

# TREATMENT OF FROSTBITES - SIX CASES EXPERIENCE. EFFECTIVENESS OF SUPRATHEL® APPLICATION



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# INTRODUCTION

- Exposure to cold can produce:
  - a. localized injury (peripheral cold injuries) includes:
    - Frostnip
    - Chilblain
    - Immersion foot, or trench foot,
    - Frostbite
  - b. generalized cooling of the entire body (systemic hypothermia),
    - Hypothermia or systemic cold injury is a clinical condition in which the core body temperature has decreased to 35°C or less.
  - c. a combination of both (local and generalized).

# INTRODUCTION

- Body temperature may fall as a result of heat loss by:
  - a. Radiation;
  - b. Evaporation;
  - c. Conduction;
  - d. Convection;

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# DEFINITION

- Frostbite refers to the clinical situation in which water molecules freeze and crystallize within biologic tissue, resulting in cellular and tissue death.
- The damage caused by frostbite results from 3 distinct processes:
  - extracellular and intracellular ice crystallization,
  - intracellular dehydration,
  - arterial insufficiency with intermittent spasm.



# LOCAL STATE AND STAGES OF FROSTBITES

- Frostbite injury have been divided into four classic stages:
  1. First degree
  2. Second degree
  3. Third degree
  4. Fourth degree
- The staging has limited clinical usefulness, because no direct correlation to survival or tissue loss exists with prognosis based on early staging.

# LOCAL STATE AND STAGES OF FROSTBITES

- ❖ First degree - nonsensate, central, white plaque surrounded by a ring of hyperemia;
- ❖ Second degree - clear blisters with surrounding erythema;



# LOCAL STATE AND STAGES OF FROSTBITES

- ❖ Third degree - hemorrhagic blisters, usually followed by eschar formation.
- ❖ Fourth degree - focal necrosis with visible tissue loss



# LOCAL STATE AND STAGES OF FROSTBITES

- Some experts describe frostbite injury as:
  - a. superficial (first and second degree): involves the skin and subcutaneous tissues. Edema develops and clear blisters filled with serous fluid appear within the first 24 hours.
  - b. deep (third and fourth degree): involves the muscle, tendons, neurovascular structures, and bone, in addition to the skin and subcutaneous tissues. Edema develops, but blisters may be absent or delayed. Blisters, if present, are filled with hemorrhagic fluid .

This allows for a better correlation between degrees and final outcome.



# LABORATORY STUDIES

- Baseline laboratory tests should include a complete blood cell count; levels of blood glucose, electrolyte, phosphorus, creatinine, amylase, lactic dehydrogenase isoenzyme, and creatine kinase isoenzyme; prothrombin time; activated partial thromboplastin time (aPTT); and arterial blood gas values.
- A toxicologic evaluation is recommended for any patient whose history is unknown or who may have ingested a drug or poison.
- An initial 12-lead ECG should be obtained, after which the patient should have continuous cardiac monitoring

# IMAGING STUDIES

- Routine imaging studies early in the diagnosis and treatment of frostbite remain relatively useless in determining the extent and amount of tissue damage.
  - Plain radiographs often demonstrate soft-tissue edema but do not distinguish viable from nonviable tissue.
  - Angiography often shows slowing of blood flow to the distal vasculature, but this does not correlate well with eventual tissue loss.
  - Technetium-99m (99m Tc) scintigraphy, allows nonviable tissue to be visualized earlier than it is in clinical examination.
  - MRI has been suggested as a more accurate assessment tool for predicting the limits of nonviable tissue and for guiding early surgical debridement.
  - Laser Doppler flowmetry may someday provide a means of predicting the extent of tissue viability in patients with frostbite.

Clinically, however, none of the techniques discussed here has shown consistent superiority to that of spending 3-4 weeks in watchful waiting for demarcation.

# TREATMENT PROTOCOL

- Rewarming - rapidly rewarm the affected area in warm water at 40-42°C for 15-30 minutes or until thawing is, by clinical assessment, complete.
- After rewarming, treatment of the affected parts includes the following:
  - a. Debridement of clear blisters and topical treatment with Suprathel or other dressings with antimicrobial agents;
  - b. The hemorrhagic blisters are left intact and treated with silver sulfathiazole.
  - c. When the hemorrhagic blisters rupture, the blisters are debrided, with following application of the Suprathel or topical antimicrobial agents to the wound.
  - d. Elevation of the affected parts;
  - e. Antitetanus prophylaxis (toxoid of immunoglobulin [Ig])
  - f. Analgesia as needed - Opiates IV or IM, as indicated
  - g. Ketoprofen 100 mg PO every 8 hours
  - h. Antibiotics (Pip / Tazo)
  - i. Daily hydrotherapy for 30-45 min at 40°C
  - j. Obtain photographic records on admission, at 24 hours, and serially every 2-3 days until discharge.
  - k. Prohibit smoking (Tobacco should be avoided because of its vasoconstrictive effect)

# TREATMENT PROTOCOL

- Adjuvant therapies:
  - a. The treatment with vitamin C 0,5 - 1,0 g /d.
  - b. Antithrombotic agents such as heparin and dextran have not been shown to enhance tissue salvage.
  - c. Pentoxifylline 400 mg every 8 hours, may aid small vessel perfusion.
  - d. Bencyclane (Halidor), 100 mg q 8 h, may reduce refractory vasospasm.



# SURGICAL THERAPY

- Surgical debridement of nonviable tissue delay for 3-4 weeks, until clinical demarcation of viable tissue has taken place.
- Wet gangrene is treated by urgent surgical excision of the affected area.
- After debridement standard postoperative care routines are followed, including consideration for amputation, skin grafting, and bone and tissue coverage, including muscle flaps

# CLINICAL CASES

- In our center we have treated 6 cases of frostbite since september 2009 (2 in last year and 4 in this year). I will present four of them that were found as clinically deep frostbites:
  - 17 years old male with I/II degree frostbite of left ear and III /IV degree frostbite of hands, knees and feet - Suprathel was not applied
  - 30 years old male with II/III degree frostbite of hands and feet - Suprathel was applied
  - 17 years old male with II/III degree frostbite of hands and feet - Supratel was applied
  - 70 years old male with III/IV degree frostbite of hands (diabetes in anamnesis) - addmitted on 5th day after injury; treated with silver sheets

# 1st CLINICAL STUDY

- ▣ A 17 years old man presents with frostbites of the left ear, hands, knees and feet. He was at a party the previous night and admits to drink alcoholic beverages but denies any drug use. On his way home he fainted and lay in a snowdrift at a temperature about minus 20 °C. He was transferred to ED and then admitted to toxicological clinic with alcohol intoxication and hypothermia. After being rewarmed and detoxicated he was transferred to our center on the 2nd day after injury.
- ▣ He has no past medical history. He is not currently on any regular medication. There is no history of allergies. His family history is negative for any pathology. He smokes approximately a few cigarettes a day and admits to drink alcohol occasionally.
- ▣ On examination, he appears to be alert, comfortable, and in no acute distress. He is well oriented to person, time, and place. Vital signs are within normal limits. His respiratory, cardiovascular and abdominal examinations reveal no abnormal findings. Neurologic examination and mental status are grossly normal.

# LOCAL PHYSICAL EXAMINATION

- ▣ Superficial frostbite of the left ear (reddening with ruptured blister).
- ▣ Clear ruptured blisters on right hand fingers with associated edema
- ▣ Clear and hemorrhagic blisters on left hand fingers with associated edema





# LOCAL PHYSICAL EXAMINATION

- ▣ cyanotic and mottled like skin on knees
- ▣ ashen-gray, cyanotic colored feet with hemorrhagic blisters and associated edema



# DIAGNOSIS AND TREATMENT

- ▣ Dx: Hypothermia. Superficial frostbite of left ear and deep frostbite of hands, knees and feet.
- ▣ Our treatment protocol was administrated:
  - a. Debridement of clear blisters and topical treatment with silver sulfathiazole;
  - b. The hemorrhagic blisters were left intact and treated with silver sulfathiazole. When they ruptured, they were debrided, with following application of topical antimicrobial agents to the wound.
  - c. Everyday dressings change: dressings removing, wounds rinsing, wiping debris out, putting on wounds silver ointments or sheets and final dressing
  - d. Elevation of the affected parts;
  - e. Ketoprofen 100 mg q 8 h
  - f. Antibiotics (Pip / Tazo)
  - g. Daily hydrotherapy for 30-45 min at 40°C
  - h. Smoking prohibition
  - i. Vitamin C 0,5 - 1,0 g /d.
  - j. Heparin and dextran.
  - k. Pentoxifylline 400 mg every 8 hours,
  - l. Bencyclane (Halidor), 100 mg q 8 h,

# LOCAL STATE AND TREATMENT

- ▣ 7 days post injury (4 days after admission): ruptured hand blisters
- ▣ Debridement of ruptured blisters was performed





# LOCAL STATE AND TREATMENT

- ▣ 14 days post injury: dry gangrene of 7 hands fingers
- ▣ Final surgical treatment - amputation of seven fingers





# 2nd CLINICAL STUDY

- ▣ A 30 years old man admitted with frostbites of hands and feet. He admits to drink alcoholic beverages on previous day. On his way home he fainted down and was lying on the ground at a temperature about minus 10 °C.
- ▣ He has no past medical history. He is not currently on any regular medication. There is no history of allergies. His family history is negative for any pathology. He smokes approximately a few cigarettes a day and admits to drink alcohol regularly.
- ▣ On examination, he appears to be alert, comfortable, and in no acute distress. He is well oriented to person, time, and place. Vital signs are within normal limits. Temperatute is 35.1 °C. His respiratory, cardiovascular and abdominal examinations reveal no abnormal findings. Neurologic examination and mental status are grossly normal.

# LOCAL PHYSICAL EXAMINATION

- ▣ Hands: clear blisters with haemorrhagic focal changes of eight fingers with associating edema
- ▣ Feet: edema and white blisters of big toes



# DIAGNOSIS AND TREATMENT

- ▣ Dx: Superficial with partial deep frostbites of hands and feet.
- ▣ Our treatment protocol was administrated:
  - a. Rewarmingin: warm room and water at 40-42°C for 15-30 minutes or until thawing is, by clinical assessment, complete
  - b. Debridement of blisters and topical treatment with Suprathel on the bed wounds and ointment on other affected parts for sufficient lubrication
  - c. Everyday dressings change: dressinngs removing (outer layers), peeling away standing out pieces of Suprathel, putting on Suprathel layers antimicrobial ointment and final dressing
  - d. Elevation of the affected parts;
  - e. Ketoprofen 100 mg q 8 h
  - f. Antibiotics (Pip / Tazo)
  - g. Daily hydrotherapy for 30-45 min at 40°C
  - h. Smoking prohibition
  - i. Vitamin C 0,5 - 1,0 g /d.
  - j. Heparin and dextran.
  - k. Pentoxifylline 400 mg every 8 hours,
  - l. Bencyclane (Halidor), 100 mg q 8 h,

# LOCAL STATE AND TREATMENT

- ▣ Debridement of ruptured blisters



- ▣ Suprathel application





# FOLLOW UP

- ▣ Epitelization of wound beds after two weeks of treatment
- ▣ Local state after one year: no signs of passed frostbites, no joints stiffness,



# 3rd CLINICAL STUDY

- ▣ A 17 years old man admitted with frostbites of hands. He was at a party the previous night and admits to drink alcoholic beverages but denies any drug use. He missed his way home, fainted down and was lying on the ground at a temperature about minus 15 °C.
- ▣ He has no past medical history. He is not currently on any regular medication. There is no history of allergies. His family history is negative for any pathology. He does not smoke and admits to drinking alcohol occasionally.
- ▣ On examination, he appears to be alert, comfortable, and in no acute distress. He is well oriented to person, time, and place. Vital signs are within normal limits. His temperature is 35.4 °C. His respiratory, cardiovascular and abdominal examinations reveal no abnormal findings. Neurologic examination and mental status are grossly normal.

# LOCAL PHYSICAL EXAMINATION

- ▣ Clear and hemorrhagic blisters on both hands
- ▣ A cold, waxy white and nonblanching skin on big toes and around ankles with surrounding flushing



# DIAGNOSIS AND TREATMENT

- ▣ Dx: Superficial frostbites of feet and deep frostbites of hands fingers.
- ▣ Our treatment protocol was administrated:
  - a. Rewarming - in warm room and water at 40-42°C for 15-30 minutes or until thawing is, by clinical assessment, complete
  - b. Debridement of blisters and topical treatment with Suprathel on the bed wounds and ointment on other affected parts for sufficient lubrication
  - c. Everyday dressings change: dressinngs removing (outer layers), peeling away standing out Suprathel pieces, putting on Suprathel layer antimicrobial ointment and final dressing
  - d. Elevation of the affected parts;
  - e. Ketoprofen 100 mg q 8 h
  - f. Antibiotics (Pip / Tazo)
  - g. Daily hydrotherapy for 30-45 min at 40°C
  - h. Smoking prohibition
  - i. Vitamin C 0,5 - 1,0 g /d.
  - j. Heparin and dextran.
  - k. Pentoxifylline 400 mg every 8 hours,
  - l. Bencyclane (Halidor), 100 mg q 8 h,



# LOCAL STATE AND TREATMENT

## ▣ Local state before debridement



## ▣ Local state after debridement





# LOCAL STATE AND TREATMENT

- ▣ Suprathel application



# LOCAL STATE AND TREATMENT

- ▣ One day after Suprathel application
- ▣ Five days after Suprathel application
- ▣ One week after Suprathel application



# LOCAL STATE AND TREATMENT

- ▣ Eight days after Suprthel application



- ▣ Ten days after Suprathel application



- ▣ Two weeks after Suprathel application



# LOCAL STATE AND TREATMENT

- ▣ Three weeks after Suprathel application





# 4th CLINICAL STUDY

- ▣ A 70 year old man admitted with frostbites of hands from other hospital on 5th day after injury. He suffers from unstable diabetes. Over one episode of hypoglycemia he fainted down and was lying on the ground for few hours at a temperature about minus 10 °C.
- ▣ His past medical history is significant for coronary artery disease, hypertension, diabetes and psychical depression. He is not currently on any regular medication. He gave up taking them. There is no history of allergies. He does not smoke cigarettes and admits to drinking alcohol occasionally.
- ▣ On examination, he appears to be alert, comfortable, and in no acute distress. He is well oriented to person, time, and place. Vital signs are within normal limits. His respiratory, cardiovascular and abdominal examinations reveal no abnormal findings. Neurologic examination and mental status are grossly normal.

# LOCAL PHYSICAL EXAMINATION

- ▣ Hemorrhagic blisters on all hands fingers.



# DIAGNOSIS AND TREATMENT

- ▣ Dx: Deep frostbites of hands fingers
- ▣ Our treatment protocol was administrated:
  - a. The blisters were left intact and treated with silver sulfathiazole.
  - b. When they ruptured, they were debrided, with following application of topical antimicrobial agents to the wound (silver sheets).
  - c. Everyday dressings changing: dressinngs removing, wounds rinsing, wiping debris out, putting on wounds silver ointments or sheets and final dressing
  - d. Insulin
  - e. Elevation of the affected parts;
  - f. Ketoprofen 100 mg q 8 h
  - g. Antibiotics (Pip / Tazo)
  - h. Daily hydrotherapy for 30-45 min at 40°C
  - i. Vitamin C 0,5 - 1,0 g /d.
  - j. Heparin and dextran.
  - k. Pentoxifylline 400 mg every 8 hours,
  - l. Bencyclane (Halidor), 100 mg q 8 h,

# LOCAL STATE AND TREATMENT

- ▣ Two days after admission (7 days after injury):



- ▣ After debridement we used silver sheets on wounds beds.



# LOCAL STATE AND TREATMENT

- ▣ 10 days after admission:  
partial necrosis of all  
fingers
- ▣ Three weeks after admission:  
dry gangrene of all fingers



# LOCAL STATE AND TREATMENT

- ▣ Patient was qualified to operation: partial amputation of all hands fingers.



# CONCLUSIONS ABOUT USING SUPRATHEL IN FROSTBITES

- ▣ Suprathel can be useful as a epidermal supplement in frostbites supplying bed wounds after debridement of blisters.
- ▣ Suprathel usage may protect frostbite wound bed from infection and desiccation and connected with them frostbite stage conversion.
- ▣ Suprathel application allows to limit dressing changes and connected with them pain.



THANK YOU FOR YOUR  
ATTENTION.

