Developed by the British Columbia Provincial Nursing Skin & Wound Committee in collaboration with NSWOCs/WCs from:

Wound Management for Frostbite Injury: Guideline

Endorsement **British Columbia & Yukon**	• Endorsement done: VCH/PHC, IHA. • Endorsement pending: FNHA, FHA, ISLH, NHA, PHSA & Yukon; until endorsement has been granted by your health authority (HA), please follow your HA's current document.
DST Indications for Use	• This Decision Support Tool (DST) guides health care professionals to determine appropriate care strategies for the treatment of frostbite wounds for clients (adult and children) across all care settings. • The client with frostbite injury(s) requires an interprofessional team approach to manage the medical complication of the injury as well as mobility/functional concerns. • In accordance with health authority/agency policy, this provincial guideline and its Quick Reference Guide (QRG) can be used with the HA/agency's frostbite protocol Prescribers Pre-Printed Orders (PPO) or with the Yukon Hospitals' Frostbite Protocol/ Physician's Pre-Print Orders.

Practice Level
British Columbia & Yukon
	• British Columbia: in accordance with their HA/agency policy:
	  ○ Registered Nurses (RN) and Registered Psychiatric Nurses (RPN) may determine a wound treatment plan for frostbite injuries.
	  ○ Licensed Practical Nurses (LPN) follows an RN/RPN established wound treatment plan for frostbite injuries.
	• Yukon: Registered Nurses, Registered Psychiatric Nurses and Licensed Practical Nurses refer to organizational policy and practice in accordance with regulatory bodies.

Need to Know	• Frostbite is a thermal injury arising from an exposure to a cold environment and occurs when skin temperature falls to -2°C or less.
	• Prevention of frostbite injury is the key intervention, (e.g., wearing correct footwear and clothing for the cold condition, minimizing cold exposure time, recognizing the early signs of frostbite such as numbness in toes or fingers, and the need to seek warmth).
	• Tissue injury is due to the formation of extracellular ice within the tissues which starts with the extremities, (e.g., toes and fingers), as well as the ears and nose. The extent of the injury and the severity increases with exposure time.
	• The severity is graded (1-4) after the initial rewarming and the grade can change over the first few days following the injury. It may take 3 to 4 weeks before the full extent of the frostbite injury is known, see Appendix A: Frostbite Grade and Appearance
	• With severe injuries:
	  ○ Medical management is needed to mitigate damage done due to vasoconstriction through the use of systemic vasodilator medications, such as, Ilosprost.
	  ○ Injury can eventually mummify and self-amputate (fall off) or surgical amputation may be done.
	• Areas injured by frostbite are more prone to a repeat injury.

Bookmarks	Assessment Determination of Treatment Strategies Interventions Client Clinical Outcomes Quality Assurance Indicators Documentation Definitions References/Bibliography Document Management Appendix A: Frostbite Grade & Appearance Appendix B: Frostbite Injury Quantification & Grading Assessment Form

Related Documents	Quick Reference Guide: Wound Management for Frostbite Injury Client Health Education Resource: Wound Care for a Frostbite Injury Guideline: Wound Management

Assessment and Determination of Treatment Strategies

Assessment

1. Assess client's situation for factors that led to the development of the frostbite injury.
   a. Inadequate or no cold-weather appropriate clothing or footwear.
   b. Inadequate heating, access to appropriate shelter or no shelter.
   c. Use of tobacco in combination with cold weather.
   d. Use of alcohol, substances and/or medication that impair cognition in combination with cold weather.
   e. Winter sports enthusiast.

2. Assess client's medical conditions for factors that led to the development of the frostbite injury:
   a. Poor arterial circulation, (e.g., peripheral vascular/arterial disease, diabetes, Reynaud's phenomenon).
   b. Decreased mobility/sensation, (e.g., spinal cord injury, cardiovascular accident, peripheral neuropathy,)
   c. Impaired oxygenation, (e.g., chronic obstructive pulmonary disease, heart failure, anemias).
   d. History of frostbite injury(s).
   e. Extremes of age due to the poor body temperature control, (e.g., prematurity or advanced age).
   f. Cognitive impairment, such as dementia or delirium, that could lead to wandering for an extended period-of-time in cold weather and/or being inappropriately dressed for the cold weather.
   g. Trauma event, (e.g., fall of a cliff) leading to hypotension related to dehydration and/or blood loss.

3. Assess for risk factors that could lead to delayed healing of the frostbite wound:
   a. Inadequate psycho-social situations, (e.g., financial resources, housing)
   b. Inadequate nutritional status.
   c. Inadequately controlled diabetes.
   d. Compromised arterial and/or venous circulation.
   e. Tobacco use.
   f. Autoimmune conditions and/or immunosuppression leading to an increased risk of developing a wound infection
   g. Medications that interfere with wound healing, (e.g., non-steroidal anti-inflammatory (NSAIDS), antineoplastics, systemic corticosteroids, anticoagulants, vasopressors).
   h. Colonization with a Multi-Drug Resistant Organisms (MDROs), such as, Methicillin-Resistant Staphylococcus Aureus (MRSA), Vancomycin-Resistant Enterococci (VRE), or other Antibiotic Resistant Organisms (AROs), if known.

4. Assess the frostbite wound(s):
   a. Location: usually upper and lower extremities, ears and/or nose, but can occur anywhere on the body, if the skin temperature has fallen to -2°C.
   b. Size: may vary in size, (e.g., tip of toe to the whole foot) and size of injury may increase over time.
   c. Wound bed: cyanotic skin, serous or hemorrhagic blisters, superficial open area, slough or necrotic tissue wet/dry eschar. See Appendix A and Appendix B.
   d. Exudate: small to moderate depending upon the amount of slough; may be no exudate if wound bed covered with dry eschar.
   e. Evidence of local infection; see Wound Infection: Guideline.
   f. Presence of pain; initially may not complain of pain but with re-warming of the site, pain can be severe.

Determine Treatment Strategies

Based upon the assessments above and the:
- Client's ability to comprehend and willingness to participate in their care
- Client's goals for care, preferences for treatment, with consideration of their culture and traditions, develop a care plan and implement interventions to treat the frostbite injury(s).

Interventions see QRG: Wound Management for Frostbite Injury

Rapid Rewarming

1. Rapid rewarming using a water bath is necessary to reverse some of the cold injury but must only be done when there is no chance of re-freezing injured areas, (e.g., after client has been transported to hospital).

2. Re-warming process can be very painful*;* ensure client has an appropriate level of analgesic to manage the pain as per MRP.

3. Remove any jewelry from the injured area(s). If clothing, such as socks or mittens, have adhered to the skin, leave in place as the bath will loosen the material allowing for easier removal.

4. For extremities, prepare the rewarming water bath with approximately 1000ml of hot (39-40°C maximum) tap water and 30ml of 2% Chlorhexidine Gluconate (CHG) with 4% Isopropyl Alcohol; CHG is used to cleanse the area.
   - Immerse affected areas in the water & CHG/alcohol bath. Ensure entire area of injury is within the bath, cover bath container with towel(s) or blanket(s) to conserve bath water temperature. Aim to keep the water temperature at 39-40°C; use a water thermometer, if available, to check the temperature approximately every 10mins and when needed, add additional hot water. Soak the injured areas for approximately 30 minutes or until area(s) becomes soft and pliable.

5. For nose and ears, apply gauze/cloth(s) well-dampened with hot (39-40°C maximum) tap water to the area(s) for approximately 30 minutes or until the area(s) become soft and pliable. Cover cloths with towel to maintain the heat. Re-dampen the cloths frequently. Use a water thermometer to check water temperature every 10mins and when needed, add additional hot water.

6. For injuries on the body, (e.g., back of leg, buttock), either immerse area(s) as per extremities above in #4 or cover area(s) with well-dampened gauze/cloths as per nose and ears in #5.

7. Once rewarming is complete, assess the area(s).
   - For the extremities, use the Frostbite Quantification & Grading Assessment Form (see Appendix B), or similar HA/agency assessment, to document the location, the skin changes of the injured area(s) and the grade of severity for each injury.
   - For nose, ears and body areas, use HA approved wound assessment tool to document the location(s) and extent of tissue injury for each area of concern.

On-going Wound Care

1. Cleanse frostbitten areas:
   - Immerse the affected extremity(s) in a warm, (e.g., as per client comfort 36-37°C) water bath; CHG/ alcohol is not required. The water bath supports cleansing of open areas, removal of slough/necrotic tissue, mobility of the joints and comfort. The length of immersion, frequency and timeframe is to be determined by care team, (e.g., 30 min. daily for first 1-2 weeks) based upon the need for wound cleansing, (e.g., the development of eschar), joint mobility and comfort.
     - If area requires more cleansing than water can provide, consult with Nurse Specialized in Wound Ostomy Continence (NSWOC)/Wound Clinician(WC) for consideration of the use of antiseptic cleanser, (e.g., Anasept or Vashe compresses for 5-10mins; do not use on drying/dry eschar.)
   - For nose and ears and areas on the body, apply gauze/cloth(s) well-dampened with warm (36-37°C) water to the area(s) to help remove slough/necrotic tissue.
   - When the water bath is no longer required, Normal Saline can be used for open wound cleansing.

2. Manage blisters, if present:
   - **Clear serum blisters**: Exposure to thromboxane and prostaglandins found within the serous exudate of the clear blisters can cause further tissue damage and should be **debrided o**r **aspirated** by a health care professional who is competent to perform Conservative Sharp Wound Debridement, (e.g., MRP, NSWOC/WC or RN with additional education).

- **Hemorrhagic blisters:** Blood-filled blisters are an indication of deep tissue and deep vessel injury and should be left intact; **do not debride**. If needed, blisters that impinge upon the joints may be aspirated after the first week of care.

3. In addition to their analgesic effect, in the early days of the injury, NSAIDs may provide systemic blocking of both prostaglandins and thromboxane that may be helpful in limiting the extent of the injury. These medications are not to be given if client is receiving alteplase (or any other thrombolytic agent) or enoxaparin, or any other anticoagulant.

4. Aloe vera may inhibit the production of thromboxane (a vasoconstrictor) at the wound level:
   - For at least the first five days of the post-injury phase, application of an aloe vera-based product, (e.g., Aloex), should be done with each dressing for all frostbite injured tissue, (e.g., mottled or cyanotic tissue, open wounds, de-roofed/aspirated clear blisters and hemorrhagic blistered areas). Ears and nose may need to be left exposed (dressing not needed) and may need repeat application of the aloe vera-based product every few hours during waking hours.

5. Wound progress:
   - For injuries with a low grade of severity, a moist wound healing environment will support wound closure; the use of the aloe vera-based product, such as Aloex, may be continued or alternatively, use a hydrogel product, (e.g., Intersite Gel). For injured areas on the nose or ears, the aloe vera-based product may be continued as a moisturizer which may need to be repeated every few hours during waking hours; leave the areas open to air.
   - For frostbitten areas with a higher grade of severity, the wounds may initially have a large amount of exudate but then likely will evolve into a dry eschar. Other areas, such as the circumferential tips of the digits, may have little or no exudate due to the severity of the vascular damage.
     - Dry eschar should be maintained; wound healing may take place under the eschar, or the area, such as a finger, may mummify over time and self-amputate. Frostbite area(s) may require surgical amputation but the decision is not made until several weeks following the injury to allow the full extent of the injury to be determined.
     - If client has arterial insufficiency, is diabetic or has a client specific risk for infection, consider local antimicrobial treatment, (e.g., 10% Povidone Iodine) which will also promote drying of the frostbitten areas on toes and/or feet. Consult NSWOC/WC.

7. To manage exudate, depending upon the area(s) of injury on hands and feet, the wounds may be dressed individually or all under one dressing.
   - Consider the area to be dressed, the amount of expected exudate and the frequency of dressing changes to determine appropriate dressing format, (e.g., ribbon, sheet, digit) and product, (e.g., gauze for small exudate, hydrofibre (Aquacel Extra) or hydroconductive (Drawtex) for moderate to copious exudate).
   - In initial days of the injury, areas can become quite edematous; avoid tight circumferential dressings.
   - If client is at risk for infection, (e.g., frostbite areas on an unkempt foot) consider an antimicrobial or antifungal powder.

8. Protect web spaces of injured toes or fingers from pressure and/or maceration, (e.g., light foam, gauze, or transfer dressing).

9. For those injuries that progress to dry eschar, leave open to air as much as possible and do not soak, (e.g., tub bath (may shower), washing dishes without gloves).

10. Elevate limbs, (e.g., use of pillows) to decrease edema in the injured areas.

11. Protect injury area(s) from trauma, consider use of bed cradle to keep blanket weight off limb(s). If injury on the foot involves more than the toes, client should not ambulate until the injury(s) has stabilized and only then ambulate with the foot well-protected from trauma.

12. Refer to Occupational Therapist (OT)/Physiotherapist (PT) for assistance with range of motion exercises, mobility, post-amputation footwear or hand dexterity as needed. Compression therapy, (e.g., finger

wrapping) should be avoided in the early weeks of the injury due to the risk of compounding the ischemia in the area; if used later in treatment, use with caution.

13. Refer to Registered Dietitian for nutritional support as needed, (e.g., high calorie, high protein, of fluid intake). If Dietitian not available, consult HealthLink BC Registered Dietitian Services at 811 or www.healthlink.bc.ca/healthyeating .
14. Refer to Social Work for assistance with any housing issues and/or connection to community care services.

Client Education and Resources (see Client Health Education Resource)

1. Explain how skin is injured when frostbitten and the stages the wound(s) go through: blistering, open wound(s) that closes/heals, dry wound(s)) that over time may go on to heal, and the potential for mummification.
2. Advise the client the injury can worsen over the first few days and that it can take up to 3-4 weeks for the wounds to show the full extent of the injury.
3. Advise client not to use tobacco or alcohol, as both can cause further vasoconstriction to the injured area(s); consider a non-nicotine-based substitute for tobacco and non-alcoholic drinks. Provide client with Community Services information as to who could assist them with this.
4. Wound care:
   - For the first few weeks of injury, it is important to attend all of the wound care appointments for dressing changes and assessment of the extent of the injury.
   - For wounds where dressings are no longer needed as the areas are now dry/eschar, it is important not to soak the areas, (e.g., having a bath (showering is okay), doing dishes without rubber gloves, wearing wet socks/shoes).
5. As per OT/PT, encourage client to do range of motion exercises and splint digit(s) and/or extremity(s) prevent or minimize contractures.
6. As per OT/PT encourage client to use any offloading or protective devices, (e.g., specialty shoe).
7. Encourage client to eat healthy meals to support wound healing or a diet as per Registered Dietitian.
8. For cases of severely frostbitten fingers or toes, the care plan may be to allow the digit to dry to the point of mummification and then self-amputate (fall off). Should the digit self-amputate; client should advise MRP or NSWOC/WC of this situation. The amputated digit can be disposed of in household garbage.
9. Once areas have healed:
   - Protect the area(s) from the cold, (e.g., wear appropriate thickness of gloves and socks for the temperature, ensure gloves, socks, shoes/boots remain dry). Areas previously frostbitten are susceptible to another injury.
   - For the client with amputation of toes or partial foot, advise regarding the need for on-going properly fitted shoes.
   - Protect the area(s) from the sun by using a strong sunscreen, (e.g., greater than 40 SPF) and prevent exposure to the sun, (e.g., avoid sandals if toes have been injured, wear a hat to protect ears or nose).

Discharge/Transition of Care

Communicate the client's frostbite wound care plan to the receiving site.

Client Clinical Outcomes

1. Client's frostbite injuries will heal with no/minimal amputation possible.
2. Client will maintain their range of motion as much as possible given the extent of injury.

Assurance Indicators

To assess the quality of care, the following quality assurance indicators may be used by a HA or agency:

1. Contributing factors were addressed.
2. Appropriate interventions were implemented to treat frostbite wounds.
3. Wounds did not become infected.
4. Education materials were provided regarding post injury care and preventing/minimized re-injury.

Documentation

1. Document, as per Health Authority or agency policy, the interventions provided as per the care plan, the clinical outcomes, and any revisions to the frostbite wound care plan.
2. Document the client and/or family education given, and written materials provided.

Definitions

Client: generic term used to describe a person accessing care regardless of care setting; patient in the hospital, client in community; person-in-care in long-term care.

MRP: Most Responsible Provider, (e.g., physician, surgeon, nurse practitioner).

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Document Management

This guideline is based upon the best evidence-based information available at the time it was published and avoids opinion-based statements, where possible. It was developed by the Provincial Nursing Skin & Wound Committee and has undergone provincial partner review.

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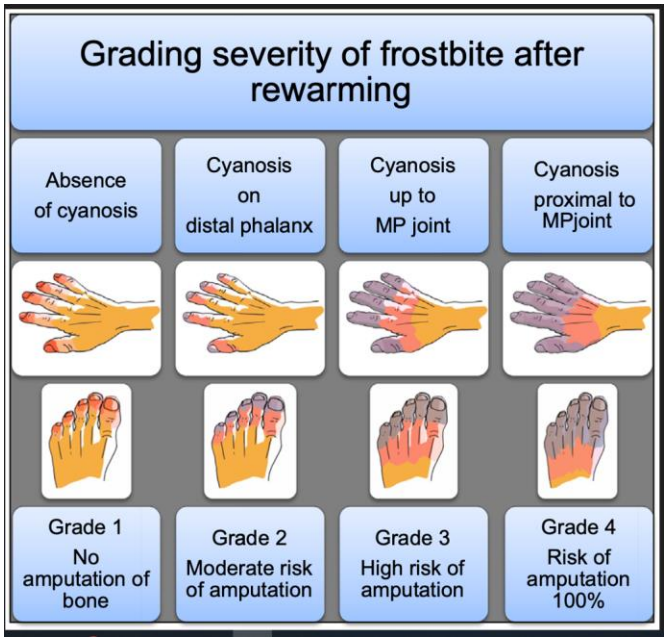
Appendix A: **Frostbite Grade & Appearance** photos used with permission A. Poole MD FRCSC

Although changes can occur within the first few days of injury, it can take 3-4 weeks for the full extent to be known.

A reason for treating Grade 2 aggressively is some injuries are clearly Grade 3 the next day.

Appendix B: Frostbite Injury Quantification & Grading Assessment

Frostbite Injury Quantification & Grading Assessment	Client Information



Source: Cauchy E. et al, Wild & Env Med 27, 92-99 (2016)

The grading of severity should be done:

- Immediately after re-warming
- Daily for the first week post-injury
- Weekly for the next 3-4 weeks until the full extent of injury known.

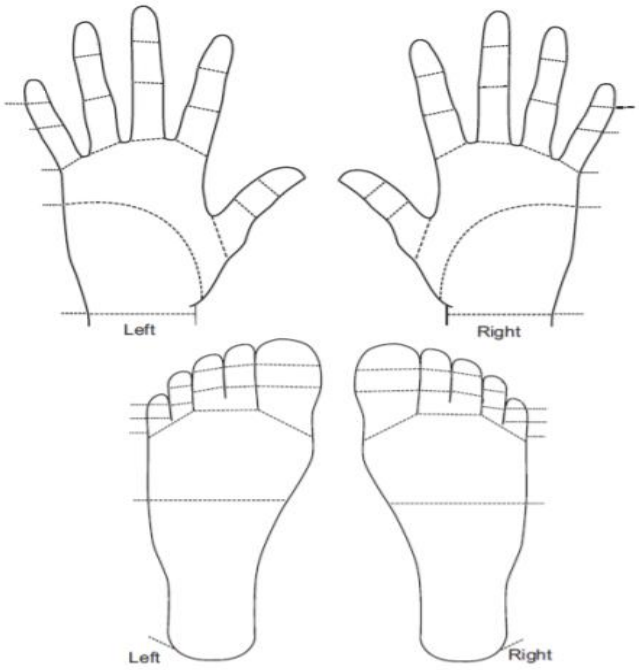
Note: Injury may progress clinically for the first 72 hours, in particular, a Grade 2 injury can quickly transition into a Grade 3 with its higher risk of amputation.

Assessment of skin changes should be completed when the grading of severity is done.

For each assessment, indicate on the diagram the grade of severity and skin changes using the following codes:

Grade of Severity: G1 G2 G3 G4 **Skin Changes**: Cyanosis(C) Serous Blister(SB) Hemorrhagic Blister(HB) Eschar(E) Open(O)

Date:_____ **Time:**_____ **Signature:**_____
YYYY/MM/DD HH:MM



Date:_____ **Time:**_____ **Signature:**_____
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