Title: Annex 1 – Procedural Sedation

Version No: 2.3 Effective date: 29/05/2020

Drugs used in Procedural Sedation

1. ENTONOX

50% Mixture of Nitrous Oxide and Oxygen in a pressurised cylinder.

Presentation
Pressurised cylinders blue and white yoke, clearly marked Entonox.

Benefits
Very rapid onset and offset of analgesia – can be used whilst establishing IV access for other analgesics.
Anxiolysis

In the co-operative patient, entonox alone can be used for painful procedures such as the reduction of a dislocation or the restoration of limb alignment.

Disadvantages
Requires patient co-operation and clinician support.

Cautions / Contraindications
Severe head injuries with impaired consciousness.
Decompression sickness.
Chest Trauma (relative).

Preparation
Gently invert the cylinder a few times immediately before use. This is especially important in cold weather. Ensure that a clean, new mouthpiece and filter are used for each patient.

Dose
Inhaled, as needed. Encourage patient to take slow deep breaths.
Allow three to five minutes to start working effectively; may take up to ten minutes before full effect is gained.
Ensure that the patient take regular top-up doses as needed.

Title: Annex 1 – Procedural Sedation

Version No: 2.3 Effective date: 29/05/2020

Children
Entonox is safe and effective in children provided they are capable of following the instructions.

2. KETAMINE

Ketamine has a wide spectrum of action, including analgesia, sedation and anaesthesia.

Presentation
Vials and Pre-filled syringes of 20ml containing 10ml in 1ml strength (200mg).

Benefits
Ketamine is a potent analgesic with rapid onset of action. It has euphoric and dissociative properties. In higher doses it is sedative and may be used as an anaesthetic agent.
It can be administered intramuscularly and appears very effective in orthopaedic trauma and burns. Ketamine is a sympathetic agonist and causes a modest rise in heart rate and blood pressure in well-perfused patients. Respiratory depression is less common than with opiates.

Note that it is essential to exclude other causes of tachycardia such as hypovolaemia or anaphylaxis before assuming that an increase in heart rate is due to ketamine alone.

Disadvantages
In the shocked, hypotensive patient, large doses or rapid administration of ketamine can lead to cardiovascular collapse and loss of airway reflexes.

It can produce an emergence delirium, which appears to be more common in adults and if large doses are given quickly. Small amounts (1mg in adults) of Midazolam may be effective in reducing this. The best ways of minimising this appears to be by titrating the dose to effect and maintaining verbal contact with the patient.

It may produce hypersalivation, particularly with large IM doses in children, that can be treated with IV Atropine (0.01mg per kg).

Title: Annex 1 – Procedural Sedation

Version No: 2.3 Effective date: 29/05/2020

Cautions / Contraindications

- Cardiac chest pain
- Pain associated with a suspected Aortic Aneurysm
- Known sensitivity
- Psychiatric illness present or past

Preparation

IV: 10mg in 1ml solution drawn up into either a 10 or 20 ml syringe and labelled.

Dose

Adults & Children, IV and IO:
Up to 0.5mg per kg titrated to effect
A lower dose may be needed if sufficient analgesia has already been given.

Adults & Children, IM:

3-5mg per kg IM
It is not anticipated that this will be used very often as there are many options available for securing either IV or IO access.

3. MIDAZOLAM

Presentation

Ampoules containing 5ml of 1mg in 1ml strength (5mg).

Note: Plastic or glass ampoules containing a variety of concentration of midazolam are widely used. This is a potential source of drug error; be sure to check the concentration that you have on hand.

Benefits

Midazolam causes hypnosis, sedation and anxiolysis. It is also an anticonvulsant. It is water-soluble. Midazolam may be used in conjunction with Ketamine and is believed to lower the incidence of emergence reactions.
Midazolam may also be used as a maintenance agent in an anaesthetised patient.

Title: Annex 1 – Procedural Sedation

Version No: 2.3 Effective date: 29/05/2020

Disadvantages
It leads to a fall in SVR of 15-33% drop in cardiac output and BP.
It can cause loss of airway reflexes (if not intubated) and respiratory depression.
It has very unpredictable dose requirements and incidence of side effects.

Note that Midazolam alone has no analgesic properties and should not be used for procedural sedation without morphine.

Contraindications
In the shocked patient, any sedation may lead to a decrease in cardiac output.

Preparation
Midazolam must always be administered in a 1mg in 1ml solution. It must be used in a 5ml syringe and must always be labelled with the correct colour coded label.

Dose
Up to 0.1mg per kg, titrated to effect, either IV or IO, at a maximum rate of 1mg per minute allowing time from the drug to work before increasing the dose.

4. FLUMAZENIL

This is an antagonist that is able to partly or completely reverse the effects of benzodiazepines (including midazolam and diazepam).

Flumazenil must be available if midazolam is being used for procedural sedation. It should be given if it is felt that the level of sedation is too deep and the preferred option is to wake the patient. In many cases, the safer option would be to proceed with an RSI and this should be discussed as part of the planning process.
Before administering flumazenil, establish a patent airway and support oxygenation and ventilation.

Title: Annex 1 – Procedural Sedation

Version No: 2.3 Effective date: 29/05/2020

Presentation
Ampoules containing 500mcg in 5ml.

Dose
100mcg increments titrated to effect, to a maximum of 500 mcg.

- Flumazenil lowers the seizure threshold and seizures related to this will not be stopped with benzodiazepines.
- FLUMAZENIL IS ONLY LICENSED FOR THE REVERSAL OF IATROGENIC BENZODIAZEPINE OVERDOSE.
- Do not administer to patients found unconscious from a possible drug overdose

5. MORPHINE SULPHATE INJECTION

Morphine does have some sedative properties, but only in high dose. It has a very high risk of respiratory depression and should probably only be used with midazolam in post-RSI sedation.

This is a controlled drug and all stock held, administered and wasted must be accounted for in the appropriate registers.

Presentation
Ampoules containing 10mg in 1ml.

Benefits
Effective analgesia from soft tissue, bone and visceral pain. Morphine produces analgesia, euphoria and sedation.
In combination with a benzodiazepine, it can produce a reasonable level of sedation and has the advantage that it does not wear off quickly.

Title: Annex 1 – Procedural Sedation

Version No: 2.3 Effective date: 29/05/2020

Disadvantages

It may depress respiration and induce hypotension, particularly if given in rapid, large doses to patients who already have cardiovascular compromise or are in shock.
Although there is good evidence to suggest that if given slowly, opiates seldom result in nausea and vomiting, these are known side effects. The concomitant use of an antiemetic should be considered in patients who are likely to be immobilised and I or flown in a supine position.

Morphine takes at least 20 minutes to reach maximum effect, so be cautious in repeating the dose too early. It is therefore less suitable for procedural sedation where time is a factor.

Cautions / Contraindications

- Children under 1 year old
- Respiratory Depression or Hypotension
- Head Injury with spontaneous ventilation
- Phaeochromocytoma
- Known hypersensitivity to morphine
- Known severe renal or hepatic impairment
- Acute Alcohol Intoxication
- Caution in patients on antidepressants as these may potentiate the respiratory depressant effects of the morphine. Caution in patients on MAOI's.

Title: Annex 1 – Procedural Sedation

Version No: 2.3 Effective date: 29/05/2020

Preparation
Morphine is to be diluted with either 0.9% saline or water for injection, made up to 10ml, in a 10ml syringe. This makes a concentration of 1mg in 1ml.

Dose
Adults: 0.1mg per kg, IV, slowly, titrated to effect and to a maximum of 20mg.
Children: up to 0.1mg per kg, IV, slowly, titrated to effect. May be repeated to a total dose of 0.2 mg per kg over 30 minutes.

6. FENTANYL

Fentanyl has little intrinsic sedative activity but may be used in combination with other drugs (for example, midazolam) to provide the analgesic component of procedural sedation. The sedative (and respiratory depressant effects) of midazolam and fentanyl are **synergistic**.

It is a controlled drug and all stock held, administered and wasted must be accounted for in the appropriate registers.

Presentation
Ampoules and Pre-filled syringes containing 50 micrograms in 1mls. Various volumes.

Benefits
Rapid, effective analgesia with an onset of peak action of 2-5 minutes

Disadvantages
Fentanyl is a more potent analgesic than morphine and can rapidly depress respiration, particularly in patients with cardiovascular compromise.
Nausea

Title: Annex 1 – Procedural Sedation

Version No: 2.3 Effective date: 29/05/2020

Cautions / Contraindications

- Children under 1 year old
- Respiratory Depression or Hypotension
- Head Injury with spontaneous ventilation
- Phaeochromocytoma
- Known hypersensitivity to fentanyl
- Known severe renal or hepatic impairment
- Acute Alcohol Intoxication
- Caution in patients on antidepressants as these may potentiate the respiratory depressant effects of the morphine. Caution in patients on MAOI's.

Preparation

Fentanyl can be administered neat or diluted with either 0.9% saline.

Dose for procedural sedation / analgesia

0.25-0.5 mcg/kg boluses cautiously titrated to effect, to a maximum of 2 mcg/kg
If using in combination with other drugs that depress respiration, dose these cautiously.