GIG CYMRU NHS WALES | Bwrdd Iechyd Prifysgol Caerdydd a'r Fro | Cardiff and Vale University Health Board	**Reference Number: UHB 153** **Version Number:3** **Date of Next Review: August 2023** **Previous Trust/LHB Reference Number:T/374**

PERI-OPERATIVE PAIN MANAGEMENT GUIDELINES IN CHILDREN

Introduction

These guidelines relate to paediatric peri-operative acute pain management. They aim to facilitate safe practice and manage the risks associated with the pain-relieving strategies utilized.

Aim

These guidelines have been produced to ensure that consistent, safe and appropriate evidence-based peri-operative pain management is provided for children throughout Cardiff and Vale University Health Board.

Objectives

To promote safe practice that is evidence based and standardised within the clinical areas. To provide clinical areas with appropriate pain management support and education.

General overview and key points:

The guidelines are suitable for most children. The use of these guidelines for acute pain from non-surgical causes **must** be discussed with the Consultant Paediatric Anaesthetist On-Call.

In some instances, they may need to be adjusted by a Consultant Paediatric Anaesthetist to reflect individual cases.

Scope

This procedure applies to all of our working in **Child Health (**including those with honorary contracts)

Equality Impact Assessment	*An Equality Impact Assessment has, been completed. The Equality Impact Assessment completed for the guideline found there to be no impact.*
Documents to read alongside this Procedure	**The most RECENT British National Formulary for Children**
Approved by	**Women and Children Quality and Safety Committee**
Accountable Executive or Clinical Board Director	Clinical Director, Anaesthetics
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Disclaimer

Review date of this document has passed please ensure that the version you are using is the most up to date either by contacting the document author or the Governance Directorate.

Summary of reviews/amendments			
Version Number	**Date of Review Approved**	**Date Published**	**Summary of Amendments**
1	12/11/2012	06/12/2012	Updated to replace previous Trust version reference no: 374. Addition of titratable intravenous ketamine regimen for scoliosis surgery Paracetamol dosing instruction format as per BNF for Children 2012-2013.
2	19/05/2015	24/06/2015	To accommodate changeover from ketamine to esketamine – section 10.00 & appendices 7&8. To implement the C&V UHB SBAR recommendations restricting the use of codeine in paediatrics – section 5.0 Amend the oral morphine dosing guidance as per BNFC 2014-2015 – section 5.1 Add in "Prescribing Discharge analgesia for tonsillectomy / adenotonsillectomy" – – appendix 12 Amend the ondansetron dose to 100mcg/kg Amend the oral paracetamol dosing guidance as per BNF for Children March 2015 12.2 Management of cardiac arrest associated with LA injection:

3			**NEW SECTIONS:** Section 1 - Introduction of a Mission Statement Section 2 - The principles of postoperative pain management Section 5 – Ketamine Infusion Esketamine has been withdrawn from UK. This section details the conversion to Ketamine. Section 6 – Intrathecal Opioids Section 8 – Regional Local Anaesthetic Infusions **CHANGES TO EXISTING SECTIONS:** Section 3 – PCA. Changes to Fentanyl Prescription. Introduction of new PCA devices. Section 4 – NCA Changes to Fentanyl Prescription. Introduction of new PCA devices. Section 7 – new guidance included from the Royal College of Anaesthetists. Section 9 – new prescription and careplan for Entonox Appendices

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Section 1 – ACUTE PAIN SERVICE MISSION STATEMENT

The service aims to ensure that paediatric patients with acute pain are managed safely, effectively and appropriately using evidence-based pain management practices in the in-patient clinical environment.

Mission Statement

'Our goal is to achieve excellence in providing safe,
effective and efficient management of pain'.

What We Provide

Expert specialist knowledge.
Liaison between multidisciplinary team members to optimise management of acute pain.
Assessment of pain.
Sophisticated methods of pain relief (epidural, PCA, NCA, intrathecal opioids, local anaesthetic blocks etc).
Management of patients with complex acute pain management problems.
Audit and research projects.
Support for patients and their families.
Information giving.
Multidisciplinary education (C&VUHB and external venues).

Section 2 - THE PRINCIPLES OF POST-OPERATIVE PAIN MANAGEMENT

PAIN ASSESSMENT

Pain assessment is crucial if pain management is to be effective. Nurses are in a unique position to assess pain as they have the most contact with the child and their family in hospital. Pain is the most common symptom children experience in hospital. Acute pain (nociception) is associated with tissue damage and an inflammatory response, it is self-limiting of short duration and does not involve neural tissue.

Pain is multidimensional therefore assessment must include the intensity, location, duration and description, the impact on activity and the factors that may influence the child's perception of pain (bio psychosocial phenomenon). The influences that may alter pain perception and coping strategies include social history, cultural and religious beliefs, past pain experiences and the first pain experience. In addition, family response to their child in pain can have a negative or positive influence.

Definition of terms

- "Pain is whatever the experiencing person says it is, existing whenever the experiencing person says it does" (McCaffery, 1989).
- "Pain is an unpleasant sensory and emotional experience, associated with or resembling that associated with, actual or potential tissue damage" (IASP, 2020).
- Pain assessment: is a multidimensional observational assessment of a patients' experience of pain.
- Pain measurement tools: are instruments designed to measure pain.
- Pain assessment is a broad concept involving clinical judgment based on observation of the type, significance and context of the individual's pain experience.

Consequences of unrelieved pain

Unrelieved pain in children has undesirable physical and psychological consequences that can affect them in both the short and longer term. Physiological responses include increased heart and breathing rates to facilitate vital organs' increasing demands for oxygen and nutrients. Psychological consequences include:

- Anxiety, fear, distress, feelings of helplessness or hopelessness.
- Avoidance of activity or medical procedures in future.
- Sleep disturbances.
- Loss of appetite.

Failure to relieve pain produces a prolonged stress state, which can result in harmful multisystem effects. There is also evidence that acute (post-operative) pain can result in chronic pain in a small but significant number of children. Other unwanted effects of unrelieved pain include:

- Prolonged hospital stays.

- Increased rates of readmission to hospital.
- Increased number of outpatient visits.

Pain Assessment

There are challenges in assessing paediatric pain, none more so than in the pre-verbal and developmentally disabled child. Therefore, physiological and behavioural tools are used in place of the self-report of pain. However, in children with developmental disabilities there can be incorrect assumptions and there is a risk of under-treating pain. It is important to take behavioural cues identified by parents/guardians and caregivers to improve pain assessment in these children.

Pain assessment in infants and children is also challenging due to the subjectivity and multidimensional nature of pain. The dependence on others to assess pain, limited language, comprehension and perception of pain expressed contextually. In some children it can be difficult to distinguish between pain, anxiety and distress.

Assessment and documenting pain are needed in order to improve management of pain. When assessing a child's level of pain careful consideration needs to be given to their:

- Cognitive ability
- Environment (hospital)
- Anxiety
- Cause of pain (e.g. post-operative)

Pain measurement quantifies pain intensity and enables the nurse to determine the efficacy of interventions aimed at reducing pain. Points to consider:

- Pain history
- Location of pain
- Intensity of pain
- Cognitive development and understanding of pain

Pain assessment is the first step in ensuring children's pain is managed effectively (Fig 1). If pain is not assessed, it is difficult to evaluate the effectiveness of any pain-relieving interventions and decide whether further action is needed.

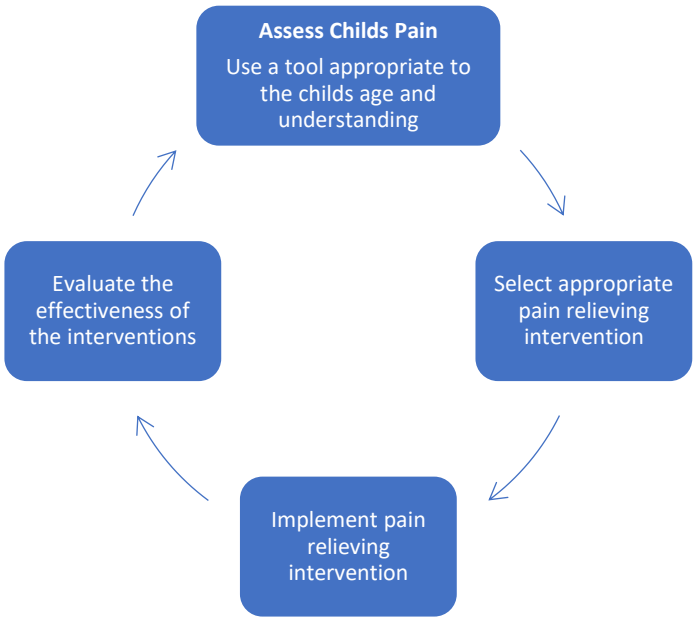

Figure 1 – The stages of Pain Management in Children

Pain Assessment Tools

Tools used for pain assessment are selected on their validity, reliability and usability and are recognized by pain specialists to be clinically effective in assessing acute pain. All share a common numeric and recorded as values 0-10 and are documented on the clinical observation chart as the 5th vital sign. The importance of using the same numeric value (0-10) is that the number relates to the same pain intensity in each tool.

Pain is a subjective experience, so individual self-reporting is the preferred method for assessing pain. Physiological indicators in isolation cannot be used as a measurement for pain. A tool that incorporates physical, behavioural and self-report is preferred when possible. However, in certain circumstance (for example, the ventilated and sedated child) physiological indicators of pain can be helpful to determine a patient's experience of pain. These include:

- Heart rate may increase.
- Respiratory rate and pattern may shift from normal i.e. increase, decrease or change pattern.
- Blood pressure may increase.
- Oxygen saturation may decrease.

Three ways of measuring pain are:

- Self-report - what the child says (the gold standard)
- Behavioural - how the child behaves
- Physiological - clinical observations

There are three main tools (APPENDIX 1) used for the neonate, infant and child 3-18 years. These tools reflect a combination of self-report and behavioural assessment:

- FLACC - The acronym FLACC stands for Face, Legs, Activity, Cry and Consolability.
- Wong-Baker faces pain scale (*3-18 years)*
- Visual Analogue Scale (*8 years and older)*

The ages above should only be used as a guide - choose an appropriate Pain Tool based on your clinical assessment of the child's understanding. This can change during an admission based on the child's clinical presentation.

It is important to assess pain **on deep breathing, movement and coughing.**

ANALGESIC LADDER

If a child scores higher than **4/10** on **any Pain Tool** it is crucial that action is taken to relieve this pain.

This action could involve:

- Administration of prescribed analgesia (please see Table 1)
- Repositioning
- Distraction

(Age)	Mild (0-3)	Moderate (4-6)	Severe (7-10)
<1 year	Analgesia for infants < 1 year of age and any complex issues must be discussed with the on-call Consultant Paediatric Anaesthetist		
1yr +	Regular paracetamol +/- NSAID	Regular paracetamol +/- NSAID Oramorph prescribed "prn" for breakthrough	Epidural or other appropriate central or regional technique + regular paracetamol +/- regular NSAID or Morphine NCA / PCA + regular paracetamol +/- regular NSAID

Table 1 – Analgesic Ladder

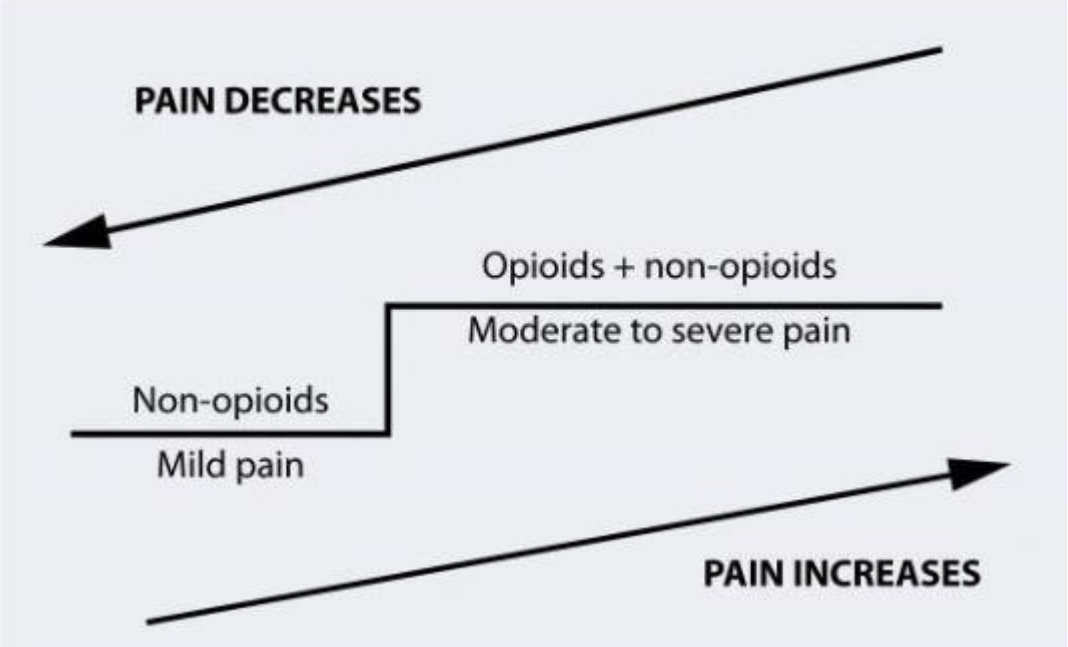

Figure 2 – Principles of Pain Management in Children
Adapted from the WHO Analgesic Ladder

Key considerations

- Assess pain using a developmentally and cognitively appropriate pain tool.
- Reassess pain after interventions given to reduce pain (e.g. analgesia) and have had time to work.
- Assess pain at rest and on movement.
- Investigate higher pain scores from expectation.
- Document pain scores.
- Use parent/guardian pain behaviour knowledge for children with cognitive impairment.

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ANALGESICS

Paracetamol

All children post-surgery should be prescribed regular paracetamol (unless specific contraindication). Paracetamol is useful as a mild analgesic and antipyretic following minor surgery or in conjunction with NSAIDS and opioids following intermediate and major surgery. The addition of paracetamol is known to have an opioid sparing effect.

Intravenous paracetamol should always be prescribed as a single route (due to differences in dose calculations between routes).

In obese children, dosing should reflect lean body mass and ideal weight for height.

Please refer to APPENDIX 2 for guidance on administering intravenous paracetamol alongside a PCA / NCA.

Refer to the most recent version of the BNF for Children for the most up-to-date guidance on paracetamol prescribing.

Non-Steroidal Anti-Inflammatory Drugs (NSAID's)

NSAID's have an opioid-sparing effect and can be particularly useful for all types of surgery. For major surgery it is suggested that NSAID's (unless contraindicated) are prescribed on the regular side of the prescription chart to ensure regular administration. This should be reviewed 48 hours postoperatively. However, if epidural analgesia is used, NSAID'S should be prescribed on an **as required basis**.

Children who are likely to be "Nil by Mouth" following surgery should have an NSAID prescribed by an alternative route i.e. rectally.

NSAID's **can** be used in children with asthma but should be used with **caution** in those children with a history of hypersensitivity to any NSAID. This includes those in whom attacks of asthma, angioedema, urticaria or rhinitis have been precipitated by an NSAID. Ttt TTTTTt b Thisa NSAID's should **not** be used in children with renal insufficiency / hepatic disease, salicylate sensitivity or coagulopathy.

Refer to the most recent version of the BNF for Children for the most up-to-date guidance on NSAID prescribing.

Weak Opioids

Tramadol and **Codeine** are two commonly used weak opioids. A weak opioid may

be useful when bridging the gap between an intravenous strong opioid or epidural and oral analgesia, particularly for those children who cannot be given NSAIDS. They should be **considered** for breakthrough pain (**in children over 12 years old**) post-surgery and as potential weaning analgesia following discontinuation of epidural or PCA / NCA analgesia.

Tramadol produces analgesia by two mechanisms: an opioid effect and an enhancement of serotonergic and adrenergic pathways. It has fewer of the typical opioid side-effects (notably, less respiratory depression and less constipation). However, Tramadol is not licensed for children younger than **12 years of age**.

Codeine is licensed for use in children. However, following a review by the European Medicines Agency (EMA), the use of codeine as an analgesic for children and adolescents is now restricted. The EMA have advised that it should only be used to relieve acute moderate pain in children older than 12 years old if pain cannot be relieved by other analgesics such as paracetamol or ibuprofen:

1. Codeine **should not** be used in any child (under 18years of age) with a history of sleep apnoea undergoing removal of tonsils and/or adenoids.
2. Codeine should only be used in children **over 12 years of age**.
3. Codeine **should not** be used in patients known to be CYPD2D6 ultra-rapid metabolisers or those with a personal or family history of adverse effects to codeine.

Please refer to APPENDIX 3 SBAR for guidance on the use of codeine in children and breast-feeding mothers.

When prescribing weak opioids ensure **naloxone** and an **anti-emetic** are prescribed on the 'prn' side of the In-Patient Medication Administration Record. A laxative should also be considered.

Refer to the most recent version of the BNF for Children for the most up-to-date guidance for prescribing weak opioids.

Strong Opioids

Morphine is the most commonly used strong opioid.

Oral morphine is useful when strong opioid analgesia is required, the child is tolerating oral fluids and when mild or moderate analgesics are insufficient. Doses should be adjusted within ranges indicated according to response. For children <12years old, oral morphine should be used as first line analgesic for breakthrough analgesia (if no contraindications) if they haven't responded to

paracetamol +/- NSAID.

Oxycodone immediate release can be used as an alternative to oral morphine in instances where side effects from morphine are limiting its use, in cases of allergy or where morphine is not effective. Oxycodone should not be used in children younger than **12 years of age unless under the direction of a Consultant Paediatric Anaesthetist**.

When prescribing strong opioids ensure **naloxone** and an **anti-emetic** are prescribed on the 'prn' side of the In-Patient Medication Administration Record. A laxative should also be considered.

Refer to the most recent version of the BNF for Children for the most up-to-date guidance on prescribing strong opioids.

Patient Controlled Analgesia (PCA)

Patient Controlled Analgesia **(**PCA) can be utilised for the management of acute postoperative pain in children likely to require strong opioid analgesia and / or who are unable to tolerate oral medication. Using a specific device, the child is able to administer a pre-determined dose of strong opioid at pre-determined intervals allowing for a wide variation in analgesic requirements. Children less then 50kgs will usually have a concurrent background infusion.

Please see SECTION 3 for further details and prescription advice.

Nurse Controlled Analgesia (NCA)

Nurse Controlled Analgesia (NCA) refers to a method of administering intravenous strong opioids for the relief of acute pain in infants and children who are unable to tolerate oral medication. It is an infusion with additional boluses. Using a specific device, the nurse is able to safely administer a pre- determined dose of strong opioid at pre-determined intervals.

At times there may be circumstances where background infusions should be avoided e.g. children who may be more sensitive to strong opioids. This decision should be at the discretion of the Consultant Paediatric Anaesthetist.

Please see SECTION 4 for further details and prescription advice.

Ketamine

A safe and effective continuous infusion of Ketamine for the relief of acute postoperative pain can be run as part of a multi-modal approach for acute pain management in paediatrics. Ketamine delivered as a continuous infusion alongside morphine will have an opiate sparing effect thus minimising opiate related side effects.

Please see SECTION 5 for further details and prescription advice.

Intrathecal Opioids

Intrathecal opioids can provide safe and effective analgesia for 12-24 hours postoperatively following surgery on the thorax, abdomen, lower limbs and spine.

Please see SECTION 6 for further details and prescription advice.

Epidural Analgesia

Epidural analgesia is used for acute postoperative pain management using a continuous infusion. The epidural solution contains a low concentration of local anaesthetic with or without an opioid.

Please see SECTION 7 for further details and prescription advice.

Regional Local Anaesthetic Infusions

Unless contraindicated an appropriate local anaesthetic block should be used in ALL children. If specific nerve /plexus /central block is not possible please ask the surgeon to infiltrate the wound.

Please see SECTION 8 for further details and prescription advice.

ENTONOX

ENTONOX (50% nitrous oxide/ 50% oxygen medical gas mixture) is a fast-acting, non-invasive analgesic that is particularly advantageous for treating short-term procedural pain in children.

Please see SECTION 9 for further details and prescription advice.

ANTI-EMETICS AND NALOXONE

Anti-emetics for Post-Operative Nausea and Vomiting (PONV)

Ondansetron is the first line anti-emetic for children.

Ondansetron is a clinically effective anti-emetic in children undergoing procedures associated with a high risk of PONV. The oral route is as effective as the intravenous route for the administration of ondansetron in preventing PONV in children. Once PONV is established, IV Ondansetron should be used to treat established PONV in children who have not already received ondansetron. For children who have already been given ondansetron prophylactically, it is recommended that a second antiemetic from another class should be given, such as IV dexamethasone or IV droperidol.

Current evidence base supports acustimulation reducing PONV compared to the non-active control situation. Acustimulation appears to be equally effective in preventing POV as anti-emetic drugs in children**.**

Please also refer to the Association of Paediatric Anaesthetists Guidelines on the management of post-operative vomiting in children (2016) and the most recent version of the BNF for Children for the most up-to-date guidance on prescribing anti-emetics.

Naloxone

This should be used for the complete or partial reversal of opioid depression including respiratory depression and sedation. It is important to remember that Naloxone has a short duration of action; repeated doses or infusion may be necessary to reverse effects of opioids with longer duration of action.

In postoperative use, the dose should be titrated for each patient in order to obtain sufficient respiratory response.

All children who are prescribed weak or strong opioids should have naloxone prescribed on the PRN side of the drug chart.

Age (years)	**Give Naloxone if respiratory rate falls:**
< 1 year	< 20
1 – 5 years	< 15
5 – 12 years	< 10
> 12 years	< 8

Refer to the most recent version of the BNF for Children for the most up-to-date guidance on prescribing naloxone.

Section 3 - PATIENT CONTROLLED ANALGESIA (PCA)

Definition

Patient Controlled Analgesia (PCA) refers to the self-administration of analgesia and in this instance to the self-administration of intravenous opioids for the relief of acute pain in children. Children less than 50kgs will usually have a concurrent infusion. Using a specific device, the child is able to administer a predetermined dose of strong opioid at predetermined intervals,

allowing for the wide variation in analgesic requirements. These doses are calculated on the child's weight and age.

Indications

- For the management of acute postoperative pain in children likely to require strong opioid analgesia for at least 24-48 hrs.

- For the management of moderate to severe acute pain in children who are unable to tolerate oral medication.

Patient Controlled Analgesia should not be offered to

- Children less than 5 years of age.
- Children who are incapable of using the device.
- Children who appear reluctant to use the device.
- Children with a head injury.
- Children with an upper airway obstruction.

Children and their parents / guardians should always receive patient information (ideally prior to the PCA being set-up or prior to surgery) regarding the use of PCA in order that the child gains maximum benefit from using this technique. The information given should include the following:

- Simple explanation regarding how PCA works which includes the use of the PCA bolus button.
- Informing child and parent/guardian that the PCA will substantially reduce pain but realistically may not completely abolish it.
- Reinforcing positive aspects of PCA, i.e. no injections.
- Reinforce the importance of parents/guardian not pressing the button i.e. It must be **patient** controlled.

Prescription

In addition to the child's own In-Patient Medication Administration Record, a Supplementary NCA / PCA prescription chart should be completed by the prescriber and be available for the nurse to check against the pump settings. Only those competent in the delivery of PCA analgesia should prescribe this method of analgesia.

Morphine is the standard opioid used in the PCA prescription. However, a Fentanyl regimen is also available for use in children with renal impairment or where there

are significant side effects from morphine. There are specific MORPHINE (APPENDIX 5) and FENTANYL (APPENDIX 6) Supplementary NCA/PCA prescription charts that should be used – please ensure the correct PCA protocol is selected.

A background infusion is an integral part of PCA in children up to 50kg. It provides more consistent pain relief than with bolus only and subsequently provides children with confidence in the technique. It also enables a better sleep pattern, especially during the first postoperative night. The duration of this infusion is tailored to individual patients. Children over 50kg should **NOT** have a PCA background infusion.

In circumstances where opioids are contraindicated (e.g. Toxic megacolon) a regimen for Ketamine infusion is available. **This must be discussed with and prescribed by a Consultant Paediatric Anaesthetist or Consultant Paediatric Intensivist.** Please see Ketamine Section for further prescribing guidance.

No other opioids should be administered whilst the child is using PCA. However, there may be exceptional circumstances e.g. children with chronic pain, children who are under the care of the palliative care team or children who are opioid tolerant, when a regular opioid may need to be prescribed to optimize analgesia in addition to a demand only PCA. This should be discussed with the Acute Pain Service prior to commencement to ensure that clinical risk is managed effectively.

The nurse looking after the child should check that naloxone and ondansetron have also been prescribed to combat the potential side effects associated with the use of opioid drugs. A pre-printed label with these should be attached to the In-Patient Medication Administration Record – note there are different labels available.

Equipment

- A dedicated PCA infusion device must be used.
- A dedicated PCA giving set incorporating an anti- reflux valve and an anti-syphon valve must always be used with these infusion devices.
- Infusion sets should be changed in accordance with the latest guidance from the manufacturer / UHB.
- Pumps should be attached to the drip stand at the same level as the child to reduce the risk of siphoning.
- Anaesthetic and nursing staff must have received training and assessment in the use of these devices and achieved the relevant competencies as per C&VUHB policy. The Acute Pain Service and the Clinical Engineering Department will provide this training.

Designated clinical areas & responsibilities

Children with PCA infusions are to be cared for **ONLY ON:**

- Paediatric critical care units
- Paediatric surgical area

With a PCA it is important to establish an initial plasma level of morphine. This can be achieved with small incremental opioid boluses in theatre +/- recovery until the child is comfortable.

The PCA must be prescribed on the appropriate Supplementary paediatric PCA or NCA prescription chart APPENDIX 4. This should then be attached to the child's In-Patient Medication Administration Record. Please also prescribe the PCA/NCA on the 'PRN' side of the In-Patient Medication Administration Record. Pre-printed adhesive labels are available to aid this process.

Balanced analgesia **-** Regular paracetamol and if appropriate an NSAID should also be prescribed (Refer to Section 2 in these guidelines for further information).

Respiratory Depression

Naloxone 4 micrograms/kg should always be prescribed on the “prn” side of the In-Patient Medication Administration Record using the pre-printed adhesive labels. This should be administered if respiratory rate falls below the figures indicated in the table below**.** In children 50kg and over, naloxone should be prescribed as per adult regimen; that is prescribed as 200 micrograms but usually administered in 50 microgram increments:

Age (Years)	**Give Naloxone 4 micrograms/kg if respiratory rate falls less than**
<1 year	20
1-5 years	15
5-12 years	10
>12 years	8

Naloxone is also prescribed on the pre-printed adhesive labels at a lower dose of 2mcg/kg for any opioid associated pruritus (itching). Please administer prescribed dose for any child experiencing distressing pruritus associated with PCA use.

Contraindications

PCA has been widely used in many centres for children as young as 5 years and has been shown to be a safe and effective form of postoperative analgesia provided that guidelines are followed:

- Strong Opioids are contraindicated in head injury and upper airway obstruction.
- PCA is contraindicated if there is inability to understand or operate the device. Under these circumstances, NCA should be initiated using the NCA regimen (SEE SECTION 4).
- Parents/guardians must not under any circumstances use the button for their child. This should be made clear during the pre-operative briefing. If parents/guardians are concerned about their child's pain relief they should seek the help of the nurse looking after that child.

Monitoring:

Careful monitoring of a child receiving PCA is essential to achieve safe delivery of the analgesia:

- Observations of pulse, blood pressure, sedation and respiration should be recorded at ½-hourly intervals for 2 hours and then 1 hourly except blood pressure). Blood pressure should subsequently be recorded 4 hourly. The respiratory rate should be counted for a full minute.

- Pulse oximetry should be used continuously in **all children** receiving PCA infusions and for **2 hours after discontinuation of the infusion**. Ensure audible alarms are set within appropriate parameters.

- Nursing Staff should ensure that controlled drugs are checked in accordance with the most recent C&VUHB guidance and ensure that the syringe is correctly labelled according to the In-Patient Medication Administration Record. The PCA syringe should be checked hourly by **the qualified nurse caring for the patient** and the In-Patient Record of Administration Chart (Page 2 on the Supplementary NCA / PCA prescription chart) should be completed according to the most recent C&VUHB Infusion Policy:
    - The volume remaining in the syringe.
    - The number of delivered demands / refused demands.

- When changing syringe and at shift handover, 2 qualified nurses (**including the qualified nurse caring for the patient**) should check the PCA settings, *i.e.* the bolus dose, lockout time and continuous infusion, against the Supplementary NCA / PCA prescription chart. Any

discrepancies should be reported to the APS or if unavailable, the On-call Anaesthetist should be contacted. Additionally, the PCA button should be removed from the child immediately, the device suspended (this will stop any continuous infusion in progress). Do **not** restart the device until the problem is resolved.

- Pain should be assessed and documented 1hrly whilst the PCA is infusing, using the appropriate pain assessment tool according to the age and cognitive ability of the child. If the child is sleeping overnight it is acceptable to document this as an S on the Observation Charts (as long as all other observations, such as respiratory rate and oxygen saturations, are stable and there are no concerns over sedation).

- If the child scores higher than 4/10 on the Pain Tool please consider the following:
    - Administer additional prescribed analgesia, such as, paracetamol and / or an NSAID.
    - Encourage to press the PCA button.
    - Reposition.
    - Contact the Acute Pain Service if no reduction in pain score.

Discontinuing the PCA

The decision to cease the PCA should be made in consultation with the Acute Pain Service/ Paediatric Anaesthetist and only considered when the child is able to tolerate / absorb analgesia via another route. Please ensure that alternative analgesia is prescribed prior to stopping the PCA.

When the infusion has been discontinued the PCA syringe and contents must be disposed of according to the C&VUHB infusion policy.

The Acute Pain Service will visit all children receiving PCA at Children's Hospital of Wales (CHfW) daily, more often if necessary. The Acute Pain Service will reduce or stop the PCA depending on the child's analgesic requirements.

If a request is made to initiate PCA for a child by a member of the medical staff who is not an Anaesthetist *or* if a member of the Acute Pain Service feels that this would be an appropriate intervention: **The Consultant Paediatric Anaesthetist on-call must be contacted for advice and be appraised of the situation.**

Pain management problems:

Between 08.00-20.00, Monday – Friday and 08:00-15:30 on the weekend the Acute Pain Service should be contacted should any problems occur on Bleep 5414. Outside of these times in the first instance contact the on-call Obstetric

Anaesthetist, Bleep 5101.

Section 4 - NURSE CONTROLLED ANALGESIA (NCA)

Definition

Nurse Controlled Analgesia (NCA) refers to a method of administering intravenous strong opioids for the relief of acute pain in infants and children. Using a device specifically designed for the purpose the nurse caring for the child is able to safely administer a pre-determined dose of strong opioid at pre-determined intervals.
It is an opioid infusion with accompanying boluses. At times there may be circumstances where concurrent infusion should be avoided e.g. neurosurgical patients or children who may be more sensitive to strong opioids. This method uses the equipment of PCA (infusion device) but the bolus control is the responsibility of the nurses, the negative feedback principle of PCA is reduced, but safety is maintained by close observational assessment by the nursing staff and a longer lockout interval.

It is suitable for children below the age of five years **and** those children aged over five who are unable to use PCA.

Indications

- For the management of acute postoperative pain in children likely to require strong opioid analgesia for at least 24-48 hrs.
- For the management of acute pain in those children who are unable to tolerate oral medication.
- For the management of acute pain in children unable to understand the concept of PCA.
- For the management of acute pain in children able to understand the concept of PCA but who may be physically incapable of using the device.

Nurse Controlled Analgesia should not be offered to:

- Children with upper airway obstruction.
- Children with head injury.
- Children able to understand and use PCA.

The parents/guardians of those children receiving NCA will need information on how NCA will control their child's pain. They should be informed that they should not under any circumstances press the button themselves. The nurse looking after the child should only press the NCA button after careful clinical assessment of the child.

The parents/guardian's assistance in assessing the child's pain should be emphasized, in particular with those who have children with learning and developmental needs.

Prescription

In addition to the child's own In-Patient Medication Administration Record, a Supplementary NCA prescription chart should be completed by the prescriber and be available for the nurse to check against the pump settings. Only those competent in the delivery of PCA analgesia should prescribe this method of analgesia.

Morphine is the standard opioid used in the NCA prescription. However, a Fentanyl regimen is also available for use in children with renal impairment or where there are significant side effects from morphine. There are specific MORPHINE (APPENDIX 4) and FENTANYL (APPENDIX 5). Supplementary NCA/PCA prescription charts that should be used – please ensure the correct NCA protocol is selected.

No other opioids should be administered whilst the child is receiving NCA. However, there may be exceptions to this rule in certain patient groups e.g. children with chronic pain, children who are under the care of the palliative care team or children who are opioid tolerant. To ensure that clinical risk is managed effectively, these individual cases **must** be discussed with the Acute Pain Service so that adequate provision is made to review the patient.

The nurse looking after the child should check that naloxone and ondansetron have also been prescribed to combat the potential side effects associated with the use of strong opioids (a pre-printed label with these should be attached to the In-Patient Medication Administration Record).

Parents / guardians should always receive patient information (ideally prior to the NCA being set-up or prior to surgery) regarding the use of NCA. They should be informed that they should not under any circumstances press the button themselves. The nurse looking after the child should always do this based on pain assessment and clinical assessment of the child. The parents'/guardian's assistance in assessing the child's pain should be emphasized in particular those who have children with learning and developmental needs.

NCA - Children under 6 months

Due to altered pharmacokinetics and pharmacodynamics, infants less than six months and particularly neonates require smaller doses of opioids because they are at more risk of opioid accumulation. Strong opioids should only be used in this age group **after seeking advice from a Consultant Paediatric Anaesthetist**. Consideration should be given to nursing the child in a Paediatric Intensive Care or High Dependency setting. Analgesia for neonates and particularly premature or ex-premature infants **must always** be discussed with the Consultant Paediatric Anaesthetist on-call.

Equipment

- A dedicated PCA infusion device must be used.
- A dedicated PCA giving set incorporating an anti- reflux valve and an anti-syphon valve must always be used with these infusion devices.
- Infusion sets should be changed every in accordance with the latest guidance from the manufacturer / UHB.
- Pumps should be attached to the drip stand at the same level as the child to reduce the risk of siphoning.
- Anaesthetic and nursing staff must have received training and assessment in the use of these devices and achieved the relevant competencies as per C&VUHB policy. The Acute Pain Service and the Clinical Engineering Department will provide this training.

Designated clinical areas & responsibilities

Children with NCA infusions are to be cared for **ONLY ON:**

- Paediatric critical care units.
- Paediatric surgical area.

NCA's are NOT to be used in Neonatal Intensive Care

With an NCA it is important to establish an initial plasma level of morphine. This can be achieved with small incremental opioid boluses in theatre +/- recovery until the child is comfortable.

The NCA must be prescribed on the appropriate Supplementary Paediatric PCA / NCA prescription chart. This should then be attached to the child's In-Patient Medication Administration Record. Please also prescribe the NCA on the 'PRN' side of the In-Patient Medication Administration Record. Pre-printed adhesive

labels are available to aid this process.

Balanced analgesia - Regular paracetamol and if appropriate, an NSAID should also be prescribed (Refer to Section 2 in these guidelines for further information).

Respiratory Depression

Naloxone 4 micrograms/kg should always be prescribed on the "prn" side of the In-Patient Medication Administration Record using the pre-printed adhesive labels. This should be administered if respiratory rate falls below the figures indicated in the table below**.** In children 50kg and over, naloxone should be prescribed as per adult regimen; that is prescribed as 200 micrograms but usually administered in 50 microgram increments:

Age (Years)	**Give Naloxone 4 micrograms/kg if respiratory rate falls less than**
<1 year	20
1-5 years	15
5-12 years	10
>12 years	8

Naloxone is also prescribed on the pre-printed adhesive labels at a lower dose of 2mcg/kg for any opioid associated pruritus (itching). Please administer prescribed dose for any child experiencing distressing pruritus associated with NCA use.

Contraindications:

NCA has been widely used in many centres for children under 5 years and has been shown to be a safe and effective form of postoperative analgesia provided that guidelines are followed:

- Strong Opioids are contraindicated in head injury and upper airway obstruction.
- PCA is contraindicated if there is inability to understand or operate the device. Under these circumstances, NCA should be initiated using the NCA regimen (SEE SECTION 4).
- Parents/guardians must not under any circumstances use the button for their child. This should be made clear during the pre-operative briefing. If parents/guardians are concerned about their child's pain relief they should seek the help of the nurse looking after that child.

Monitoring:

Careful monitoring of a child receiving NCA is essential to achieve safe delivery of the analgesia:

- Observations of pulse, blood pressure, sedation and respiration should be recorded at ½-hourly intervals for 2 hours and then 1 hourly except blood pressure). Blood pressure should subsequently be recorded 4 hourly. The respiratory rate should be counted for a full minute.

- Pulse oximetry should be used continuously in **all children** receiving NCA infusions and for **2 hours after discontinuation of the infusion**. Ensure audible alarms are set within appropriate parameters.

- Nursing Staff should ensure that controlled drugs are checked in accordance with the most recent C&VUHB guidance and ensure that the syringe is correctly labelled according to the **Supplementary NCA / PCA prescription chart**. The NCA syringe should be checked hourly by **the qualified nurse caring for the patient** and the Record of Administration Chart (Page 2 on the Supplementary NCA / PCA prescription chart) should be completed according to the most recent C&VUHB Infusion Policy:
    - The volume remaining in the syringe.
    - The number of delivered demands / refused demands.

- When changing syringe and at shift handover, 2 qualified nurses (**including the qualified nurse caring for the patient**) should check the NCA settings, *i.e.* the bolus dose, lockout time and continuous infusion, against the Supplementary NCA / PCA prescription chart. Any discrepancies should be reported to the APS or if unavailable, the On-call Anaesthetist should be contacted. Additionally, any background infusion should be suspended immediately and the device **not** restarted until the problem is resolved.

- Pain should be assessed and documented 1hrly whilst the NCA is infusing, using the appropriate pain assessment tool according to the age and cognitive ability of the child. If the child is sleeping overnight it is acceptable to document this as an S on the Observation Charts (as long as all other observations, such as respiratory rate and oxygen saturations, are stable and there are no concerns over sedation).

- If the child scores higher than 4/10 on the Pain Tool please consider the following:
    - Administer additional prescribed analgesia, such as, paracetamol and / or an NSAID.
    - Press the NCA button (if no evidence of opioid toxicity).
    - Reposition.
    - Contact the Acute Pain Service if no reduction in pain score.

Discontinuing the NCA

The decision to cease the NCA should be made in consultation with the Acute Pain Service/ Paediatric Anaesthetist and only considered when the child is able to tolerate / absorb analgesia via another route. Usually the NCA background is discontinued prior to the NCA being stopped. Please ensure that alternative analgesia is prescribed prior to stopping the NCA.

When the infusion has been discontinued the NCA syringe and contents must be disposed of according to the C&VUHB infusion policy.

The Acute Pain Service will visit all children receiving NCA at CHfW daily, more often if necessary. The Acute Pain Service will reduce or stop the NCA depending on the child's analgesic requirements.

If a request is made to initiate a NCA for a child by a member of the medical staff who is not an anaesthetist *or* if a member of the Acute Pain Service feels that this would be an appropriate intervention: **The Consultant Paediatric Anaesthetist on-call must be contacted for advice and be appraised of the situation.**

Pain management problems:

Between 08.30-20.00, Monday – Friday and 08:30-15:30 on the weekend the Acute Pain Service should be contacted should any problems occur on Bleep 5414. Outside of these times please contact the following for advice:

- NCA: Infants <12months contact the Consultant on-call for Paediatric Anaesthesia via switchboard.
- NCA >12months: In the first instance contact the on-call Obstetric Anaesthetist, Bleep 5101.

Section 5 - PAEDIATRIC KETAMINE INTRAVENOUS INFUSION

An adjunct for short term use in acute pain

Definition

The administration of continuous Ketamine is an intravenous anaesthetic which if used in sub-anaesthetic doses has an analgesic action both centrally and peripherally in the nervous system. Ketamine exerts strong adjuvant analgesic properties by inhibiting the binding of glutamate to the NMDA receptor. This mode of action is different to the action of opioids such as morphine and therefore the use of Ketamine in combination with opioids can improve pain relief.

NB Esketamine has previously been used in C&VUHB for Acute Pain Management. This is no longer readily available in the UK. **Esketamine is twice as potent as Ketamine** and therefore dose adjustments need to occur when prescribing Ketamine
i.e. Ketamine 10mg in 1ml is equivalent Esketamine 5mg in 1ml

Only Ketamine should be prescribed in the management of acute pain management in CAVUHB.

Indications

To receive a safe and effective continuous infusion of Ketamine for the relief of acute postoperative pain as part of a multi-modal approach for acute pain management in paediatrics. Ketamine delivered as a continuous infusion alongside morphine will have an opiate sparing effect thus minimising opiate related side effects.

Its use is indicated in the following cases:

- Severe ischaemic pain.
- Postoperative amputation.
- Opioid tolerant patients.
- Pain that is not opioid responsive.
- Neuropathic pain.
- Post scoliosis surgery.

Contraindications

Absolute	Cautions
Hypertension Severe cardiac disease Raised intracranial pressure Head trauma	Renal failure Liver failure Pregnancy Confirmed or suspected drug abuse
Absolute	**Cautions**
Pre-eclampsia Acute porphyria's	Predisposition to nightmares / hallucinations (may increase risk of developing hallucinations) Raised intra-ocular pressure Major psychiatric illness e.g. schizophrenia and acute psychosis Acute intermittent porphyria Predisposition to seizures Thyroid disfunction (increased risk of hypertension and tachycardia) Current respiratory infection (ketamine sensitises the gag reflex, potentially causing laryngospasm)

Please see below for prescribing guidance

In obese children, dosing should reflect lean body mass and ideal weight for height.

Prescription

Ketamine must be prescribed by an anaesthetist or intensivist using the pre-printed label and affixed on the 'as required' side of the In-Patient Medication Administration Record.

The ketamine infusion will be used as an adjuvant to opioids. Paracetamol, strong or weak opioids, non-steroidal anti-inflammatory drugs, (if appropriate and not contraindicated) plus local anaesthetics can be used concurrently with the ketamine infusion. As ketamine has an opioid sparing effect, the opioid dose may need to be decreased in order to avoid over sedation or respiratory depression.

The Ketamine infusion should not exceed 5 days.

The Paediatric Ketamine Prescription is available in the APPENDIX 6.

Equipment

- A dedicated PCA infusion device must be used.
- The appropriate protocol according to child's weight must be prescribed on the Supplementary Ketamine prescription chart and pre-printed label must be signed and attached to PRN side of the In-Patient Medication Administration Record.
- A dedicated PCA giving set incorporating an anti- reflux valve and an anti-syphon valve must always be used with these infusion devices.
- Infusion sets should be changed according to local policy.
- Nursing staff must have received training and assessment in the use of these PCA infusion devices and achieved the relevant competencies. The Clinical Engineering Department and the Acute Pain Service will provide this training.

Designated clinical areas & responsibilities

Children with Ketamine infusions are to be cared for **ONLY ON:**

- Paediatric critical care units.
- Paediatric surgical area.

Initiating treatment in patients receiving an intravenous Ketamine Infusion

Nurses responsibilities:

All registered nurses caring for a child with an intravenous ketamine infusion must have received specific training in the management of such infusions.

Setup of the infusion device should only occur in the Recovery Unit by a recovery nurse, an advanced infusion device user and / or the Acute Pain Service. All of whom must have been assessed as competent in the setup of the device.

- The infusion device will be setup on the appropriate intravenous ketamine infusion protocol (according to the patients' weight and prescription).
- The protocol, infusion device settings, and prescription, will be checked with another (suitably trained) registered nurse and the record of administration chart signed by both.
- Once all checks have been completed, the infusion device will be attached to an established and patent I.V. cannula.
- Infusion initiated at the prescribed rate.

Monitoring of patients receiving intravenous ketamine infusion

Potential side effects include:

- Changes in sensory perception
- Hallucinations
- Hypertension

To assess for these side effects the following monitoring is required:

- Initially for the first 2 hours following commencement of the infusion, respiratory rate, pulse, B/P and O2 saturation and nausea/vomiting should be monitored every 30 minutes and following this **1 hourly** for the duration of the Ketamine infusion.

- Pulse oximetry should be used continuously in all children receiving Ketamine infusions and for 2 hours after discontinuation of the infusion. Ensure audible alarms are set within appropriate parameters.

Please refer to the attached APPENDIX 7 – Nursing Care Plan for all monitoring requirements for patients receiving an intravenous ketamine infusion.

Discontinuing the Ketamine infusion

The Ketamine infusion should not be stopped abruptly as this could cause undesirable side effects. The decision to cease the ketamine infusion should be made in consultation with the Acute Pain Service/ Paediatric Anaesthetist.

When ketamine is used, the order in which the analgesia is weaned must be discussed with the Acute Pain Service prior to changing.

When the infusion has been discontinued the ketamine must be disposed of according to the C&VUHB infusion policy.

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Section 6 - PAEDIATRIC INTRATHECAL OPIOID ANALGESIA

(12 years and above)

Definition:

Intrathecal opioids can provide safe and effective analgesia for 12-24 hours postoperatively.

Indications:

Intrathecal opioids can provide analgesia for surgery on the thorax, abdomen, lower limbs and spine.

Contraindications:

- Contraindications to neuraxial blockade.
- Patients on CNS depressants/high dose opioids.
- Advanced respiratory disease/obstructive sleep apnoea.

Prescription:

The recommended morphine dose is 5-10mcg/kg (body weight) with a maximum dose of 200mcg.

The recommended dose of diamorphine is 10-20mcg/kg (body weight) with maximum dose of 1mg.

If the patient requires additional intravenous morphine supplementation as rescue analgesia the potential for respiratory depression is increased. Senior Anaesthetist to consider whether referral to Critical Care (for monitoring within the immediate postoperative period) is required.

The anaesthetist must place a sticker (**Caution Paediatric Intrathecal opioid**) on the In-Patient Medication Administration Record to indicate that the patient has received Intrathecal opioid.

NSAIDs such as Ibuprofen and Paracetamol should be prescribed as regular medications if not contraindicated.
Oramorph at 0.1 – 0.2 mg/kg 4-6 hourly can be used as rescue analgesia (max dose 10mg).

A patient can be prescribed a PCA or NCA instead of oramorph if the Consultant Paediatric Anaesthetist feels that PRN oramorph will not be sufficient or if the patient is NBM.

- A PCA / NCA can be prescribed and connected to the patient.
- The PCA /NCA handset should only be given to the patient when their pain score is **> 3/10**.
- They are **NOT** to have a PCA / NCA background Infusion.
- No other opioids (parenteral or oral) should be prescribed for 24 hours.

Designated clinical areas of responsibilities:

Children who have received Intrathecal opioid are to be cared for **ONLY ON:**

- Paediatric critical care units.
- Paediatric surgical area.

Monitoring of patients:

Observations of the pulse, blood pressure, pain scores, nausea and vomiting, sedation score, temperature and respiratory rate should be **½ hourly** for the first two hours, then **1 hourly** thereafter for the first **24 hours**.

Pulse oximetry should be used continuously in all children for 24 hours after receiving intrathecal opioids. Ensure audible alarms are set within appropriate parameters.

Patients must have an intravenous cannula in situ for 24 hours following the administration of Intrathecal opioid analgesia.

See the intrathecal analgesia care plan (APPENDIX 8) for further information on monitoring and the management of any potential side effects.

Thromboprophylaxis:

Please discuss with the consultant anaesthetist responsible for the patient before administering any pharmacological agents to prevent VTE.

TED stockings can be used if the clinical situation warrants it.

Section 7 - PAEDIATRIC EPIDURAL ANALGESIA

Definition

A low concentration of local anaesthetic with or without an opioid infused into the epidural space to provide pain relief, without complete loss of motor function. It provides excellent pain relief with high patient satisfaction when compared with other methods of analgesia and may avoid side effects associated with systemic therapy.

Indications

To receive a safe and effective continuous infusion of epidural analgesia for the relief of acute pain as part of a multi modal approach for acute pain management in paediatrics

- Acute postoperative pain.
- Fractured ribs.
- Non-spinal trauma.

Contraindications

Absolute	Relative
• Patient / parental refusal • Infection at site of catheter insertion • Raised intracranial pressure in those at risk of cerebral or cerebellar herniation • Allergy to agents prescribed in epidural • Lack of appropriately trained medical/nursing personnel available • Coagulopathy APPTT ratio or INR >1.4 • Platelet count <100 • Local sepsis • Low molecular weight heparin (e.g. Enoxaparin/Clexane given 12 hours if on prophylactic dose (20-40mg) or within last 24hrs if on therapeutic dose (>40mg) • Clopidogrel given within last 7 days	• Cognitive or communication impairment that leads to difficulty in clinical assessment of epidural function or complications. • The Immunocompromised patient and patients with an abnormality of coagulation

Additionally, further advice may need to be sought from a haematologist if the patient has a co-morbidity that would adversely affect coagulation or the length of action of the anti-coagulant (such as renal function).

Prescription

Epidural analgesia should be prescribed as a continuous infusion. In addition to the child's own In-Patient Medication Administration Record, the prescriber should also complete the Supplementary epidural prescription chart. Pre-printed labels are available in the anaesthetic rooms and the recovery rooms for use by the prescriber.

The following pre-filled bags of epidural analgesia solution are available for use:

- **Bupivacaine 0.1% with Fentanyl 2 micrograms/ml**
- **Bupivacaine 0.1% only**

No other systemic opioids (strong/weak) should be prescribed whilst the patient is receiving epidural analgesia containing fentanyl. However, there may be exceptions to this rule in certain patient groups e.g. children with chronic pain, children who are under the care of the palliative care team or children who are opioid tolerant. Some children may receive a local anaesthetic only epidural with a concurrent prescription of an opioid via an alternative route. To ensure that clinical risk is managed effectively, these individual cases **must** be discussed with the Acute Pain Service so that adequate provision is made to review the patient.

The lowest possible effective concentration of local anaesthetic should be used in order to preserve motor function as much as possible. This improves patient satisfaction and aids detection of neurological complications.

It is important to carefully consider the rate of epidural infusion in pre-term babies beyond the official neonatal period i.e. over 4 weeks of age; these may be best considered as neonates,

There are several protocols to choose from and the choice must be indicated on the dedicated yellow epidural prescription chart.

If a child requires an epidural bolus please follow guidance in Appendix 12. Boluses should **ONLY** be administered by the Acute Pain Team or an Anaesthetist after careful assessment.

Designated clinical areas and responsibilities

Children with epidural analgesia infusions are to be cared for **ONLY ON:**

- Paediatric critical care unit

- Paediatric surgical areas

Epidurals are NOT permitted on the Neonatal Intensive Care.

Minimising the risk of wrong route error

The bags of epidural solution should be clearly labelled 'For Epidural Use Only'.
No bags of epidural analgesia solution should be stored in the operating theatres or anaesthetic rooms.

Epidural infusion bags containing Fentanyl and Bupivacaine should be stored in a lockable controlled drug cupboard. Local anaesthetic ONLY infusion bags should be stored in a separate cupboard from those holding intravenous and other types of infusions in order to reduce risk of wrong route administration.

Epidural infusions should be connected to the epidural catheter as soon as possible by the clinician responsible for its insertion to minimise errors due to wrong route administration of local anaesthetic.

Adverse events suspected to be associated with epidural infusions should always be reported via the MHRA Yellow Card Scheme.

Equipment

The Epidural Infusion device and dedicated yellow giving set must be used and labelled correctly. It must be easily distinguishable from those used for intravenous and other routes. A bacterial filter must always be used.

A patent intravenous cannula must be in situ for the duration the child is receiving epidural analgesia.

Please refer to NRFit lead for latest guidance on the transition of use of the newly developed NRFit neuraxial connector. For further information please refer to local guidance.

Initiating treatment & monitoring of patients receiving epidural analgesia

Nurses responsibilities:

Setup of the Infusion device should only occur in the Recovery Unit by a recovery nurse, an advanced pump device user and/or the Acute Pain Service. All of whom has been assessed as competent in the setup of the device.

- The infusion device will be setup on **Protocol B, C or D (**according to prescription) and primed using the dedicated yellow infusion line and a prefilled bag of solution used.

- The protocol and infusion device settings will be checked with another (suitably trained) registered nurse against the In - Patient Medication Administration Record and Supplementary Epidural Prescription Chart and signed by both.

- Once all checks have been completed, the infusion device will be attached to the epidural catheters via the bacterial filter using aseptic non- touch technique (ANTT).

- All connections are checked as being tight and secure.

- A "NOT FOR IV CONNECTION" sticker will be attached to the yellow infusion line at the point where it joins the bacterial filter.

- The child has established and patent IV access.

- Infusion initiated at the prescribed rate.

- Children receiving epidural analgesia should be situated on a ward in such a way that allows close supervision by nursing staff.

- Monitor and document **½ hourly** observations for the first 2 hours after the infusion has been setup and then **1 hourly** thereafter blood pressure should be recorded:
  - < 8yrs **4 hourly**,
  - > 8 yrs **2 hourly**

- Temperature should be recorded **4 hourly.**

- Pulse oximetry should be used continuously in all children for duration of treatment. Ensure audible alarms are set within appropriate parameters.

- Sedation is often the most sensitive indication of opioid induced respiratory depression and should be recorded and documented **1 hourly**.

- Assess and document pain scores (at rest and on movement or deep breathing), sedation score, straight leg raises (SLR) and nausea scores **1 hourly**. If the child reports moderate or severe pain, increase the rate of the epidural infusion within the prescribed rates.

- If in the immediate postoperative period the child, has a moderate pain score following an assessment on an appropriate pain tool, nursing staff in the recovery room should contact the prescribing Anaesthetist as a bolus of more concentrated local anaesthetic may be necessary to settle the child.

- Bolus epidural injections should only be performed by staff with appropriate training and competence. Refer to APPENDIX 12 for further information.

- Following an epidural bolus more intensive monitoring of the child is required - a minimum period of every 5 minutes for the first 30 minutes should be maintained.

- Assess epidural insertion sites for inflammation, tenderness leakage or unusual bleeding, bruising, swelling, or redness **6 hourly** and documents findings in the nursing documentation. **Note: If evidence of infection, obtain swab for M, C&S from the site and notify surgical team, inserting Anaesthetist and the Acute Pain Service.**

- Monitoring of sensory and motor block is essential for the early detection of potentially serious complications. The Bromage scale (APPENDIX 9) should be used to assess such following surgery and **1 hourly** until the epidural infusion is discontinued and then for a further **24 hours** following removal of epidural catheter.

- Please refer and follow the leg weakness flow chart management if any leg weakness identified with an epidural analgesia (Appendix 10). An increasing degree of motor weakness usually implies excessive epidural drug administration. However, it can indicate very serious complications including dural penetration of the catheter, or the development of an epidural haematoma or abscess.

- If a dense motor block fails to resolve after cessation of ongoing epidural infusions (no reduction in motor block/improvement in Bromage score for two consecutive hours), or if the motor block increases (Bromage score reduces) from one hour to the next, an escalation in care is warranted, the APS and or Obstetric Anaesthetist should be called to assess the patient.

- New onset of severe back pain in a child with a recent epidural should raise suspicion of epidural abscess or haematoma. **Inform on-call Anaesthetist as a matter of urgency.**

- Staff should be aware that increased or breakthrough pain in an otherwise working epidural may indicate surgical complications including the development of compartment syndrome. These children should be urgently reviewed by a Paediatric Consultant Anaesthetist. Special care should be taken when interpreting physical signs in patients who may have sustained neurological damage.

- Care should be taken of a child nursed in a head down position for prolonged periods as they risk cephalad spread of epidural solution, with the potential for subsequent complications.

- Document **1 hourly** infusion device checks as per C&VUHB infusion device policy.

- During every staff change the infusion device must have its protocol, prescription on the Supplementary Prescription Chart and device settings checked. These checks must be signed on the In-Patient Medication Administration Record (found on the Supplementary Prescription Chart).

- Change the premixed infusion bags as required, indicating on the record of administration chart that a new bag has been supplied, **TWO** registered nurses must sign for the new bag on the In-Patient Medication Administration Record.

- Ensures that the epidural remains connected to the Infusion device at all times and never disconnected from the bacterial filter. This will reduce the risk of wrong route errors. ***If there has been an inadvertent wrong route error stop infusion immediately and follow the AAGBI Guidelines (attached).***

Please refer to care plan for further information on monitoring requirements (APPENDIX 11).

Complications	**Recommendation**
Hypotension	Hypotension should be recognised and treated promptly. A fall in blood pressure greater than 20% from baseline warrants further assessment and management. Assessment of hypotension should include the exclusion of causes other than sympathetic blockade. Management may require the use of a fluid bolus and vasoactive drugs. Protocols should be in place to ensure the child is managed by a suitably competent person, if these are required.
Spinal Canal Space Occupying Lesions (Including epidural haematoma and epidural abscess)	Nursing staff should be trained to recognise signs and symptoms of spinal canal space occupying lesions in patients treated with epidurals. Epidural abscess should be considered in all patients with signs of (otherwise unexplained) systemic infection with an epidural in situ or with infection at the epidural site. However, not all patients with epidural abscess display fever. The presence of severe or increasing back pain, even in the absence of fever may indicate epidural infection and should be reported to the responsible Anaesthetist/ on-call Anaesthetist and APS immediately. Other symptoms that should raise concern include inappropriate motor weakness (even when unilateral). The 3rd National Audit Project identified epidural catheter removal as the time of greatest risk for epidural haematoma development. Local

	guidelines on the timing of safe catheter removal should be followed when patients are receiving anti-coagulant medication. Clinical suspicion of a spinal canal space occupying lesion should prompt urgent discussion with a senior Anaesthetist. Epidural haematoma and abscess are considered neurosurgical emergencies. Clinical suspicion of an epidural vertebral canal haematoma or abscess should be investigated firstly with an urgent MRI scan (unless contraindicated) by the team responsible for managing the epidural. If this pathology is identified, there must be urgent discussion with the local neurosurgical unit to determine further management.
Total Spinal	Total spinal is an anaesthetic emergency that should be considered in any case of respiratory arrest, cardiovascular collapse or loss of consciousness in a patient who has recently received an epidural bolus. The Resuscitation Team (Bleep 2222) should be called and treatment in the first instance is stopping the epidural infusion and supportive measures in accordance with paediatric life support guidelines. This includes: securing the airway, ensuring adequate ventilation and supporting the cardiovascular system with fluids and/or vasoactive medications.
Post-Dural Puncture Headache (PDPH)	Any patient developing a headache following epidural anaesthesia or with a known accidental dural puncture should be followed up until headache resolution. Differential diagnoses should be considered for all patients. Those patients not responding to conservative treatment should be offered epidural blood patch, if appropriate. Those with unresolved symptoms should be discussed with a neurologist and undergo further investigations to exclude complications of PDPH or an alternative diagnosis when appropriate.
Local Anaesthetic Toxicity (LAT)	The Association of Anaesthetists have published concise guidelines regarding the management of severe local anaesthetic toxicity. These should be readily available in all areas where boluses are administered via epidurals along with an emergency treatment box including 20% lipid emulsion (i.e. Intralipid®) for the treatment of LAT.
Neuropraxia and Major Nerve Damage	In the rare event of in any form of nerve injury occurring after epidural insertion (but not related to a spinal canal space occupying lesion) urgent referral to a neurologist should be made. Any nerve or spinal cord damage after epidural should be reported using locally established patient incident reporting systems.

Discontinuing epidural analgesia

Before removing the epidural catheter, the following points should be considered:

- Epidural infusions in under 5 kg babies should be discontinued at 48 hours. If epidural infusion is indicated for longer duration, it will be at the discretion of the Paediatric Consultant Anaesthetist and documented in the child's notes.

- Epidural infusions for management of acute pain in paediatric patients should only be maintained for up to **5 days** as the risk of infection rises beyond this point.

- Is the child able to tolerate free fluids and absorb alternative analgesia?

- Regular analgesia should be commenced on stopping the epidural infusion. PRN analgesia should be prescribed and available if clinically required. This should avoid inadequate pain management when transitioning to alternative pain management.

- Epidural infusions do not have to be weaned prior to discontinuing.

- Once stopped the epidural catheter and infusion device should be left in place for **4 hours** and pain assessment continued.

- If pain scores escalate and is not managed by alternative analgesia the epidural can be restarted (if not exceeding **5 days** and baby not 5kg and under) and re assessed after 24 hours. Discuss with Acute Pain Service and or Consultant Paediatric Anaesthetist.

- If the patient has a coagulopathy or is receiving an IV Heparin infusion, seek advice from the APS/ Consultant Paediatric Anaesthetist.

- All patients with an epidural should have a post-op FBC taken. The epidural catheter should not be removed if the platelet count is less than 100. However, if there is a high risk of epidural related infection, specific advice should be sought from the Consultant Paediatric Anaesthetist.

- Consideration may be given to the removal of the child's urinary catheter once the epidural catheter has been removed.

- Infusion catheters can only be removed by trained staff using an ANTT. Carefully remove the dressing and with gentle traction remove the catheter. Apply a non-occlusive dressing for at least 24 hours. If there is any resistance, do not continue and inform the Acute

Pain Service or Obstetric Anaesthetist out of hours. Ensure the full length of the catheter is removed, that the end of the catheter is visualised and document in notes. If there are any signs of infection at the catheter site, send the tip and swab site for MC&S and inform Acute Pain Service.

- The site should be observed for **3 days** following its removal for any signs of infection. The nurse caring for the patient should check the epidural site every day for 3 days and assess and document patient's ability to Straight Leg Raise every **2 hours** for **24 hours** post removal of the epidural catheter. The Acute Pain Service or Anaesthetist should be contacted regarding any concerns.

- If the child is discharged before this time or if the child experiences any new back pain, altered sensation or weakness to lower limbs or unexpected bowel or bladder problems then they should contact the Acute Pain Service or Obstetric Anaesthetist on duty via the hospital switch board. A patient information leaflet regarding epidural analgesia and containing this advice will be provided by the Acute Pain Service to all patients receiving epidural analgesia.

- It is the responsibility of the discharging nurse to ensure that either the district nurse conducts epidural site checks or parent/ guardian is educated to check the epidural site and seek medical advice if necessary. Written and verbal advice should be provided to child, parent and carers alerting them to the signs and symptoms of an epidural abscess and what to do if these occur after discharge home as many children are discharged before the mean time of onset of these signs and symptoms.

- Any problems should be discussed with the Paediatric Consultant Anaesthetist responsible for the epidural. If this is not possible then contact the Consultant on call for Paediatric Anaesthetist via switchboard.

Management of severe local anaesthetic toxicity

Local anaesthetic toxicity can occur if there is excessive absorption into the bloodstream. It is rare but imperative that the signs are recognised and that the child is managed according to the AAGBI Guidelines. Hourly monitoring aims to identify symptoms in the earliest stages to ensure remedial action can be taken. Please refer to chart overleaf.

Early signs of local anaesthetic toxicity	Action for early signs
• Muscle twitching • Tinnitus • Tingling around the mouth • Light headiness	• Stop regional continuous local anaesthetic • Continue monitoring as per guideline and increase frequency as dictated by clinical presentation

• Visual disturbance	• Continue close monitoring until symptoms subside • Recommencing the epidural infusion of local anaesthetic should only occur following discussion with an Anaesthetist and Acute Pain Service. • If continuous regional local anaesthetic is to be recommenced consider restarting at a lower rate.
Critical signs of local anaesthetic toxicity	Action for critical signs
• Unresponsiveness • Fitting • Cardiac arrest	• Follow **AAGBI Guidance (APPENDIX 13)** • Simultaneously call the arrest team and commence basic life support • Stop regional continuous infusion of local anaesthetic.
NB: Intralipid is located in the recovery room of both the Children's Hospital of Wales and main recovery room University Hospital of Wales.	

Section 8 - MANAGEMENT OF ACUTE PAIN IN PAEDIATRIC PATIENTS USING REGIONAL CONTINUOUS INFUSIONS OF LOCAL ANAESTHETICS

(Children over 10kgs and 1 year of age and above)

Definition

A continuous infusion of local anaesthetic into an area of the body (excluding epidural infusion). The administration of continuous local anaesthetic infusion (regional analgesia) can be used as part of a multi modal approach for acute pain management in paediatrics. Regional continuous infusions of local anaesthetic can reduce the amount of opiates required and also improve patient experience and recovery. Local anaesthetics exert effect as analgesics by blocking sodium channels and impeding neuronal excitation and or conduction.

Indications

To receive a safe and effective regional continuous infusion of local anaesthetic for the relief of acute postoperative pain or pain following trauma.

Contraindications

Absolute	Caution
Patient/parent refusal Local infection/sepsis Allergy to local anaesthetic drugs (suspected or documented)	Hepatic impairment Coagulopathy

Prescription

Regional analgesia should be prescribed as continuous infusion. In addition to the child's own In-Patient Medication Administration Record, the prescriber should complete a Supplementary Paediatric Regional Continuous Prescription chart. Pre-printed labels are available in the anaesthetic rooms and recovery rooms for use by the prescriber to affix to the PRN side of the paediatric medication chart.

The following pre-filled regional continuous analgesia solutions are available for use:

- Bupivacaine 0.1%
- Bupivacaine 0.125% (Bupivacaine 0.125% is the preferred choice)

Regular balanced analgesia should be prescribed alongside the regional continuous infusion of local anaesthetic. Additional supplementary analgesia may be considered if indicated such as PRN opioids/ PCA/ NCA.

Equipment

A dedicated pain management infusion device must be used. The regional continuous infusion device and dedicated yellow infusion line must be used and labelled correctly. It must be easily distinguishable from those used for intravenous and other routes. A bacterial filter must always be used.
A patent intravenous cannula must be insitu whilst the child is receiving continuous regional analgesia infusion.

Designated areas of responsibility

A child with a regional anaesthetic continuous infusion is to be cared for **ONLY ON:**

- Paediatric critical care unit.
- Paediatric surgical area.

Initiating treatment and monitoring of child receiving regional continuous analgesia

Nurses responsibilities:
All registered nurses caring for a child with a regional continuous infusion of local anaesthetic must have received specific training in the management of such.
Setup of the Infusion device should only occur in the Recovery Unit by a recovery nurse, an advanced pump device user and / or the Acute Pain Service. All of whom must have been assessed as competent in the setup of the device.

- The infusion device will be setup on **Protocol H or J** (according to prescription) and primed using the dedicated yellow infusion line and a prefilled bag of Bupivacaine 0.1% or Bupivacaine 0.125%.

- The protocol and infusion device settings will be checked with another (suitably trained) registered nurse and the record of administration chart signed by both.

- Once all checks have been completed, the infusion device will be attached to the regional catheters via the bacterial filter using ANTT.

- All connections are checked as being tight and secure.

- A "NOT FOR I.V. CONNECTION" sticker will be attached to the yellow infusion line at the point where it joins the bacterial filter.

- The child has established and patent I.V. access.

- Infusion initiated at the prescribed rate.

- Monitor and document ½ **hourly** observations for the first 2 hours after the infusion has been setup and then **1 hourly** thereafter if stable, more frequent if clinically indicated until infusion is discontinued.

- Assess and document pain scores (at rest and on movement and deep breathing), sedation score and nausea scores **1 hourly**. If the child reports moderate or severe pain, increase the rate of the local anaesthetic infusion within the prescribed rates.

- Assess catheter site check (CSC) for unusual bleeding, bruising, swelling, or redness **6 hourly** and documents findings in the nursing documentation. **Note: If evidence of infection, obtain swab for M, C&S from the site and notify surgical team and Acute Pain Service.**

- Document **1 hourly** infusion device checks as per C&VUHB infusion device policy.

- During every staff change the infusion device must have its protocol, paediatric medication chart and device settings checked. These checks must be signed on the Record of Administration chart by both registered nurses.

- Change the premixed Bupivacaine 0.1%/ 0.125% infusion bags as required, indicating on the record of administration chart that a new bag has been supplied, **TWO** registered nurses must sign for the new bag on the prescription chart.

- Ensures that the regional continuous infusion of local anaesthetic remains connected to the Infusion device at all times and never disconnected from the bacterial filter. This will reduce the risk of wrong route errors. ***If there has been an inadvertent wrong route error stop infusion immediately and follow the AAGBI Guidelines*** **(APPENDIX 13).**

- Please refer to paediatric epidural/ regional analgesia care plan **(APPENDIX 12)** further trouble shooting guidance.

Minimising wrong route error

The bags of local anaesthetic infusion solution should be clearly labelled.

No bags of local anaesthetic analgesia solution should be stored in the operating theatre or anaesthetic rooms.

Bags of local anaesthetic solution should be stored in separate cupboard from those holding

intravenous and other types of infusion in order to reduce risk of wrong route administration.

Discontinuing infusion

- Discontinuing regional local anaesthetic infusions should only occur on the advice of the Acute Pain Service and or Obs on-call Anaesthetist**.**
- Regional continuous infusions of local anaesthetic for management of acute pain in paediatric patients can be maintained for up to **5 days only.**
- Regular and rescue analgesia should be commenced prior to stopping the continuous regional anaesthetic infusion. This should avoid inadequate pain management when transitioning to alternative pain management.
- Regional continuous infusions of local anaesthetic do not have to be weaned prior to discontinuing.
- Once stopped the regional continuous infusions of local anaesthetic catheter and infusion device should be left in place for 4 hours and pain assessment continued.
- If pain scores escalate and are not managed by alternative analgesia the regional continuous infusions of local anaesthetic can be restarted (if not exceeding 5 days) and re-assessed after 24 hours. This should be discussed with Acute Pain Service first and or Obs on-call Anaesthetist**.**
- Infusion catheters can only be removed by trained staff using an ANTT. Carefully remove the dressing and with gentle traction remove the catheter. Apply a non-occlusive dressing for at least 24 hours. If there is any resistance, do not continue and inform the surgical team and Acute Pain Service. Ensure the full length of the catheter is removed, that the end of the catheter is visualised and document in notes. If there are any signs of infection at the catheter site, send the tip and swab site for MC&S and inform Acute Pain Service.

Management of severe local anaesthetic toxicity

Local anaesthetic toxicity can occur if there is excessive absorption into the bloodstream. It is rare but imperative that the signs are recognised and that the patient is managed according to the AAGBI Guidelines (APPENDIX 13). Hourly monitoring aims to identify symptoms in the earliest stages to ensure immediate action can be taken. Please refer to Chart overleaf.

Early signs of local anaesthetic toxicity	Action for early signs
Muscle twitching Tinnitus Tingling around the mouth Light headiness Visual disturbance	Stop regional continuous local anaesthetic Continue monitoring as per guideline and increase frequency as dictated by clinical presentation Continue close monitoring until symptoms subside All symptoms should be reported and discussed with Acute Pain Service and or Obs on-call Anaesthetist. Recommencing the regional infusion of local anaesthetic should only occur following discussion with an Anaesthetist and Acute Pain Service and all symptoms are subsided. If continuous regional local anaesthetic is to be recommenced consider restarting at a lower rate. Maintain oxygenation and BP throughout
Critical signs of local anaesthetic toxicity	**Action for critical signs**
Unresponsiveness Convulsions Cardiovascular collapse: bradycardia, arrhythmias & / or cardiac arrest.	Follow **AAGBI Guidance (APPENDIX 13)** Simultaneously call the arrest team and commence basic life support Stop regional continuous infusion of local anaesthetic.
NB: Intralipid is located in the recovery room of the Children's Hospital of Wales and main recovery room of the University Hospital of Wales.	

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Section 9 - ENTONOX

Definition

ENTONOX (50% nitrous oxide/ 50% oxygen medical gas mixture) is a fast-acting, non-invasive analgesic that is particularly advantageous for treating short-term procedural pain in children.

ENTONOX is licensed for use across all age groups. As long as the child is able to activate the demand valve and understand instructions on how to use the equipment, then it is safe to use (unless specific contraindications – see below).

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 pressurised mixture remains gaseous at temperatures above –6^{o}C.

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

Indications

Entonox is indicated for the relief of acute moderate to severe pain (see contraindications for exclusion criteria) during short, painful procedures e.g.

- Fracture manipulation
- Endoscopy (e.g. colonoscopy)
- Suturing of lacerations
- Venepuncture
- Wound dressing changes
- Burns dressing
- Orthopaedic joint manipulation
- Patient mobilisation / physiotherapy
- Wound drain removal
- Examination of wounds or fractures

Contraindications

Contraindications to Entonox are:

Contraindication:	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	
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.

Special Precautions

Repeated or prolonged exposure to nitrous oxide depletes the body's stores of vitamin B12 and very rarely this can precipitate neurological complications.

Patients at higher risk include those:

- Who use Entonox frequently,
- With a poor oral intake or on a diet low in animal products e.g. Vegans,
- With malabsorption syndromes, particularly those with ileal resections,
- On synthetic diets (eg. phenylketonuria, maple syrup urine disease),
- On a diet for which special vitamin and mineral supplements are prescribed (more than standard vitamins such as abidec)

Ensure the area is well ventilated during and after administration

The nitrous oxide constituent of ENTONOX causes inactivation of vitamin B_{12}, which is a co-factor of methionine synthase. Folate metabolism is consequently interfered with and DNA synthesis is impaired following prolonged administration of ENTONOX. Prolonged or frequent use of ENTONOX may result in megaloblastic marrow changes, myeloneuropathy and sub-acute combined degeneration of the spinal cord. **ENTONOX should not be used for more than a total of 12 hours within a 4-day period, without close clinical supervision and haematological monitoring.** Specialist advice should be sought from a haematologist in such cases. Haematological assessment should include an assessment for megaloblastic change in

red cells and hypersegmentation of neutrophils. Neurological toxicity can occur without anaemia or macrocytosis and with B_{12} levels in the normal range.

In patients with undiagnosed subclinical deficiency of vitamin B_{12}, neurological toxicity has occurred after single exposures to nitrous oxide during general anaesthesia.

In patients taking other centrally acting depressant medicinal products, such as morphine derivatives and/or benzodiazepines, concomitant administration of ENTONOX may result in increased sedation, and consequently have effects on respiration, circulation and protective reflexes. If ENTONOX is to be used in such patients, this should take place under the supervision of appropriately trained personnel. Where the patient has been exposed to agents which are toxic to the lungs, such as Paraquat, the use of gases containing more than 21% oxygen should be avoided.

It may be difficult for Entonox to be used by the very young due to mask fitting and administration difficulties.

Staff in the first trimester of pregnancy may wish to avoid the area while Entonox is in use.

Prescription

Entonox must be prescribed. Please use the ENTONOX Prescription Chart (APPENDIX 14) and attach / sign the pre-printed adhesive to the In-Patient Medication Administration Chart.

Entonox is self-administered using a dedicated Entonox demand valve

Consent

Verbal Patient Consent must be obtained to be able to administer Entonox and documentation of this consent should be made in the medical /nursing notes. A patient information leaflet should be provided to the child / parent / guardian prior to administration.

Equipment

Entonox demand apparatus is available on the Paediatric Surgical area. The mouthpiece is available from CSSD. The equipment will be regularly serviced and maintained by the Regional Anaesthetic Support Services unit who should be contacted if any problems are encountered with the equipment.

Designated clinical areas & responsibilities

Entonox may be used anywhere within the hospital if there are suitably trained qualified nurses to supervise its administration. As Entonox is a form of patient-controlled analgesia, it is the responsibility of the nurses to instruct the child in its use.

Monitoring Requirements

Please follow the care plan (APPENDIX 15) (on the back of the Supplementary Prescription Chart) for the monitoring requirements.

Entonox should only be administered by staff that are trained and competent in both its use and the equipment available for its administration.

Online Entonox Training can be completed here: https://www.boctraining.co.uk/login/index.php. You will need to sign up via BOC to access this free educational course. At completion of the course you will be provided with a Certificate of Competence. Individual Practitioners are responsible for keeping their own competency record.

Please read BOC Entonox - Essential Guide for further information on the administration of Entonox or contact the Acute Pain Service on Bleep 5414.

Section 10

TRAINING

It is a mandatory requirement within Cardiff and Vale University Health Board that any personnel using infusion devices, including intravenous PCA and Epidural / Regional, undergo training and competency assessment (please refer to the Policy for the use of Parenteral Infusion Devices). Training is available through Clinical Engineering.

Pain Management Study days are provided by the Acute Pain Team throughout the year. There are specific dates for Registered Nurses (although other members of the multidisciplinary team are welcome to attend) and HCSWs. Please arrange via LED.

IMPLEMENTATION

These guidelines are an update to previous guidelines. Throughout the formal pain management study days and informally in day to day clinical practice reference is made to the document. These guidelines are written for the multidisciplinary team.

EQUALITY IMPACT AND ASSESSMENT

An equality impact assessment has been undertaken to assess the relevance of these guidelines to equality and potential impact on different groups, specifically in relation to the General Duty of the Race Relations (Amendment) Act 2000 and the Disability Discrimination Act 2005 and including other equality legislation. The assessment identified that the guidelines presented no risk to the Health Board.

FURTHER INFORMATION

For any further information or clarification in relation to paediatric peri-operative pain management practices please contact the Clinical Lead for Paediatric Anaesthesia via the Department of Anaesthetics or the Acute Pain Team on Bleep 5414.

AUDIT

Compliance with these guidelines will be audited continuously by the Acute Pain Service via the Acute Pain Service Clinical Workstation Database. Audit results will be discussed and distributed to each relevant clinical area.

DISTRIBUTION

These guidelines will be available throughout the Health Board via the Sharepoint system.

APPENDIX 1 Pain Assessment Tool

Cardiff & Vale University Health Board

Pain Assessment Scales

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Caerdydd a'r Fro
Cardiff and Vale University Health Board

Hurts as much as you can imagine
(Score as 10)

Hurts a lot
(Score as 8)

Hurts even more
(Score as 6)

Hurts a little more
(Score as 4)

Hurts just a little bit
(Score as 2)

Does not hurt
(Score as 0)

WONG & BAKER FACES SCALE

Having explained to the child what each face means, ask child to choose the face which expresses their pain / hurt.

PAIN THERMOMETER

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Caerdydd a'r Fro
Cardiff and Vale University Health Board

Cardiff & Vale University Health Board

FLACC Pain Assessment Scales

(Face, Legs, Activity, Cry, Consolability)

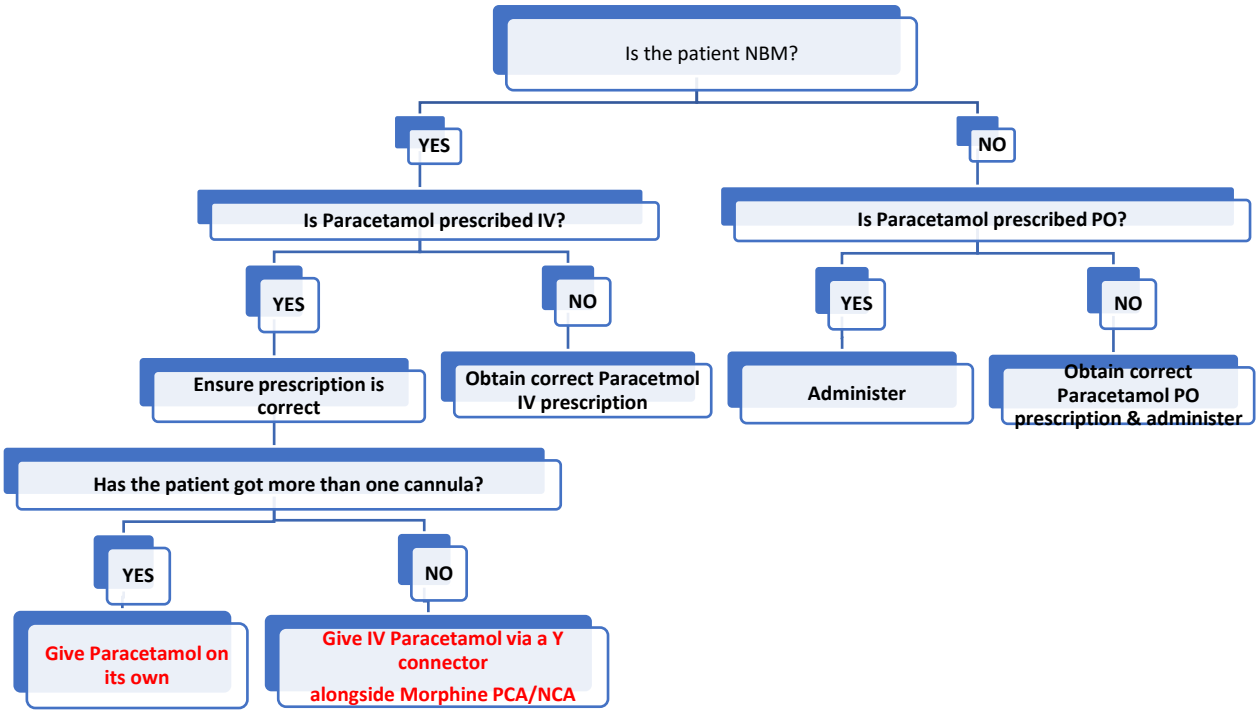
- Behavioural Scale - can be used in children up to 7 years.
- Can be used in children with congnitive impairment.
- Each of the 5 catagories (Face, Legs, Activity, Cry, Consolability) is scored 0-2 and the scores added to get a total from 0-10.
- Behavioural scores need to be considered within the context of the child's psychological status, anxiety and other environmental factors.

	0	1	2
Face	No particular expression or smile.	Occasional grimace or frown, withdrawn, disinterested.	Frequent to constant frown, clenched jaw, quivering chin.
Legs	Normal position or relaxed.	Uneasy, restless, tense.	Kicking or legs drawn up.
Activity	Lying quietly, normal position, moves easily.	Squirming, shifting back and forth, tense.	Arched, rigid or jerking.
Cry	No cry (awake or asleep).	Moans or whimpers.	Crying steadily, screams or sobs, frequent complaints.
Consolability	Content, relaxed.	Reassured by touch.	Difficult to console or comfort.

Carefully score each section above and total.

See reverse of Observation Chart regarding nursing interventions when scores have been totalled.

APPENDIX 2 - Guidance for The Administration of IV Paracetamol for Paediatrics Receiving Morphine PCA/NCA



Please ensure:

- **Correct dose for age**
  (including adjustments for gestational age & max daily dose)
- **Correct weight**
  (up to date weight documented on prescription chart)
- **Correct route**
  (including dose adjustments pertaining to route)
- **Most up-to-date version of BNF used for dosage reference**

APPENDIX 3 - Guidance For the Use of Codeine In Children And Breastfeeding Mothers

S **Situation**	The Pharmacovigilance Risk Assessment Committee (PRAC) of the European Medicines Agency (EMEA) and the US regulator (FDA) has recommended restrictions on the use of codeine. They include:- Restricting use of codeine to children over 12 years of age Avoiding the use of codeine in all children (under 18) who undergo tonsillectomy or adenoidectomy (or both) for obstructive sleep apnoea.
B **Background**	A European review of the safety of codeine-containing medicines licensed for pain relief in children (age 0-18 years) began in October 2012. This review was triggered by concerns of an increased risk of morphine toxicity when susceptible children receive codeine for pain after surgery. These concerns follow the reporting of three fatalities and one life-threatening case of respiratory depression in children given codeine after tonsillectomy or adenoidectomy in the treatment of obstructive sleep apnoea. Codeine is converted to morphine in the liver by CYP2D6 enzyme. There are many genetic variations of CYP2D6, which affect the extent of this conversion in individuals. Different plasma morphine concentrations in patients' blood leads not only to different levels of pain relief, but also to a variable and unpredictable risk of side effects due to morphine's action on the brain and respiratory centre.
A **Assessment**	Given the widespread use of codeine in paediatric practice including postoperative analgesia, particularly after day stay surgery, this has caused considerable concern. The current advice falls short of contraindicating the use of codeine in all children but has left clinicians with a dilemma to either continue to use the drug with increased caution, (in the knowledge of the MHRA communication) or to change practice to one of a number of alternatives such as oral morphine, tramadol, oxycodone or dihydrocodeine. These products may not be available in the same range of formulations; may contain unsuitable excipients; may have similar adverse effect profile and/or may not be suitable for use on discharge from hospital.
R **Recommendation**	The following recommendations have been made following discussions at the Child Health Directorate Safe Medication Practice Group and agreement at the Quality and Safety and Patient Experience Group. 1. Codeine should not be used in any children (under 18 years of age) who undergo removal of tonsils or adenoids due to sleep apnoea 2. Codeine should only be used in children over 12 years of age. Change to the prescribing of low dose morphine for breakthrough pain at home. Some teams are uncomfortable with providing morphine outside the hospital setting albeit at a low dose, even though it is not a controlled substance in this dilute formulation. However, as a precaution, we are able to provide the appropriate amount of morphine as a limited number of individualised doses, with access to advice should pain continue. As with codeine, patients who have undergone removal of adenoids or tonsils with a history of obstructive sleep apnoea are a special case. Again, these patients need in-hospital evaluation of opioid sensitivity. Decisions need to be made whether to keep these children in the hospital until no longer requiring opioids or to send them home with an appropriately considered dose of opioid for breakthrough pain. All patients should be closely monitored, healthcare professionals should be alert to the symptoms of toxicity including reduced levels of consciousness, somnolence, respiratory depression. If any of these symptoms develop the patient should be reviewed **immediately** by a doctor. No further doses should be given. Naloxone may be indicated. Pin-point pupils, lack of appetite, constipation or nausea and vomiting are also signs of toxicity. **Breastfeeding -** Codeine MUST NOT be used in breastfeeding mothers

APPENDIX 4 – Morphine PCA / NCA Prescription

PAEDIATRIC PRESCRIPTION CHART FOR INTRAVENOUS PATIENT / NURSE CONTROLLED ANALGESIA

Patient Details (affix addressograph)	Consultant:	Type of Pump:	**Arcomed SP6000**
	Ward:	Actual Weight:	Kg
	Bar Code:	**Drug Calculation Weight:**	kg

Complete pre-printed PCA / NCA label for 'as required' part of the medication chart (includes naloxone & ondansetron)

DRUG	**MORPHINE**
Diluent	0.9% Sodium Chloride / 5 % Dextrose. TOTAL VOLUME = **50mls**

Paediatric NCA UNDER 6 MONTHS ☐ *Select*	Mass of Drug: **1mg/kg = mg** Final Concentration: **20 micrograms/kg/ml = micrograms/ml** Bolus Dose: **10 micrograms/kg** Lockout: **15 or 20 minutes** (please circle) Background Infusion Rate: **10 microgram/kg/hr**	Background discontinued: Date ..... Time ..... Signature:
Paediatric NCA 6 MONTHS+ & <50kg ☐ *Select*	Mass of Drug: **1mg/kg = mg** Final Concentration: **20 micrograms/kg/ml = micrograms/ml** Bolus Dose: **20 micrograms/kg** Lockout: **15 minutes** Background Infusion Rate: **10 micrograms/kg/hr**	Background discontinued: Date..... Time..... Signature:
Paediatric NCA 50kg+ ☐ *Select*	Mass of Drug: **50mg in 50mls** Final Concentration: **1 mg/ml** Bolus Dose: **1 mg** Lockout: **15 minutes** Background Infusion Rate: **0.5 mg/hr**	Background discontinued: Date ..... Time ..... Signature:
Paediatric PCA <50kg ☐ *Select*	Mass of Drug: **1mg/kg= .....mg** Final Concentration: **20 micrograms/kg/ml = micrograms/ml** Bolus Dose: **20 micrograms/kg** Lockout: **10 minutes** Background Infusion Rate: **4 micrograms/kg/hr**	Background discontinued: Date ..... Time..... Signature:
Paediatric PCA 50kg+ ☐ *Select*	Mass of Drug: **50mg in 50mls** Final Concentration: **1 mg/ml** Bolus Dose: **1 mg** Lockout: **5 minutes** Background Infusion Rate: **NO BACKGROUND INFUSION**	

Recovery room nursing staff: Prescription calculations and infusion device settings to be checked before return to ward:	Signature 1.	
	Signature 2.	

If respiratory rate < ..... (see overleaf for appropriate rate).
Stop PCA, call Acute Pain Service BLEEP 5414 / Obstetric Anaesthetist BLEEP 5101. Consider giving Naloxone.

Prescribers Name:		Setup by:	Checked by:
Prescribers Signature:			
DATE:			

APPENDIX 5 – Fentanyl PCA / NCA Prescription

PAEDIATRIC PRESCRIPTION CHART FOR INTRAVENOUS PATIENT / NURSE CONTROLLED ANALGESIA

Patient Details (affix addressograph)	Consultant:	Type of Pump:	ARCOMED SP6000
		Bar Code:	
	Ward:	**Weight:**	Kg

Complete pre-printed PCA / NCA label for 'as required' part of the medication chart (includes naloxone & ondansetron)

	DRUG	FENTANYL
	Diluent	0.9% Sodium Chloride / 5 % Dextrose. TOTAL VOLUME 40mls

Paediatric NCA UNDER 6 MONTHS ☐ Select	Mass of Drug: 40 mcg/kg = micrograms Final Concentration: 1 microgram/kg/ml = micrograms/ml Bolus Dose: 0.5 micrograms/kg Lockout: 20 minutes Background Infusion Rate: 0.5 micrograms/kg/hr	Background discontinued: Date ..... Time ..... Signatures:
Paediatric NCA OVER 6 MONTHS & <50kg ☐ Select	Mass of Drug: 40mcg/kg = micrograms Final Concentration: 1 microgram/kg/ml = micrograms/ml Bolus Dose: 0.5 micrograms/kg Lockout: 20 minutes Background Infusion Rate: 1 micrograms/kg/hr	Background discontinued: Date ..... Time ..... Signatures:
Paediatric NCA 50kg + ☐ Select	Mass of Drug: 1000 micrograms Final Concentration: 25 micrograms/ml Bolus Dose: 25 micrograms Lockout: 20 minutes Background Infusion Rate: 50 microgram/hr	Background discontinued: Date ..... Time ..... Signatures:
Paediatric PCA <50kg ☐ Select	Mass of Drug: 1000 micrograms Final Concentration 25 micrograms/ml Bolus Dose 0.4 micrograms/kg Lockout: 10 minutes Background Infusion Rate: 0.4 micrograms/kg/hr	Background discontinued: Date ..... Time ..... Signatures:
Paediatric PCA 50kg & over ☐ Select	Mass of Drug: 1000 micrograms Final Concentration: 25micrograms/ml Bolus Dose: 20 micrograms Lockout: 5 minutes Background Infusion Rate: NO BACKGROUND INFUSION	

If respiratory rate < ..... (see overleaf for appropriate rate).
Stop PCA, call Acute Pain Service BLEEP 5414 / Obstetric Anaesthetist BLEEP 5101. Consider giving Naloxone.

Recovery room nursing staff: Prescription calculations and infusion device settings to be checked before return to ward:			Signature 1.	
			Signature 2.	
Prescribers Name:		Date:	Setup by:	Checked by:
Prescribers Signature:				

APPENDIX 6 – Ketamine Prescription

PAEDIATRIC PRESCRIPTION CHART FOR INTRAVENOUS KETAMINE INFUSION

Patient Details (affix addressograph)	Consultant:	Type of Pump:	ARCOMED SP6000
		Bar Code:	
	Ward:	Weight:	kg

Complete pre-printed Ketamine label for 'as required' part of the medication chart

DRUG:	KETAMINE	
Diluent:	0.9% Sodium Chloride	TOTAL VOLUME = 50mls

<50kg Regimen	Mass of Drug: 2mg/kg = mg Final Concentration: 40 microgram/kg/ml = micrograms/ml			
Standard Regimen: ☐	Starting Rate: ..... micrograms/kg/minute Range: 1 – 3 micrograms/kg/minute *Rate to be adjusted by anaesthetists or APS **ONLY** & signed for on record of administration*			
Post-operative reducing regimen: ☐		Set up by:	Checked by:	Date & Time:
	DAY OF SURGERY: 3 micrograms/kg/minute			
	DAY 1 10:00: 2 micrograms/kg/minute			
	DAY 2 10:00: 1 microgram/kg/minute			
	DAY 3 10:00: STOP			

50kg + Regimen	Mass of Drug: 200mg Final Concentration: 4mg/ml			
Standard Regimen: ☐	Starting Rate:..... mg/hr Range: 2 – 10 mg/hr *Rate to be adjusted by anaesthetists or APS **ONLY** & signed for on record of administration*			
Post-operative reducing regimen: ☐		Set up by:	Checked by:	Date & Time
	DAY OF SURGERY: 8mg/hr			
	DAY 1 10:00@ 5mg/hr			
	DAY 2 10:00: 2mg/hr			
	DAY 3 10:00: STOP			

Prescribers Name:		Date:	Setup by:	Checked by:
Prescribers Signature:				
Recovery room nursing staff: Prescription calculations and infusion device settings to be checked before return to ward:			Connected by:	Checked by:

N.B. Ketamine 10mg in 1ml is therapeutically equivalent to Esketamine 5mg in 1ml
Esketamine is no longer in use. Only Ketamine Infusions should be prescribed.

APPENDIX 7 – Paediatric Ketamine Careplan

Date	Problem	Goal	Nursing Care
	1. Unrelieved pain	Patient will have no more than moderate (4/10+) pain at rest and on movement.	Check that the intravenous catheter is patent. Check that the administration set is unclamped and connected properly. Administer prescribed analgesics e.g. Paracetamol, NSAID, weak/strong Opioid. If pain score remains moderate, call Acute Pain Service (APS) or On-Call Anaesthetist. Record and document 1 hourly pain assessment alongside other observations (See section 3). Contact the APS to see if Ketamine rate could be increased
	2. Potential problems with administration	Ketamine is safely administered.	The Ketamine infusion should be checked hourly by the qualified nurse caring for the child and a record of administration chart should be completed. Any discrepancies should be reported to the APS/ On-Call Anaesthetist immediately, stop the continuous infusion until the problem is resolved. Ensure that the Ketamine is infused as a continuous infusion via a locked PCA infusion device. When changing syringe and at shift handover, 2 qualified nurses (including the qualified nurse caring for the child) should check the Ketamine prescription against the dedicated PCA infusion device settings and ensure that the syringe is correctly labelled and contents agree with the prescription chart. Check and record pump checks hourly including handover/ syringe changes.
	3. Potential side effects:	Early detection and treatment.	Initially for the first 2 hours following commencement of the infusion, respiratory rate, pulse, B/P and O_2 saturation and nausea/vomiting should be monitored every 30 mins, and following this hourly for the duration of the Ketamine infusion. Pulse oximetry should be used continuously in **all children** receiving Ketamine infusions and for **2 hours after discontinuation of the infusion**.
	a) Respiratory depression /arrest	Respiratory rate appropriate for their age	Respiratory depression may be associated with the opioid analgesia that is administered alongside the ketamine infusion. Give Naloxone 4micrograms/kg if respiratory rate falls: < 1 year < 20/min, 1-5 years < 15/min, 5-12 years < 10/min, > 12 years < 8/min. Monitor respiratory rate and oxygen saturation continuously until patient is stable. **Contact Acute Pain Service or On-Call Anaesthetist immediately.** **If child has respiratory arrest. Stop the Ketamine infusion. Give supplementary oxygen at 15litres.** Stop all other medications which could be contributing to the sedation. **Call the arrest team on 2222**, and resuscitate as per CPR guidelines. Administer Naloxone as above if Opioid toxicity is suspected. **If pulseless: call the arrest team on 2222,** give supplementary oxygen at 15litres and resuscitate as per CPR guidelines. **Contact Acute Pain Service or On-Call Anaesthetist.**
	b) Sedation Score 2 or 3	Sedation score: 0-1	If the sedation score is 2, stop Ketamine infusion, and withhold Opioid analgesia, give oxygen 4l/min and monitor sedation level and respiratory rate. Record every 15 minutes. If the sedation score is 3, give oxygen 15l/min, via a non-rebreather mask, administer Naloxone (if sedation is thought to be due to Opioid analgesia) as stated in section 3b until sedation score is 0-1. Monitor O2 saturations continuously and check and record respiratory rate every 5 minutes. Contact the APS/ On-call Anaesthetist
	c) Oxygen Saturations <94%	O2 saturations: > 94%	If O2 saturations <94%, give oxygen 15l/min. If no improvement after 5 minutes, seek advice from APS/ On-call Anaesthetist (Consider patients baseline oxygen saturation level prior to commencing Ketamine/Opioids). Contact APS / On-Call Anaesthetist if concerned.
	d) Dysphoria problematic or distressing	Early detection and prevention	Contact Acute Pain Service on bleep 5414 or On-call Anaesthetist on bleep 5101 to reduce infusion rate.
	4. Potential problem with discontinuing Ketamine infusion	Safe weaning and discontinuation of the Ketamine infusion	The Ketamine infusion should not be stopped abruptly as this could cause undesirable side effects. Please seek advice from the Acute Pain Team / on call Anaesthetist prior to discontinuing the Ketamine infusion. The Ketamine infusion should not **exceed 5 days** unless the Acute Pain Service stipulate otherwise. The Ketamine infusion needs to be slowly titrated down prior to discontinuing in order to prevent undesirable side effects.

In accordance with the most recent guidance from C&VUHB Infusion Policy –

training and assessment in the use of the dedicated PCA Infusion Devices is mandatory for ANY nurse caring for a child with a PCA/NCA

Children's Hospital for Wales, Acute Pain Service - Bleep 5414.

Out of hours, the On-call Anaesthetist: bleep 5101 or Consultant Paediatric Anaesthetist *via* Switchboard should be contacted.

APS/OCT 2021

GIG CYMRU NHS WALES | Bwrdd Iechyd Prifysgol Caerdydd a'r Fro | Cardiff and Vale University Health Board

Acute Pain Service Paediatric Intrathecal Analgesia Care Plan

Addressograph

Patient's name

Ward	Consultant Paediatric Anaesthetist	Nurse's signature

Date	Problem	Goal	Nursing care
	1. Unrelieved pain	Patient should not have more than mild pain at rest and mild to moderate pain on movement	Assess and document pain scores every 1hour, or more frequently, if necessary. Administer prescribed Paracetamol/ NSAIDs (if not contraindicated). Give PRN Oromorph as prescribed every 4 to 6 hours. If this is ineffective, a prescription for PCA may be required. Contact the Acute Pain Service (APS)/ On call Anaesthetist.
	2. Potential Side effects	Early detection and treatment.	For **24 hours** assess and document – sedation score, nausea/vomiting scores, respiratory rate, pulse, blood pressure, temperature and oxygen saturation. Observations should be recorded **½ hourly** intervals for 2 hours and then **1 hourly** for 24 hours. Oxygen saturations should be recorded continuously for 24 hours post intrathecal opioid.
	a) Respiratory rate <8/min and or sedation score 2 or above	Respiratory rate>12/min	Give oxygen 15 litres/min, monitor oxygen saturation levels and give IV Naloxone in 50mcg increments and repeat until respiratory rate >12/min and or sedation 2 or above contact the APS)/ On call Anaesthetist. The respiratory rate should be recorded for a full minute.
	b) Oxygen saturations <94%.	Oxygen saturations>94%	Administer oxygen 15 litres/min. If oxygen saturation has not improved after 5 minutes, seek advice from APS/ On call Anaesthetist
	c) Nausea and vomiting.	Early detection of nausea and prevention of vomiting	Administer IV Ondansetron 0.1mg/kg (maximum 4 mg) and/or Dexamethasone 0.1 mg/kg (maximum 6 mg). If nausea persists contact APS/ On call Anaesthetist
	d) Itching.		Assess patient for itching. If troublesome administer IV Naloxone 50 mcg, repeat if necessary. If itching persists please contact APS/ On call Anesthetist
	e) Urinary retention.		Please record urine output on fluid balance chart. If patient has not passed urine for 12 hours postoperatively and/or is experiencing pelvic discomfort, contact medical staff for review.

University Hospital of Wales: Acute Pain Service: bleep 5414 Out of hours Obstetric on call Anaesthetist: bleep 5101

APPENDIX 9 – Bromage Scale

Bromage Scale

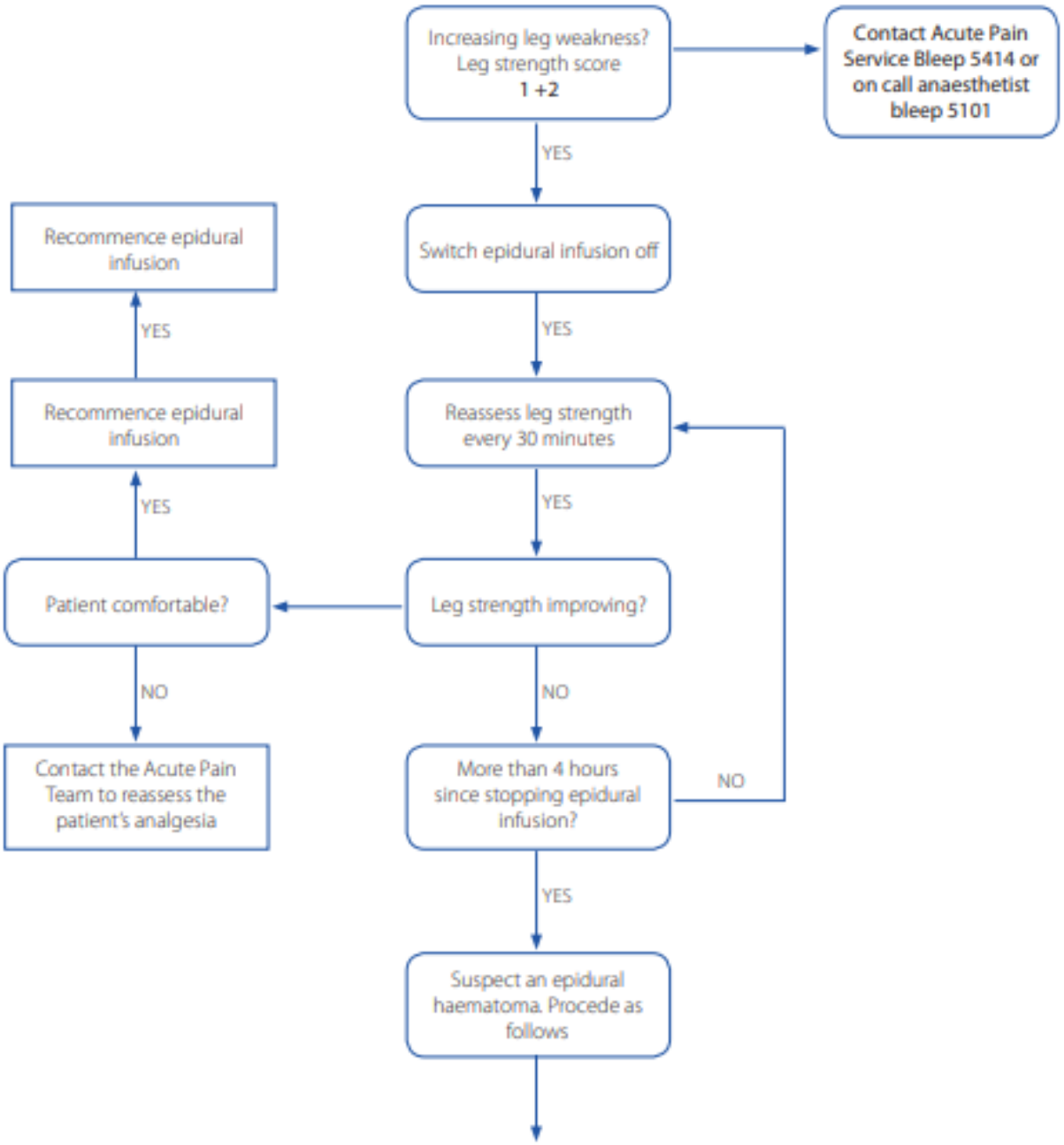
Score	Degree of motor block	
1	Complete block, unable to move feet or knees	
2	Able to move feet only	
3	Just able to flex knees; free movement of feet	
4	No block; full movement of knees and feet	

Reproduced with permission from Association of Anaesthetists & Obstetric Anaesthetist's Association Safety Guideline: Neurological monitoring after obstetric neuroaxial blockade (4).

APPENDIX 10 – Management of Leg Weakness with Epidural Analgesia

Management of leg weakness with epidural analgesia

All patients receiving epidural analgesia must have leg strength assessed as per bromage scale. Thoracic epidural analgesia should not cause profound leg weakness. Increasing leg weakness usually means the infusion rate is too high. However it may mean that the patient is developing an epidural haematoma. If not diagnosed and treated promptly, this will lead to paraplegia. Use this algorithm to help differentiate.



During weekday office hours contact a member of the Acute Pain Team bleep **5414** who will arrange an urgent spinal MRI scan through the neuroradiology department and contact the neurosurgical team on take. After hours and weekends contact the Anaesthetist on call (bleep **5101**) who will arrange an urgent spinal MRI scan through the on call radiologist and neurosurgical teams. An epidural haematoma has to be evacuated within 8 hours of the onset of symptoms for your patient to have the best chance of recovery of neurological function. Do not delay.

APPENDIX 11 – Paediatric Epidural/Regional Careplan

Problem	Goal	Nursing care
1.**Unrelieved pain**	Child will have no more than mild pain on rest or movement	**Record pain assessment hourly, utilising the most appropriate pain assessment tool according to age/cognitive ability of child.** Check **epidural or local anaesthetic** infusion catheter connections and insertion sites for leakage. If there is a unilateral block (epidural) that is not covering the site of pain, lay child on the painful side. If connections are secure, increase infusion rate within prescribed limits. Check level of block if indicated. **If not contraindicated, give regular Paracetamol +/- NSAID.If pain persists despite epidural or local anaesthetic infusion infusing at maximum prescribed rate, contact Acute Pain Service (APS) / On-call Anaesthetist. If child <12months contact the Consultant Paediatric Anaesthetist on-call.** Do not routinely administer another opioid if the epidural solution contains Fentanyl.
2.**Potential problems surrounding the safe administration of analgesia**	Administer epidural or regional local anaesthetic infusion safely as prescribed	Follow Cardiff & Vale UHB Controlled Drug Policy when Fentanyl is being administered epidurally. Follow Cardiff & Vale UHB drug administration policy, including 2-person initial check of epidural and regional local analgesia solution against prescription. Ensure that the giving set is labelled: **"NOT FOR IV CONNECTION"** Check infusion device settings hourly and complete infusion record of administration chart hourly as per C&V UHB Policy. At shift handover 2 qualified nurses check the infusion device, its programme and the amount remaining in the infusing bag to ensure all correspond with the prescription and record of administration charts. **These tasks should be completed by the qualified nurse caring for the child and if this registered nurse has not yet undergone infusion device training then a suitably competent nurse should oversee this process.** Any discrepancies should be reported **contact APS / On-call Anaesthetist immediately.**
3. **Potential side effects / complications**	Early detection / treatment	Assess and record at ½ hourly intervals for 2 hours and then 1 hourly sedation, nausea score, respiratory rate and heart rate until infusion discontinued.

Problem	Goal	Nursing care
3. **Potential side effects / Complications continued**	Early detection / treatment	**In children <8 years** blood pressure should be recorded **4 hourly**. **In children > 8 years** blood pressure should be recorded **2 hourly.** Record temperature **4-hourly** and assess epidural or regional local anaesthetic infusion insertion site **6 hourly**. Ensure child has patent IV access throughout duration of infusion.
Respiratory Depression		The respiratory rate should be counted for a full minute. If respiratory rate falls below the acceptable level for the age of the child switch off epidural, administer oxygen. Administer prescribed IV Naloxone. Reassess every 5 minutes until respiratory rate > rate appropriate of the age of the child. If respiratory rate falls below the figures indicated, **contact APS/or Paediatric on-call Anaesthetist.**
Sedation score 2 or 3		If the sedation score is 2, **STOP** epidural infusion. Administer oxygen and monitor sedation level and respiratory rate every 5 minutes. If sedation score is **3**, administer oxygen, IV Naloxone as above until sedation score is 0-1.
SaO2<94%		Monitor Oxygen saturations continuously and ensure audible alarms are set within appropriate parameters. If Oxygen saturations < 94%, give oxygen. If no improvement after 5 minutes, **contact APS/ Obstetric on- call Anaesthetist or Consultant on-call Paediatric Anaesthetis**t. Inform medical team caring for child. If appropriate give oxygen 15L via face mask.
Opioid-induced Pruritus		Administer dose of IV Naloxone if child has opioid induced itching. IV Naloxone 2 microgram/kg should be administered to counteract the effects of itching. If problem unresolved **contact APS / paediatric anaesthetist on-call.**
Nausea and Vomiting		Assess for nausea / vomiting every 1 hours and record on observation chart. Administer anti-emetic (see Acute Pain Service Guidelines for Nausea and Vomiting).
Potential displacement of epidural or local		Insertion site should be covered with a transparent IV 3000, with the dressing's edges secured with Mefix tape. The infusion catheter should be secured with

Problem	Goal	Nursing care
Potential displacement of epidural or local anaesthetic infusion catheter continued	Early detection / treatment	Mefix tape. The filter should be secured to the front of the child over gauze swabs. Ensure the filter is in situ and all connections are secure. If they are not, **contact APS / On-call Anaesthetist**. If catheter becomes displaced from filter, do not reconnect filter. Stop infusion and wrap end of catheter in sterile gauze. **Contact APS /On-call Anaesthetist** who will connect new filter until line can safely be removed.
Local anaesthetic Toxicity	Early detection / treatment	Observe child for circumoral numbness (tingling around the mouth), dizziness, light-headedness, muscle twitching, drowsiness, ringing in the ears (tinnitus) and visual disturbances. **Critical symptoms of local anaesthetic toxicity include**: unresponsiveness, fitting and cardiac arrest **Contact APS/ Obstetric on-call Anaesthetist or Consultant on -call Paediatric Anaesthetis**t. Stop infusion immediately, call paediatric resuscitation team 2222 and follow most recent paediatric in hospital resuscitation guidance. Intralipid is located in recovery room of the Children's Hospital of Wales and main recovery room, University Hospital of Wales.
Decreased or loss of motor function in legs	Early recognition / treatment of epidural haematoma /abscess.	**Epidural only** - every 2 hours ask the child if possible to straight leg raise (SLR) both legs record on observation chart. If child unable to SLR please document motor block assessment with Bromage Scale (Appendix 1) and follow instructions for the 'management of a leg weakness with epidural analgesia' flow chart (Appendix 2). **If problem persists or if pain is inadequately controlled contact APS / On-call Anaesthetist.**
Epidural / regional local anaesthetic site /space infection	Early recognition / treatment of epidural infection	**All epidural and regional local anaesthetic** catheters must be removed within 5 days of insertion unless the Acute Pain Service or anaesthetist indicates otherwise. If the transparent dressing becomes loose or fluid pools beneath it, the insertion site must be redressed. Use an aseptic technique carefully clean the site using forceps, sterile swabs and sterile saline, rubbing in a circular motion from the centre to the periphery. Change infusion bags using aseptic technique. Check insertion site (ESC) 6-hourly for pus, inflammation, tenderness or leakage and record on observation chart and in nursing care evaluation. If any signs of infection contact

Problem	Goal	Nursing care
		APS / On-call Anaesthetist. **If the epidural or regional local anaesthetic catheter is to be removed - Use aseptic technique.** Clean the insertion site with sterile normal saline, ensure the full length of the catheter is removed, that the end of the catheter is visualised and documented in notes, apply a transparent IV 3000 dressing over site. Guidance outlined under Problem 4 within this care plan should also be followed when removing epidural catheters. **If an epidural site infection** is suspected, send tip and swab from site for MC+S. Vancomycin (or Teicoplanin) plus Ceftriaxone should be started. Please consult Microbiology if there is concern about antibiotic allergies. This treatment should be reviewed when the MC+S results are available. **If an epidural** site infection is confirmed clinically, antibiotic treatment should be continued and be tailored as per Microbiology Department advice. The child will be reviewed regularly by the APS until the infection has resolved. If the insertion site becomes exposed, **please contact the APS / On-call Anaesthetist to review** as the infusion catheter will probably need to be removed as outlined above. Once removed the **epidural** insertion site should be observed for 3 days for signs of infection. If child is discharged before the end of this 3 day period, the discharging Nurse must ensure that either a Community Nurse conducts a day 3 check, or if appropriate the child's s parent/guardian is educated to check the **epidural** site. Ensure the child has been provided with an epidural analgesia child information leaflet and understands the steps to be taken if a problem occurs.
4.Potentially unsafe removal of epidural catheter paralysis	Early recognition / treatment of epidural haematoma /abscess.	Prior to removal of epidural child should have had a post-op **Full blood Count (FBC)** and **Platelets must be >100.** Contact APS or On-call Consultant Paediatric Anaesthetist if any of these blood results are abnormal prior to removal of epidural. **If child is on any thromboprophylaxis treatment, or if there are any concerns regarding coagulation** contact APS or On-call Consultant Paediatric Anaesthetist for advice prior to removal of epidural.

APPENDIX 12 – Epidural Bolus

Administering Epidural Bolus - Guidelines for Acute Pain Nurses & Anaesthetists ONLY

- Assess pain, level of block (with ice), sedation and respiratory rate.
- If pain score 2 or over and observations within normal limits then consider epidural bolus.
- Contact Consultant Paediatric Anaesthetist on-call to prescribe bolus.
- Draw up 0.5ml/kg***** of Levobupivacaine 1.25mg/ml******
- Check and record blood pressure prior to bolus. (Children <8 tend not to get sympathetic response from local anaesthetic but check blood pressure anyway).
- Administer bolus – for volumes over 5mls give in three divided doses (approx).
- Check blood pressure every 5 minutes for 30 minutes following bolus.
- Check sensory level of block (with ice) following bolus.
- Assess pain, sedation and respiratory rate following bolus.
- Seek advice from on call Consultant Paediatric Anaesthetist if pain score not reduced to 0 or 1 following bolus.

Note:

- Position patient with painful side down for unilateral block prior to bolus, particularly if child has been lying with the pain free side facing up for a prolonged period.
- Consideration should be given to withdrawing catheter by 1cm if unilateral block persists and bolus fails. Discuss with Consultant Paediatric Anaesthetist on call.

*Maximum volume 10ml

**To prepare a solution of Levobupivacaine 1.25mg/ml (0.125%), draw up 12.5mgs of Levobupivacaine 5mg/ml (2.5mls) and add 7.5ml of Sodium Chloride 0.9% making total volume of 10mls.

(The pre-filled bag containing 0.1% Bupivacaine with Fentanyl 2mcg/ml is ***not*** used for the top-up this is in order that the administration of additional Fentanyl is avoided).

Vital Signs – parameters for different age groups

Age (years)	**Respiratory rate (per minute)**	**Heart rate (per minute)**	**BP (mmHg)**
<1	30-40	110-160	70-90
1-2	25-35	100-150	80-95
2-5	25-30	95-140	80-100
5-12	20-25	80-120	90-110
>12	15-20	60-100	100-120

APPENDIX 13 – AAGBI Management of Severe Local Anaesthetic Toxicity

[Management of severe local anaesthetic toxicity | Association of Anaesthetists]

AAGBI Safety Guidelines

Management of Severe Local Anaesthetic Toxicity

1 Recognition

Signs of severe toxicity:

- Sudden alteration in mental state, severe agitation or loss of consciousness, with or without tonic-clonic convulsions
- Cardiovascular collapse: sinus bradycardia, conduction blocks, asystole and ventricular tachyarrhythmias may occur
- Local anaesthetic (LA) toxicity may occur some time after an initial injection

2 Immediate management

- Stop injecting the LA
- Call for help
- Maintain the airway and, if necessary, secure it with a tracheal tube
- Give 100% oxygen and ensure adequate lung ventilation (hyperventilation may help by increasing plasma pH in the presence of metabolic acidosis)
- Confirm or establish intravenous access
- Control seizures: give a benzodiazepine, thiopental or propofol in small incremental doses
- Consider drawing blood for analysis, but do not delay definitive treatment to do this

3 Treatment

IN CIRCULATORY ARREST

- Start cardiopulmonary resuscitation (CPR) using standard protocols
- Manage arrhythmias using the same protocols, recognising that arrhythmias may be very refractory to treatment
- Consider the use of cardiopulmonary bypass if available

GIVE INTRAVENOUS LIPID EMULSION
(following the regimen overleaf)

- Continue CPR throughout treatment with lipid emulsion
- Recovery from LA-induced cardiac arrest may take >1h
- Propofol is not a suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

WITHOUT CIRCULATORY ARREST
Use conventional therapist to treat:

- hypotension,
- bradycardia,
- tachyarrhythmia

CONSIDER INTRAVENOUS LIPID EMULSION
(following the regimen overleaf)

- Propofol is not suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

4 Follow-up

- Arrange safe transfer to a clinical area with appropriate equipment and suitable staff until sustained recovery is achieved
- Exclude pancreatitis by regular clinical review, including daily amylase or lipase assays for two days
- Report cases as follows:
  in the United Kingdom to the National Patient Safety Agency (via **www.npsa.nhs.uk**).
  in the republic of Ireland to the Irish Medicines Biard (via **www.imb.ie**).
- If Lipid has been given, please also report its use to the international registry at **www.lipidregistry.org**. Details may also be posted at **www.lipidrescue.org**

Your nearest bag of Lipid Emulsion is kept .....

This guideline is not a standard of medical care. The ultimate judgement with regard to a particular clinical procedure or treatment plan must be made by the clinician in light of the clinical data presented and the diagnoses and treatment options available.

Figure 1A. *Reproduced by kind permission of the Association of Anaesthetists of Great Britain and Ireland and available for download at:* www.aagbi.org/publications/guidelines/docs/la_toxicity_2010.pdf

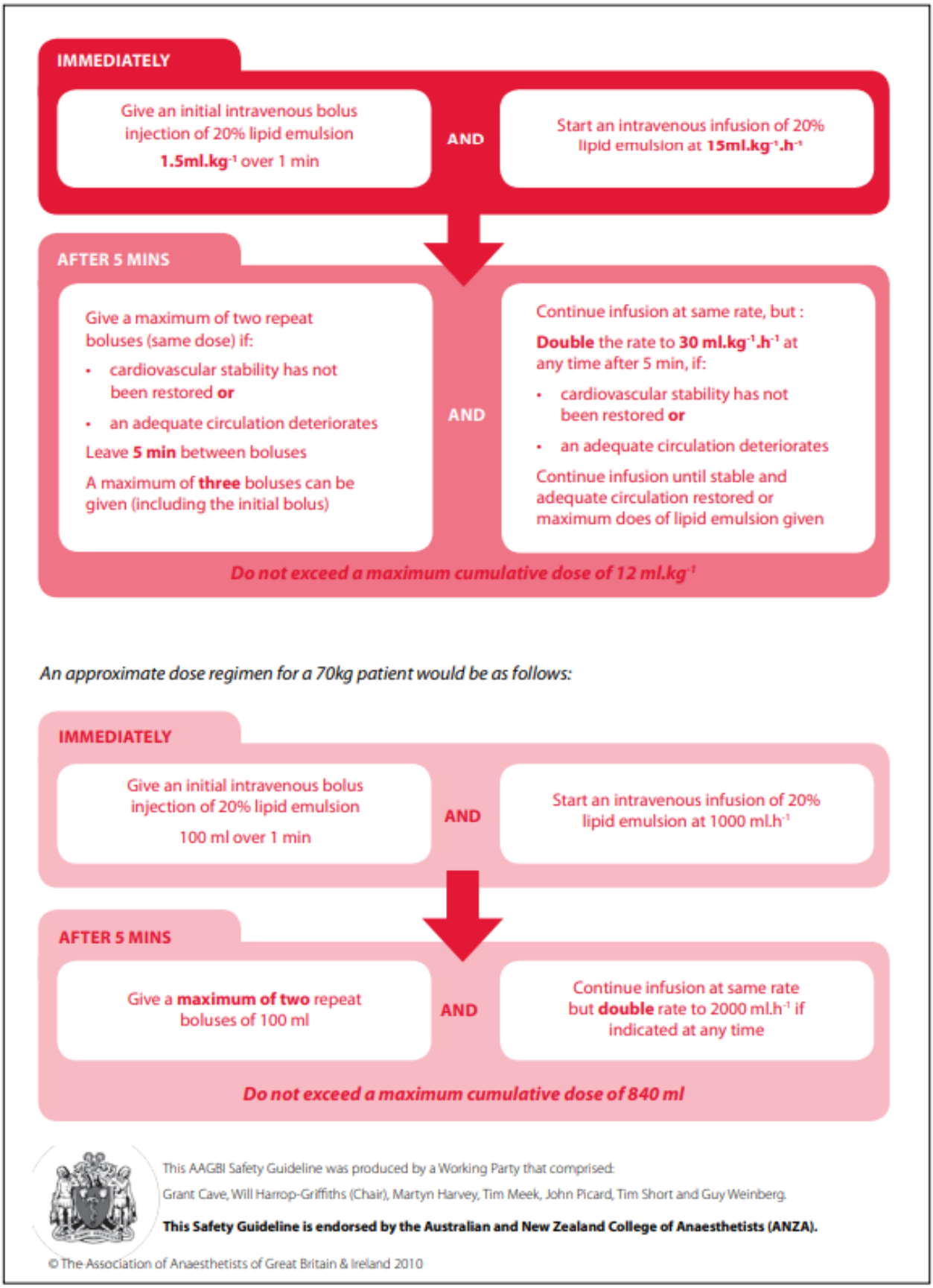


Figure 1B. *Reproduced by kind permission of the Association of Anaesthetists of Great Britain and Ireland and available for download at:* www.aagbi.org/publications/guidelines/docs/la_toxicity_2010.pdf

APPENDIX 14 – Entonox Prescription

ENTONOX PRESCRIPTION CHART

FOR ACUTE PROCEDURAL PAIN ONLY

Patient Details (affix addressograph)	Consultant:	Allergies:
	Ward:	Weight:
Date:	Drug: **ENTONOX**	Pharmacy:
Route: **Inhalation**	Concentration: **50:50 Nitrous Oxide : Oxygen**	**Self-Administration ONLY**

Special Instructions: Must only be administered by staff who have had training in the use of Entonox. Please complete pre-printed label and stick on medication chart	Frequency: ENTONOX should not be used for more than a total of 12 hours within a 4 day period To be discontinued after procedure

Contraindications:

- artificial, traumatic or spontaneous pneumothorax
- air embolism
- decompression sickness
- following a recent dive
- following a head injury
- following air encephelography
- severe bullous emphysema
- use during myringoplasty
- gross abdominal distension
- in patients having received recent intraocular injection of gas
- in patients who are intoxicated

Special Precautions:

1. Repeated or prolonged exposure to nitrous oxide depletes the body's stores of vitamin B12 and very rarely this can precipitate neurological complications. **Patients at higher risk include those:**
   a. Who use Entonox frequently,
   b. With a poor oral intake or on a diet low in animal products eg. Vegans,
   c. With malabsorption syndromes, particularly those with ileal resections,
   d. On synthetic diets (eg. phenylketonuria, maple syrup urine disease),
   e. On a diet for which special vitamin and mineral supplements are prescribed (more than standard vitamins such as abidec)
2. Ensure the area is well ventilated during and after administration
3. Staff in the first trimester of pregnancy may wish to avoid the area while Entonox is in use
4. **ENTONOX should not be used for more than a total of 24 hours, or more frequently than every 4 days, without close clinical supervision and haematological monitoring (please see APS Guidelines).**

Prescribers Signature:

Bleep No:.....

Please refer to the Acute Pain Management Guidelines (Adult or Paediatric) for further guidance or contact the Acute Pain Service on Bleep 5414.

APPENDIX 15 – Paediatric Entonox Careplan

ASSESSMENT	RATIONALE
INITIAL ASSESSMENT	
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 prescribed.
PREPARATION	
Ensure the Entonox has been prescribed on patients drug chart or if administered under a patient group directive (PGD) in the medical/nursing notes.	Entonox is a 'prescription only ' medicine
If Entonox is to be administered more frequently than every four days or for more than 24 hours, routine blood cell counts should be performed and referral to Haematologist for assessment	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 applications of Entonox	To allow staff to be aware of the side effects & occupational exposure limits of Entonox
Gather and prepare the following equipment: • Turn Entonox cylinder on and prime the administration set by pressing the test button on the back of the demand valve. • Check the cylinder to ensure it is at least a quarter full. If it is not, arrange for a new cylinder. • 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 are available in the hospital in similar cylinders
To prepare the patient: • Consider the patient's suitability for use of Entonox, including their ability & motivation to self-administer the gas. • Obtain parental/carer cooperation in ensuring that the gas is entirely self-administered by the child to reduce the incidence of over sedation. • Obtain age appropriate informed consent or implied consent from the child. • Encourage parent/carer presence throughout the procedure. • The child does not need to be fasted. • Explain the procedure to the patient and family/carer in an age/child appropriate language, including other options available for pain management during the procedure should the need arise. Similarly, explain the potential benefits and side effects anticipated, with emphasis on how the Entonox might make the child feel. • Show the child the equipment to be used and demonstrate the noise associated with inhaling through the demand valve - allow the child 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 • Consider using distraction techniques and play as appropriate. • Ensure the patient is in a comfortable and safe position.	To relieve anxiety and determine level of co-operation It is extremely important that the patient, rather than the nurse, hold the mouthpiece during administration of the gas to prevent excessive sedation The patient may need considerable encouragement to start inhaling the gas. It is worth persevering as any initial reluctance usually disappears once the patient realises that the Entonox is working 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*
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	To provide additional pain relief
ADMINISTRATION	
To administer the Entonox: • Ask the child to breathe normally throughout the procedure. • Allow the child to inhale gas for a few minutes prior to commencing the procedure to ensure full analgesic effect	To establish an effective inhalation technique To ensure Entonox has taken effect before introduction of painful stimuli
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 - if the patient hyperventilates they should be encouraged to exhale slowly	To provide effective analgesia with minimal side-effects To prevent hyperventilation
Assess the patient throughout the procedure to determine: • The level of pain (using an age appropriate pain assessment tool) • The presence of any side-effects • Whether they are using the Entonox effectively	To ensure that adequate pain relief is provided with minimal side-effects
Entonox related side-effects include: • Earache • Nausea & vomiting • Dry mouth • Over sedation • Dizziness or disorientation • Parasthesia in hands and nose	If the patient experiences any Entonox related side-effects they should be reassured, and cease inhalation until the side-effects wear off. It may be necessary to stop the procedure until alternative analgesia and/or sedation has been prescribed and given
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. The patient may choose to put up with these sensations and continue inhalation to maintain effective pain relief.	To provide effective analgesia with minimal side-effects
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
Oxygen saturation must be monitored throughout the procedure if there is a history of respiratory or cardiac problems.	For early identification of any hypoxia
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. • The patient may then recommence administration if they wish	The side-effects of Entonox wear off quickly once inhalation ceases To prevent inhalation of vomit n.b. 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 clinical engineering 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	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, replace the cylinder in readiness for next use • Turn off the cylinder and depressurise the system fully by operating the test button	To ensure that there is an adequate supply of Entonox for the next patient To prevent misuse and to maintain a safe ward environment
Monitoring 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 and should be advised to avoid driving or operating machinery for 30 minutes following administration.	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	To prevent post administration hypoxia
To clean the equipment: • Depressurise 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 & the demand valve it must be sent to HSDU to be autoclaved. • Single use face equipment must be discarded - Filters are for single patient use and must be discarded. They may be kept by the patient's bed if they are going to use Entonox again within the next 24hours • The external surfaces of the administration set must be cleaned with an alcohol-impregnated wipe	To maintain a safe environment To minimise the risk of cross infection
Document details of Entonox administration, how effective it was & 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

APPENDIX 16 – Abbreviations

ANTT	Antiseptic non-touch technique
APS	Acute Pain Service
CHfW	Children's Hospital of Wales
FLACC	Face, Leg, Activity, Crying, Consolability
g	gram
IV	Intravenous
Kg	kilogram
L.A.	Local anaesthetic
LAT	Local Anaesthetic Toxicity
Mg	milligram
ml	millilitre
NCA	Nurse Controlled Analgesia
NSAID	Non-Steroidal Anti-Inflammatory drug
PCA	Patient Controlled Analgesia
Po	Per oral
Pr	Per rectum
Prn	As required