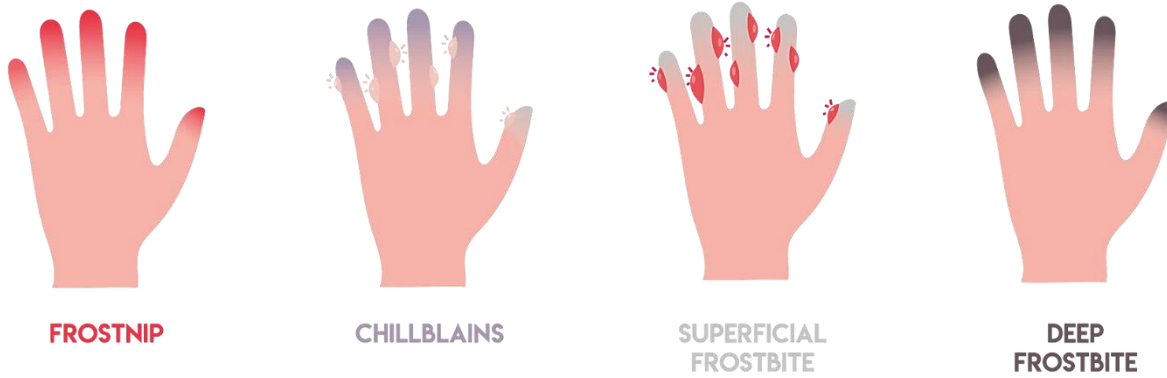


# SUMMARY OF FROSTBITE MANAGEMENT IN CHILDREN

- Staging
- Grading For Deep Frostbite
  - Grade 1
  - Grade 2
  - Grade 3-4
- Hyperbaric Oxygenation (HBO)
- Dosing
  - Iloprost
  - Alteplase
  - Analgesia
  - Aspirin and NSAIDs
- References

## STAGING



## GRADING FOR DEEP FROSTBITE

Grading severity of frostbite after rewarming			
Absence of cyanosis	Cyanosis on distal phalanx	Cyanosis up to MP joint	Cyanosis proximal to MP joint
Grade 1 No amputation of bone	Grade 2 Moderate risk of amputation	Grade 3 High risk of amputation	Grade 4 Risk of amputation 100%

## SUMMARY OF FROSTBITE MANAGEMENT IN CHILDREN

Suspected deep frostbite



Rewarm



Assess grade after rewarming



### Grade 1 (No risk of amputation)

No specific treatment

### Grade 2 (Low risk of amputation)

< 72 hours from rewarming

Iloprost infusion for 6 hrs per day for 5 days\*

< 24 hrs from rewarming

CONSIDER Alteplase (TPA) infusion for 6 hrs day 1 only, started 1 hr after Iloprost commenced

+ Start heparin infusion without bolus once TPA commenced OR S/C enoxaparin after the infusion is completed and no bleeding has occurred (minimum duration of anticoagulation is 72 hrs^)

CONSIDER HBO (daily for up to 14 days) to start ASAP if response to Iloprost ± TPA inadequate – there will be access limitations based on medical stability, consult HBO Physician on call

### Grade 3-4 (High risk of amputation)

< 72 hrs from rewarming

Iloprost infusion for 6 hrs per day for 5 days\*

< 24 hrs from rewarming

IF NOT CONTRAINDICATED Intra-arterial Alteplase – consult IR urgently, followed by heparin/enoxaparin

If not amenable to IA therapy or IR not available THEN USE, use systemic Alteplase + anticoagulation as per Grade 2

HBO (daily for up to 14 days)

## HYPERBARIC OXYGEN (HBO)

HBO Monday-Friday (7am-6pm) call FMC HBO 403 9446645. After hours and on weekends call the Hyperbaric Physician on call at FMC via ROCA > FMC > Other > Hyperbaric.

There are significant limitations to the capability of the Calgary HBO chamber. The treatments are 2 hours in duration during which time the child must be alone in the chamber without IV therapy running.

The Edmonton and Vancouver HBO chambers can cater for higher levels of acuity.

## SUMMARY OF FROSTBITE MANAGEMENT IN CHILDREN

### DOSING

#### Iloprost

< 40 kg

- Start at 0.05 mcg/kg/hour (0.83 nanograms/kg/min)
- Titrate up every 30 min by additional 0.05 mcg/kg/hour, if systolic BP  $\geq 5^{\text{th}}$  percentile (70 mmHg + 2 x age in years)
- Max dose 0.15 mcg/kg/hour (2.5 nanograms/kg/min, MAX 10 mcg/hour)
- Continue for total 6 hours
- Repeat daily for 5 days
- If infusions day 1 and 2 tolerated well, start day 3 at max rate
- If hypotension occurs, do not support with vasopressors or fluid boluses (unless hypovolemia is suspected), simply hold Iloprost at highest tolerated dose

$\geq 40$  kg

- Start the intravenous solution at 2 mcg/hour, then increase dose by 2 mcg/hour every 30 minutes if systolic BP > 90 mmHg, up to:
- a MAX rate of 6 mcg/hour for patients 40 to 50 kg
- a MAX rate of 8 mcg/hour for patients 51 to 74 kg or
- a MAX rate of 10 mcg/hour for patients 75 kg or more
- Continue infusion for 6 hours daily regardless of the rate

#### Alteplase

< 40 kg

- No initial bolus dose (unless recommended by Hematology)
- Infusion: give 0.15 mg/kg/hr for a total of six (6) hours
- Total MAX dose (including bolus = 100 mg)

$\geq 40$  kg

- Bolus: give 0.15 mg/kg intravenous over 15 minutes
- Infusion: give 0.15 mg/kg/hr for a total of six (6) hours
- Total MAX dose (including bolus = 100 mg)

Intra-arterial alteplase dosing and duration to be determined by IR

Consider low dose Alteplase (0.01-0.06 mg/kg/hr) if very small infant and/or increased risk of bleeding or low odds of benefit.

Note that the titration of Alteplase to higher doses e.g. 0.5 mg/kg/hr is challenging in frostbite as there is no clear marker that thrombolysis has been achieved.

### IMPORTANT

If time to transport to ACH is > 24 hours, consider starting Iloprost locally.

Start Iloprost (+/- TPA) as soon as possible.

## SUMMARY OF FROSTBITE MANAGEMENT IN CHILDREN

Time delay limit recommendations after rewarming are suggested and not absolute. If in doubt, seriously consider treating. There are case reports of benefit from late treatment.

If Iloprost and TPA are not used due to the presentation time delay post-rewarming, HBO should still be used.

\*The rationale behind the 6 hours of Iloprost infusion per day is also not absolute. If deterioration in grading occurs once Iloprost is stopped, consider prolonging the infusion. It can technically be run continuously for >5 days, as in one study it was used continuously for 8 days.

Do not respond to Iloprost induced systemic hypotension with vasopressors or fluid boluses. Reduce the dose of Iloprost to the highest dose tolerated.

Do not place an arterial line in the affected limb (unless required for regional thrombolysis by IR). Most Iloprost infusions can be monitored with cuff BP measurements in an unaffected limb.

^If Alteplase is used, anticoagulation should be continued for at least 72 hrs, but can be extended if recommended by Hematology, e.g. evidence of ongoing arterial thrombosis with salvageable tissue in that distribution, DVT prophylaxis. Some centers use enoxaparin for 14 days.

### Analgesia

From rewarming and beyond, frostbite can cause severe pain. Consult acute pain service (APS).

### Aspirin and NSAIDs

There is no evidence that aspirin is useful, but the use of NSAIDs for analgesia is logical due to the potential benefit from the anti-platelet effect. NSAIDs should probably be delayed until after TPA is administered.

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