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TV-PGN-05 Practice Guidance Note

Entonox – Clinical use during wound management by the Tissue Viability Nurses V01

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Author/Designation	**Kevin Chapman – Tissue Viability - Modern Matron**	
Responsible Officer / Designation	**Anne Moore – Director of Infection Prevention and Control**	

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1 Introduction

1.1 Many procedures or interventions are painful to the patient and the level of discomfort experienced is often underestimated or discounted as being part of a therapeutic or beneficial intervention.

1.2 Entonox is an inhaled agent that provides effective analgesia that can be self-administered to provide immediate pain relief. It is particularly suited for the relief of acute pain.

2 Purpose

2.1 This practice guidance note (PGN) is to guide staff in the use of Entonox. It is not designed to restrict or limit professional judgment and decision-making.

3 Scope

3.1 This practice guidance note (PGN) applies to only those staff within Northumberland, Tyne and Wear NHS Foundation Trust (the Trust/NTW) identified as authorized and competent to provide and administer Entonox in the context of reducing dressing change pain and improving client concordance.

4 Definitions

4.1 **Entonox** is a homogeneous gas mixture containing 50% nitrous oxide (N_2O) and 50% oxygen (O_2). It is stored in cylinders at 137 bar. This pressurized mixture remains gaseous at temperatures above –6^{o}C.

4.2 **Nitrous oxide** is a colourless, sweet smelling gas with powerful analgesic properties. Pulmonary transfer of nitrous oxide is rapid, with onset of effect in seconds and full analgesia within one to two minutes. Likewise it is rapidly eliminated from the blood, via the lungs, when inhalation ceases.

4.3 Entonox combines the analgesic effect of the nitrous oxide with the anti-hypoxic effect of 50% oxygen.

5 Duties and Responsibilities

5.1 Trust Responsibility

- The Trust is responsible for delivering ‘best practice’ policies to ensure patient safety throughout their hospital stay

5.2 Medical staff’s Roles and Responsibilities

- It is the responsibility of the medical staff who initiated the treatment, using Entonox® as analgesia, to ensure that consent has been given by the patient, and the patient is able to appropriately use the device

- It is the responsibility of the medical staff to ensure that all documentation is correctly completed

- It is the overall responsibility of the medical staff who initiated the treatment to resolve any problems that may occur

5.3 Tissue Viability Nurses

- When involved in a patient's care, it is his/her responsibility to seek informed consent for anaesthesia, having discussed the benefits and risks with the client and the broader Multi-Disciplinary Team (MDT)

5.4 Nursing Staff

- In the unlikely event that the nursing team may have to manage or administer Entonox to a patient this will only be done as an exception and after discussion with the broader MDT. This must be care planned and monitored. It will remain the responsibility of the nursing staff caring for patients using Entonox® to be adequately trained to care for a patient during and after its use, and be able to correctly assess pain levels this may involve completion of the e-learning competency training. The Tissue Viability nurses will assist in ensuring that designated staff have access to training and are competent to assist with the administration of the Entonox.

6 Storage

Entonox® cylinders must be stored in accordance with data sheet information from BOC (Entonox cylinders will be stored and monitored by the Tissue Viability team in line with Trust medical gases procedures)

- Entonox® is stored in white or blue cylinders with blue and white shoulders. It is supplied in cylinders at a pressure of 137 bar and must be stored above its pseudo-critical temperature of -6°C. Below this temperature the N2O liquefies in a process called lamination. If this occurs a high concentration of O2 will be delivered first with little analgesic effect, but as the cylinder empties the mixture will become progressively more potent and hypoxic as it approaches 100% N2O.

- A single Entonox Cylinder will be stored securely by the TVN's

- The cylinder will be stored by the TVN's in their locked cupboard securely held and behind a locked fire door displaying a clear warning notice.

- Weekly checks will be implemented to monitor security, integrity and expiry dates of the stored cylinder.

- If cylinders have to be stored outside, they must be stored in a designated and clearly signed area of the gas store and the temperature monitored. If the temperature in the store has fallen below 10°C, then before being used, cylinders should first be either:

a. Stored horizontally for 24 hours at a temperature above 10°C, or,

b. Stored for at least 2 hours at a temperature above 10°C, then completely inverted three times

7 Prescribing and administration

7.1 Entonox must be prescribed by medical staff or non-medical prescribers with responsibility for the care of the patient prior to use and should only be administered by TVN staff who are trained in both its use and the equipment available for its administration.

7.2 Entonox is self-administered using a dedicated Entonox demand valve or mask

8 Indications

8.1 Entonox is indicated for the relief of acute moderate to severe pain of any aetiology (see contraindications at section 6.3 for exclusion criteria). The pain or discomfort could be: as the result of injury or due to a dressing procedure carried out in hospital.

- Entonox® use **must not preclude definitive pain management** for on-going pain related to a procedure or painful condition

8.4 Contraindications

Contra indication	Rationale
Pneumothorax,	The nitrous oxide constituent of Entonox passes into all gas-containing spaces in the body faster than nitrogen passes out. This can cause expansion of the gas space, compressing surrounding structures.
Bowel obstruction	
Air embolism	
Decompression sickness or following a recent underwater dive	
Following air encephalography	
Severe bullous emphysema	
During myringoplasty (Ear drum repair)	
Head injuries with impaired consciousness.	Entonox will cause sedation, which may confound neurological observation of the patient.
Drug or alcohol Intoxication	Drowsiness and aspiration would be a hazard in the event of vomiting.
Maxillo-facial injuries	The patient may not be able to hold the mask tightly to the face or use the mouthpiece adequately.
Heavily sedated patients	The patient may be unable to use the equipment properly and increased sedation may be hazardous.
Violence and Aggression	Entonox can exacerbate some clinical conditions, some clients may find the effects of the gas unsettling, strange or uncomfortable leading to stress, anxiety

	and potential increase in negative behaviours. Staff must assess this risk before use!

9 Side effects

9.1 General

9.1.1 Dry mouth, disorientation, dizziness, euphoria, loss of inhibition, feeling floaty, blurring vision, tingling sensation to lips, fingers and nose (harmless and will stop when inhalation of Entonox® is discontinued) and less commonly, nausea and vomiting, excessive sedation

9.2 Vitamin B12

9.2.1 N2O oxidizes cobalamin and thereby inactivates vitamin B12. Prolonged exposure to N2O may precipitate depression of white cell formation and other blood related issues

9.3 Cardiovascular effects

9.3.1 N2O may cause mild increases in pulmonary vascular resistance which may be significant in patients with pulmonary hypertension, particularly mitral stenosis

9.4 Other

9.4.1 Addiction to N2O has occasionally been reported and misuse is possible

10 Cautions

10.1 At high concentrations can cause sedation, unconsciousness and hypoxia. The very young and the very old require additional care in the administration of Entonox® due to possible mask fitting difficulties or inability to understand instructions for use

10.2 Chronic Obstructive pulmonary disease (COPD) – the high level of oxygen (50%) in Entonox® may depress respiration in a small number of patients who have raised CO2 levels.

10.3 Administration of Entonox® more frequently than 4 or more days and for more than 6 hours should have blood taken for megaloblastic anaemia and leucopoenia.

10.4 Although it is unlikely to occur it is recommended that the patient waits for 30 minutes before driving or operating heavy machinery following administration of Entonox®.

11 Infection Control Issues

11.1 Disposable lightweight tubing will be used.

11.2 If the tubing has been used, it is changed weekly and recorded. If it is visibly contaminated it is changed immediately; in accordance with the manufacturers guidelines.

11.3 A bacterial filter protects the tubing from internal contamination. The outside of the tubing that is held by the patient is socially cleaned in the same way as the rest of the equipment.

11.4 Tubing should be cleaned between patient use e.g. wiped with a detergent and water and dried thoroughly.

11.5 Each individual patient will have their own mouthpiece and bacterial filter or facemask and filter.

11.6 Administration devices, masks and mouthpieces are **single patient use only**.

11.7 If a patient is known to be colonized or infected with an alert organism, or has an acute infection then the tubing remains with the patient**. (Refer to IPC for specific advice)**

12 Health and Safety Issues

12.1 **Within NTW only the smaller cylinders should be used, should a situation arise where larger are required a separate and thorough risk assessment should take place before use:**

- Entonox® is a mixture of two substances, therefore to ensure thorough mixing small cylinders (E or smaller) should be stored on their sides

- Care must be taken when lifting and carrying smaller cylinders. Larger cylinders are transported using trolleys. Care must be taken when moving cylinders on and off trolleys and between store and clinical area

- Entonox® is excreted unaltered via the patient's breath so administration must take place in a well ventilated area****** to prevent others inhaling the Entonox®

- **** The evidence base for what constitutes a well ventilated area is sparse but literature and anecdotal evidence from practitioners experienced in the use of Entonox® suggest areas with air conditioning or open windows are adequate for occasional to regular use. Individual clinical areas will need to assess potential use and ventilation requirements before implementation.** Entonox should be used in a well ventilated area to maintain the average occupational exposure level of the healthcare professional to less than 100ppm (parts per million) over an 8 hour period.

- Control of Substances Hazardous to Health (COSHH) requirements must be adhered to i.e. an assessment of risk and implementation of methods to control the risk. The risk assessment should be carried out by TVN before commencement of any Entonox use to ensure

adequate ventilation is in place and wards will be provided with relevant risk assessments and COSHH data sheets. .

13 Training Requirements

13.1 **Aim -** To provide adequate information and knowledge to ensure the safe delivery of Entonox therapy to patients with acute pain.

13.2 **Objectives – Tissue Viability staff will be able to:**

- Define the indications for Entonox
- Describe Entonox and its effects
- List the contraindications/cautions in the use of Entonox
- Demonstrate an understanding of how the associated equipment operates
- Complete the BOC – 'Entonox - Discover pain management' E-learning competency training http://www.boctraining.co.uk/login/index.php

14 Children and adolescent considerations

14.1 Entonox is safe to use with children provided that they are capable of following administration instructions.

- Consider the young person's suitability for use of Entonox, including their ability and motivation to self-administer the gas
- Obtain age appropriate informed consent or implied consent from the young person
- The young person does not need to be fasted before the procedure
- Explain the procedure to the young person in an age/child appropriate language, including other options available for pain management during the procedure should the need arise. (The persons mental health issues and level of learning difficulties may influence the type and method of communication)
- Similarly, explain the potential benefits and side effects anticipated, with emphasis on how the Entonox might make them feel
- Use alternative methods of communication as necessary i.e. Makaton, visual aids. (Seek support to facilitate this from appropriately competent practitioners)
- Show the young person the equipment to be used and demonstrate the noise associated with inhaling through the demand valve
- Choose a mask or mouthpiece as preferred by the young person and to optimize ease of gas delivery
- Consider using distraction techniques and play as appropriate

- Allow the young person to practice inhaling the gas prior to starting the procedure to ensure that he/she can activate the demand valve and is confident and competent with the equipment
- Ensure the young person is in a comfortable and safe position

14.2 During the Procedure

- Ask the young person to breathe normally throughout the procedure
- Allow the young person to inhale gas for a few minutes prior to commencing the procedure to ensure full analgesic effect
- Use an age appropriate pain assessment tool
- Continuously assess the young person, observing skin colour and ability to obey commands, respiratory rate and any signs of pain or distress
- Observe the young person for any side effects

14.3 Following the Procedure

- Observe the young person for thirty minutes following the procedure
- It is recommended that the young person be supervised by the staff for between three to four hours following the procedure.

15 References and Associated Documentation

- Royal Marsden Manual of Clinical Nursing Procedures, Lisa Dougherty, Sara Lister, 9th Edition 2015.
- BOC Medical Gas Data Sheet http://www.bochealthcare.co.uk/internet.lh.lh.gbr/en/images/HLC_505605-MGDS%20ENTONOX%20(web)409_57640.pdf?v=7.0
- BOC Educational on-line material: http://www.boctraining.co.uk/login/index.php
- Entonox – Essential guide, http://www.bochealthcare.co.uk/internet.lh.lh.gbr/en/images/entonox_essential_guide_hlc401955_Sep10409_64836.pdf?v=2.0
- Entonox:; everything a parent-to-be needs to know: http://www.bochealthcare.co.uk/internet.lh.lh.gbr/en/images/501915-Healthcare%20ENTONOX%20Parents%20Brochure%20Rev2_02409_74836.pdf?v=1.0
- Entonox; conquering procedural pain in children: http://www.bochealthcare.co.uk/internet.lh.lh.gbr/en/images/entonox_kids_brochure_hlc_402615_jul09409_74838.pdf?v=1.0

Appendix 1

Evidence Based protocol for Practice

Initial Assessment	Rationale
Assess the degree of pain likely for the procedure being performed	To determine whether Entonox is required
Ensure that Entonox is not contra-indicated for the patient	To reduce the likelihood of complications
Assess individual patient for the ability to use Entonox. The patient should be able to: • Understand simple instructions (via an interpreter if necessary) • Hold the demand valve and inhale the gas through the mask or mouthpiece while breathing normally.	To ensure the patient is able to use Entonox effectively
If Entonox is considered inappropriate for either the patient or the procedure, alternative analgesia should be considered and prescribed.	
Preparation	
Ensure the Entonox has been prescribed on patients drug chart	To meet Trust policy
If Entonox is to be administered more frequently than every four days or for more than 6-12 hours, routine blood cell counts should be performed	To observe for : • evidence of megaloblastic change in red cells • reduced production of leucocytes
The area should be well ventilated to prevent the accumulation of nitrous oxide	To maintain a safe environment. The occupational exposure standard for long term exposure is 100 parts per million (ppm)
Staff should be trained in the use and application of Entonox	To allow staff to be aware of the side effects and occupational exposure limits of Entonox
Gather and prepare the following equipment: 1. Turn Entonox cylinder on and prime the administration set by pressing the test button on the back of the demand valve. 2. Check the cylinder to ensure it is at least a quarter full. If it is not arrange replacement 3. Attach the filter to mask or mouthpiece before attaching this to the demand valve	To ensure immediate availability of Entonox once inhalation commences To reduce risk of infection

Entonox cylinders should be checked carefully before use to ensure they contain the correct mix of 50% nitrous oxide and 50% oxygen	To prevent drug errors as stronger concentrations of nitrous oxide may be available in the hospital in similar cylinders
Ensure that a saturation monitor is available if the patient has respiratory or cardiac problems	To prevent using a cylinder that is at temperatures lower than -6^{o}C and has not been left to homogenise at 10^{o}C
To prepare the patient: • Explain the procedure to be carried out and how Entonox will be used, including information about the side effects • Reassure them that if side-effects occur they wear off quickly once they stop inhaling the gas	To relieve anxiety and determine level of co-operation
The patient should not eat anything for an hour before procedure.	To reduce the likelihood of nausea and vomiting.
Give supplementary analgesia as prescribed: • Oral or rectal drugs should be given some time before starting the procedure, to allow full effect. • The patient may continue to use their PCA if one is in progress • A bolus of intravenous opiate may be given if a high degree of pain is anticipated (Where prescribed)	To provide additional pain relief
The patient should be allowed to practice using the Entonox before the procedure is started	To ensure an effective technique is established
If the patient is unable to maintain an effective seal or inhale the gas effectively the use of Entonox should be abandoned and alternative analgesia and/or sedation should be prescribed Do not fix the mask or mouth piece with straps etc it is essential that the patient controls the inhalation to prevent over sedation.	
Administration	
To administer the Entonox: • Explain the procedure to the patient. Try to reassure them and explain that they should concentrate on breathing normally. • Offer the demand valve to the patient • If they have chosen to use a mask they should hold it over their mouth and nose, maintaining an airtight seal, and breathe normally • If they have chosen the mouthpiece they should hold it between their teeth and breath through their mouth only • Inhalation should commence for at least four breaths before the procedure starts	To establish an effective inhalation technique To ensure Entonox has taken effect before introduction of painful stimuli

The patient may need considerable encouragement to start inhaling the gas. It is worth persevering as any initial reluctance usually disappears once the patient realizes that the Entonox is working	
Monitoring	
Once administration has commenced: • The patient should continue to use the Entonox as required throughout the procedure and should be encouraged to breathe slowly and deeply	To provide effective analgesia with minimal side-effects
• If the patient hyperventilates they should be encouraged to exhale slowly	To prevent hyperventilation and fainting
Observe the patient throughout the procedure to determine: • Level of pain • The presence of any side-effects • Whether they are using the Entonox effectively Oxygen saturation should be monitored throughout the procedure if patients have an underlying cardiac or respiratory condition	To ensure that adequate pain relief is provided with minimal side-effects
If use of Entonox is unsatisfactory at any stage it may be necessary to stop the procedure until alternative analgesia and/or sedation has been prescribed and given	
• If the patient experiences any Entonox related side-effects they should be reassured, and cease inhalation until the side-effects wear off and the sensation of pain starts to return	
• For particularly painful procedures it may be advisable to wait for the patient to recommence inhalation before continuing	
Entonox related side-effects include: • Earache • Dry mouth • Dizziness or disorientation • Over sedation • Nausea and vomiting • Paresthesia in hands and nose (Pins and needles or Numbness)	
If the patient complains of earache inhalation should be stopped and alternative analgesia prescribed	To prevent perforation of the eardrum.
A dry mouth is a common side effect but is not usually distressing. The patient should be encouraged to continue inhaling the Entonox.	To provide effective analgesia
If the patient starts to feel dizzy or disorientated they may cease inhalation until the sensation starts to wear off and the sensation of pain starts to return.	To provide effective analgesia with minimal side-effects

The patient may choose to put up with these sensations and continue inhalation to maintain effective pain relief.	

If the patient becomes drowsy the seal around the mask or mouthpiece is lost and they will no longer inhale the gas. It is essential that only the patient holds the mask/mouthpiece	To prevent the onset of deeper stages of analgesia and sedation and loss of protection of the laryngeal reflex
If the patient complains of nausea they should be encouraged to cease inhalation if they wish Less commonly the patient may vomit. If so: • Remove the demand valve immediately • Reassure the patient and clear any obstruction to breathing • Clean and replace face mask/mouthpiece • Clear vomit from the demand valve by vigorously shaking it using a "flicking" downward action, taking care regarding splash risk. The patient may then recommence administration if they wish	The side-effects of Entonox wear of quickly once inhalation ceases To prevent inhalation of vomit The side-effects of Entonox wear off quickly once inhalation ceases
Technical Problems	
If any of the following technical problems occur they should be reported to TVN immediately: • Equipment not delivering gas • Leak at joint between regulator and cylinder valve • Demand valve leaks or does not shut cleanly • Demand valve does not stop giving flow after test button is released • Staff should ensure that the valve is shut and issues reported	To ensure equipment is safe and in good working order
Completing Procedures	
After use : • Ensure the patient is comfortable • Check the cylinder gauge for contents: If less than ¼ full, ring arrange to replace the cylinder • Turn off the cylinder and depressurize the system fully by operating the test button	To ensure that there is an adequate supply of Entonox for the next patient / session To prevent misuse and to maintain a safe ward environment
Monitoring of the patient should continue for 30 minutes to ensure that the effects of the Entonox have completely worn off. Accordingly, patients should not walk around unaided until any dizziness or disorientation has gone.	To maintain patient safety
If the patient has respiratory or cardiac problems they may benefit from oxygen therapy for 10-15 minutes after using Entonox – This must be agreed ahead of time, documented and be care planned	To prevent post administration hypoxia

To clean the equipment: • Depressurize the system • The external surfaces of the demand valve must be cleaned with an alcohol-impregnated wipe. • If any contamination is suspected between the hose connection and the demand valve it must be replaced. • Single use face equipment / Mouth pieces must be discarded (Where a 'single patient' option is used ensure effective cleansing occurs post procedure) • The external surfaces of the administration set must be cleaned with an alcohol-impregnated wipe • Filters are for single patient use and must be discarded. They may be kept securely in the clinic if they are going to use Entonox again within the next day	To maintain a safe environment To minimize the risk of cross infection
Document in Rio details of Entonox administration, how effective it was and any side effects experienced by the patient	To provide an accurate record of efficacy and total duration received by the patient
Entonox cylinders should be kept in a secure environment, attached to a wall or trolley and away from patients when not in use	To maintain safe environment To ensure equipment is in good working order
If the Entonox is used infrequently the cylinder should be checked weekly and its contents recorded. The expiry date should also be checked (Entonox has a 3 year shelf-life from date of fill).	To maintain a safe environment To ensure equipment is kept in good working order
Re-Ordering Equipment	
Entonox cylinders follow internal procedures product code : EW size	To ensure that there is an adequate supply on the ward and within the hospital
Demand valve or Masks disposable or reusable follow internal procedures	To ensure that there is an adequate supply on the ward
Filters follow internal procedures	To ensure that there is an adequate supply on the ward