a case of an 18-year-old man. The patient was previously healthy, with no daily use of prescribed medication. He was transferred to our regional hospital with severe frostbite lesions on both hands.

The patient was in a state of intoxication after drinking a large amount of alcohol at the local pub. He had fallen asleep outside his own house with an outside temperature of -30°C . Reportedly, he slept outside for around 30 min before he was brought to the hospital.

Treatment was initiated at the local hospital aided by telemedical guidance prior to referral to the regional hospital. He received rewarming with lukewarm water, and in addition, analgesic and anti-inflammatory treatment with ibuprofen was given. Furthermore, a tetanus booster was administered.

The injury was initially graded as second-degree to third-degree frostbite with several big bullae and small blood-filled blisters. The patient's dressings were removed and changed in a sterile fashion, initially daily and later every second day.

The patient was transferred to the regional hospital by a regular airplane 19 days after the incident for further treatment. Clinical examination at admission at the regional hospital showed that the patient's right hand had swollen thick fingers plus loss of sensations in all fingers (figure 1). Small amounts of pus were observed on several fingers. However, no strong redness or deeper necrosis was observed on the right hand. The left hand looked similar, but less severe. On his fifth finger, dark, dry necrosis was observed. Both the thumbs were less affected than the rest of the fingers. Remaining clinical examination, including vital signs, was normal. He started treatment with oral antibiotics.

INVESTIGATIONS

When infection occurred, samples for bacterial cultivation were taken from three different sites with pus. Samples were taken at two separate occasions 3 days apart. All cultures showed growth of *Staphylococcus aureus*, which was sensitive to dicloxacillin, erythromycin, fusidic acid, gentamicin and piperacillin/tazobactam and resistant to penicillin.

TREATMENT

Initial treatment consisted of rewarming in warm water, administration of tetanus booster and per oral prophylactic antibiotics. The wounds were treated in the following way: intramuscular analgesic injection was given, dressings were removed in soapy water baths for 2–10 min (not longer, because of concern for making the skin too soft). Afterwards, the skin was air dried, followed by topical application with a thin layer of antiseptic Flamazine (silver sulfadiazine), and finally dressed with dry dressings together with paraffin gauze (Jelonet, Lomatuell H) or smooth acetate gauze (Cuticerin). Different brands of non-adhesive dressings were used, as they were available at the hospitals. When infection was suspected, blisters were punctured. Wound care, including replacement of the dressings, was initially done daily and later every second day. The frequent changing of dressings in the beginning was done to ensure better hygiene and because of fluid discharge from the wounds and also to ensure proper clinical observation and to perform physical therapy. When clinical improvement was observed, the

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Figure 1 Severe frostbite lesion of the right hand.

dressings were changed less frequently. Dressing of the wounds was stopped when the wounds were dry and proper healing was observed. Clinical judgement was the guiding principle. All wound care was performed as sterile as possible. Resting splints were not used to prevent contractures. However, the dressings caused sufficient immobilisation. In order to prevent contracture of digits and to achieve optimal function, the patient received daily physical therapy. The first 2 weeks after the injury, the hands were so swollen that little movement was possible. However, movement was encouraged. Formal therapy instructed by physiotherapist started at the regional hospital 20 days after the injury. The patient trained daily flexion and extension movements over all joints. Number of physiotherapy exercises increased along with clinical improvement. This treatment procedure illustrates how our patient was treated. We want to emphasise that our treatment should be seen as guidance for other physicians, not as an evidence-based exact way of treating frostbites. Clinical judgement is essential.

OUTCOME AND FOLLOW-UP

After admittance, the patient was treated for 2 months with wound care daily or every second day. Antibiotics were discontinued 6 weeks after the frostbite incident when clinical findings of infection (in this case pus formation, erythema and oedema) had disappeared. Antibiotics were given for this relatively long period, as during wound care, signs of infection were present. Wound healing was good. No loss of digits or parts of digits occurred (figure 2). At follow-up 1 year after the frostbite incident, the patient had regained full mobility and strength in all fingers. He had no complaints about pain, loss of sensation or cold intolerance.

DISCUSSION

Frostbite is normally not life threatening, unless disorders such as simultaneous hypothermia, trauma or complications like sepsis occur. With frostbite comes, however, risk of severe morbidity

Figure 2 Successful treatment of severe frostbite lesions of both hands.

with limb and tissue loss. The most affected body parts are fingers, toes, ears, nose, cheeks, chin and male genitalia.^{3–5} Amputation might occur through the physiological process of auto-amputation.^{4,5} Long-term sequelae of frostbite commonly include increased vulnerability to future cold injuries, chronic pain, neuropathy, cold hypersensitivity, diminished sensation and numbness.^{1,4,5} Examples of more rare complications due to freezing injuries (NFCI and frostbite) are local osteoporosis, subchondral bone loss, undergrowth of bone in children, chronic ulceration and malignant squamous transformation in affected areas.^{4,5} The clinical picture of frostbite also compromises a challenge since infection, rewarming methods and refreezing of tissue can turn less severe frostbite or a NFCI into becoming more critical, that is, a grade 2 injury can progress to a grade 3 injury.^{2,4,5}

Surgical amputation is required when uncontrolled infection occurs. Imaging studies such as technetium-99 scintigraphy, MRI and magnetic resonance angiography have nowadays been proposed to aid surgical decision making in amputation and debridement.^{4,5} Early surgical intervention can damage more than it might be saving.^{3,5} The phenomenon of auto-amputation should preferably be applied, since tissue that seems non-vital tissue may recover.⁵

Clinical examination remains, however, the backbone of clinical decision making and should perhaps remain so. Conservative treatment performed properly over a long time should be encouraged and emphasised to reduce tissue and limb loss. Our case shows that full recovery can be achieved even with severe frostbite lesions.

Today, emerging therapies in the form of thrombolysis and use of vasodilators (prostacyclin analogue) have been proposed

Learning points

- ▶ Frostbite may cause severe morbidity. Proper treatment and diagnosis of frostbite together with addressing comorbidities and other conditions are of major importance.
- ▶ Conservative treatment including proper wound care, treatment of infection and physical therapy should be applied to avoid tissue loss and function.
- ▶ Surgical amputation should be applied only for uncontrolled infection and sepsis or chronic lesions. Auto-amputation should be preferred.
- ▶ Treatment with thrombolysis or vasodilators (prostacyclin analogues) should always be considered.

for frostbite treatment.^{3 6} More evidence is needed to determine which treatments options are most effective.

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