NHS
London and South East
Burns Clinical Network

Nitrous Oxide

Nitrous Oxide Burn Pathway:

Frostbite Burn

Use this pathway for patients presenting with cold injury/frostbite burns associated with nitrous oxide canisters.

CONTACT DETAILS

St Andrews Centre (Chelmsford)
Adults **0300 44 30475**
Children **0300 44 30405**

Chelsea & Westminster Hospital (London)
Adults **020 3315 2500**
Children **020 3315 3706**

The Royal London Hospital (London)
Adults and Children **020 3594 5693**

Queen Victoria Hospital (East Grinstead)
Adults **01342 414440**
Children **01342 414469**

Stoke Mandeville Hospital (Aylesbury)
Adults and Children **01296 315040**

John Radcliffe Hospital Oxford
Adult and Children **01865234760**

First Aid

Immediate First Aid

Time critical: first aid should ideally be started within 3 hours of injury.

- Rapidly rewarm the affected area by immersion in warm water[1] for 30–60 minutes.
- Do not rub or massage the affected area as this may cause further tissue damage.
- Give oral analgesia/anti-inflammatory treatment if appropriate: consider ibuprofen 10mg/kg, maximum 600mg four times daily, or aspirin 300mg.

Delayed presentation: if the patient presents late[2], rewarming may no longer be clinically effective. Assess tissue viability, rewarm if appropriate, and proceed to burns referral.

[1] Water temperature should be comfortable for the patient, ideally in the normal range for core body temperature (about 35-37ºC), and not more than 39ºC. The water temperature must be checked regularly and adjusted accordingly.
[2] Late presentation is typically after 24 hours, or when irreversible clinical effects are present.

Refer to Burns Service

- Refer to the burns service for specialist advice using the same telereferral system for burns patients.
- Any patient with signs of freezing cold injury including blistering, evidence of deep tissue involvement, circumferential injury, persistently impaired perfusion or concerns about viability, significant pain, or delayed presentation must be discussed with a burns service for further assessment and management.

Burn Wound Assessment and Treatment

- Assess the burn wound using the usual burns protocol including depth, size, location, perfusion, sensation and signs of infection.
- Apply a dressing appropriate to the depth and type of injury.
- Provide suitable analgesia and safety-netting advice.

- Remember that the extent of injury may not be clinically fully apparent at the time of first presentation, especially with erythema, and further progression may occur over days or weeks.

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Treatment plan

Nitrous Oxide-Related Neurological Risk

Start hydroxocobalamin vitamin B12 treatment where nitrous oxide-related neurological harm is suspected: 1 mg IM stat, then three times weekly for 2 weeks. Arrange GP follow-up and continue three-times-weekly IM injections until symptoms/signs plateau.
Important: vitamin B12 levels may appear falsely reassuring due to pathway disruption. Consider methylmalonic acid and homocysteine levels where diagnosis is unclear.

Surgery and Skin Graft Consideration

Due to the commonality of full thickness injuries in nitrous oxide-related frostbite burns, consider early senior burns review for possible surgical management, including debridement and skin grafting where clinically indicated.

VTE Risk

Treat as high risk for venous thromboembolism due to the increased risk of blood clots associated with nitrous oxide use. Assess for symptoms/signs of DVT, PE or cerebral venous sinus thrombosis and manage according to local VTE guidance.

FOLLOW UP

- Refer to Re-Solv for support and advice around nitrous oxide use - www.re-solv.org.
- Consider physiotherapy, talking therapy or substance misuse support as appropriate.
- Provide clear safety-netting advice and ensure follow-up with GP, burns service and relevant specialist teams.

Supporting Evidence:

1. Paris A, Luke Lake,2 Albert Joseph,2 Anna Workman,2 Joseph Walton,2 Tom Hayton,3,4 Nikos Evangelou,5,6 James B Lilleker, Ruth M Ayling, David Nicholl, Alastair J Noyce1,2. Nitrous oxide- induced subacute combined degeneration of the cord: diagnosis and treatment. Pract Neurol 2023;23:222–228. doi:10.1136/pn-2022-003631
2. C. Joerres, M. Patyjewicz, M. Cetin, T. Bariana, B. Onen, L. Hone, J. Green, D. Tambe, P. Dalby, A. Keller, A. Noyce, Assessing the prevalence of nitrous oxide usage in patients aged 35 years or under presenting with unprovoked VTE between 2021-2023., Thrombosis Update, https://doi.org/10.1016/j.tru.2024.100184.
3. Govind S. Mann MBBS, Mustafa Al-Kharsan MD*, Constantine Farmakidis MD, Mazen M. Dimachkie MD, Long Davalos MD, Mamatha Pasnoor MD. Diagnostic Challenges and Key Insights of Nitrous Oxide Neuropathy: A Case Series. RRNMF Neuromuscular Journal 2025;6(2)
4. M. Hamdan, M. Hanala, D. Minter; Internal Medicine, McLaren Oakland, Pontiac, MI, United States. Pulmonary Embolism in a Chronic Nitrous Oxide Abuser: The Role of Homocysteine and Vitamin B12 Deficiency in Venous Thromboembolism Am J Respir Crit Care Med 2024;209:A2129
5. Barts Health, Patient information Vitamin B12 Treatment Patient Guide Ambulatory Emergency Care Pathway for Spinal Cord Degeneration due to Nitrous Oxide Misuse - 1269-Vitamin-B12-Treatment-Patient-Guide.pdf