Technical Bulletin

"It's OK to Pass Gas in the Ambulance!"

The Use of N_2O/O_2 in Pre-hospital Emergency Medicine

Overview

Nitrous oxide/Oxygen N_2O/O_2) is a medical gas mixture that is both a sedative and an analgesic. In the pre-hospital emergency field, the gas mixture is widely used around the world by ambulances services. The gas primarily delivered in these markets in a pre-mixed, 50%/50% N_2O/O_2 mixture. Its efficacy and safety are well documented. Because the route of administration is by patient-controlled inhalation, the gas mixture is ideal for short duration patient rescues and transports.

The gas is delivered to the patient via a demand valve which reacts to the patient's inspiratory effort and provides a flow rate equivalent to that demanded. When the patient stops inhaling, the gas ceases to flow.

The gas is supplied either in a 50/50 premixed state in a single cylinder or can be supplied from individual cylinders of N_2O and O_2 using a blender. Regardless of the delivery method, in the pre-hospital environment these two gasses are always provided in a 50/50 mix.

How it Works

The way that the active ingredient, N_2O works is not completely understood however it does increase the activity of the principal inhibitory neurotransmitter, causes the release of endogenous opioids and causes dopamine release. Very little N_2O is absorbed by the body. A person inhaling N_2O breathes out most of it as it is not metabolised. The peak effect is quickly reached within 2–5 minutes, and its duration of action is about the same. Side effects include light-headedness, headache, dizziness, confusion, nausea and vomiting, as well as feelings of euphoria.

Indications

N_2O/O_2 Analgesic Gas is delivered, on demand, to a conscious, spontaneously breathing patient.

The gas is suitable for use in:

- Pre-hospital (emergency medical) use, and
- In-hospital use (ER, Labor and Delivery etc.)

O-Two Medical Technologies Inc.
45A Armthorpe Road Brampton, ON, Canada L6T 5M4
+1 905 792-6896 | +1 800 387 3405 Toll Free
+1 905 799 1339 Facsimile
www.otwo.com
resuscitation@otwo.com

Contraindications

The contraindications for this gas mixture include, but may not be limited to:

- Hypersensitivity to the medication
- Head injuries with impaired consciousness
- Maxillofacial injuries
- Artificial, traumatic or spontaneous pneumothorax
- Air embolism
- Middle ear occlusion, ear infection
- Decompression sickness
- Abdominal distension / intestinal obstruction

N_2O/O_2 mixtures must never be used in any condition where air is trapped in the body and expansion (up to 3x original size) would be dangerous.

NOTE: Without supplemental oxygen, inhaling nitrous oxide can cause hypoxia

Occupational Exposure

Prolonged or repeated exposure to laughing gas can lead to a vitamin B deficiency, reproductive problems in pregnant women, and numbness. Because very little nitrous oxide is absorbed by the body, a person inhaling the gas breathes out most of it. This will then contaminate the environment unless adequate ventilation or gas scavenging is employed.

Because the gas is heavier than air the vehicle should be well ventilated otherwise the gas may present risks to emergency personnel, through both short-term intoxication and long-term cumulative exposure. However,

Scavenger systems exist and should be used to vent the gas outside the vehicle.

Conclusions

Nitrous oxide can be safely and effectively used in the prehospital environment. As the gas is not routinely used, the exposure to its effects by EMS personnel is both limited and of short duration. Precautions however should be taken to avoid a build-up of the exhaled gas in confined spaces (such as the back of an ambulance). These precautions can be as simple as the use of the ambulance ventilation system or the use of a dedicated scavenging system.

It's sedative and analgesic effects are similar to that of opiates; however, nitrous oxide doesn't require an IV and is self-administered by the patient. N_2O/O_2 mixtures are a safe, effective and inexpensive tool for the control of pain in the pre-hospital environment.

References

- Emmanouil DE, Quock RM. Advances in understanding the actions of nitrous oxide. Anesth Prog. 2007;54(1):9–18.
- Thal ER, Montgomery SJ, Atkins JM, et al. Self-administered analgesia with nitrous oxide. Adjunctive aid for emergency care systems. JAMA. 1979;242(22)2418–2419.
- Ducasse JL, Siksik G, Durand-Bechu M, et al. Nitrous oxide for early analgesia in the emergency setting: A randomized, double-blind multicenter prehospital trial. Acad Emerg Med. 2013;20(2):178–184.
- Donen N, Tweed WA, White D, et al. Pre-hospital analgesia with Entonox. Can Anaesth Soc J. 1982;29(3):275–279.
- Joint Royal Colleges Ambulance Liaison Committee. (2006). UK ambulance service clinical practice guidelines. Retrieved Dec. 31, 2013, from www2.warwick.ac.uk/fac/med/research/hsri/emergencycare/prehospitalcare/jrcalcstakeholderwebsite/guidelines/clinical_guidelines2006.pdf.
- Bledsoe BE, Myers J. Future trends in prehospital pain management. JEMS. 2003;28(6):68–71.
- Faddy SC, Garlick SR. A systematic review of the safety of analgesia with 50% nitrous oxide: Can lay responders use analgesic gases in the prehospital setting? Emerg Med J. 2005;22(12):901–908.
- Alonso-Serra HM, Wesley K. Prehospital pain management. Prehosp Emerg Care. 2003;7(4):482–488.
- Housel FB, Murphy TG. Ambient levels of nitrous oxide in a modular ambulance. Am J Emerg Med. 2008;26(2):186–188.