Hauora
Tairāwhiti

Children's Acute Pain Management Handbook

3rd Edition - 2020

"Optimal pain management is the right of ALL patients and the responsibility of ALL Health Professionals."
(RCH Children's Pain Management Service)

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1.0 INTRODUCTION

The purpose of this handbook is to assist with the education of Hauora Tairawhiti staff in the commonly available methods of acute pain management for children.

It is intended to be a guide which medical and nursing staff can refer to when prescribing and managing pain in children.

It is not intended to be exhaustive or to restrict the way individuals practice, but children admitted to hospital may benefit from a more co-ordinated approach to pain management.

Paediatric pain management is the responsibility of the primary team. If the primary team has difficulties with pain management of a patient, it is the responsibility of the primary team to contact an anaesthetist.

However, if any healthcare professional cannot get resolution of a patient pain management issue, please contact an anaesthetist directly.

Please read/use this manual in conjunction with the Hauora Tairawhiti Pain Management Manual

"Pain control must be based on scientific fact,
not on personal beliefs or opinions."
(RCH Children's Pain Management Service)

2.0 PRINCIPLES OF ANALGESIC ADMINISTRATION IN CHILDREN

There are some major differences between paediatric pain relief and adult pain relief, and this may not be readily appreciated by medical and nursing staff who rotate from adult areas or who work in the emergency department.

Pain Receptors – Nociceptors: (RCH Principles)

- Receptors are present all over the body that are sensitive to noxious stimuli
  - Skin = polymodalreceptors: touch/pressure, heat and chemicals
  - Cornea, dentine, periosteum = unimodalreceptors: pain only
- All sensory nerves will produce pain sensation if stimulated sufficiently

Harmful Effects of Unrelieved Pain:

- Cardiovascular: ↑HR ↑BP ↑CO ↑O2 consumption
- Respiratory: ↑RR ↓flow/vol ↓SaO2
- Endocrine: ↑cortisol ↑adrenaline ↑glucagon ↑BSL
- Gastrointestinal: ↓gastric & gut motility
- Musculoskeletal: tension, spasm, fatigue

Some General Principles Apply In Children:

- Paediatric analgesia needs to be calculated on a mg/kg basis and these dosages need to be rounded off to make volume calculations easy.
- **Children do not like intramuscular (IM) injections and they should not be used unless special circumstances exist.**
  IM injections are unpredictable, largely ineffective and many children will deny having pain to avoid injections. Intravenous, oral and rectal are the preferred routes of administration.
- Following the administration of oral, subcutaneous (or IM) opioids, 60 minutes should elapse before starting opioid infusions, NCA or PCA.
  No other opioids or sedatives should be given while using these techniques unless ordered by an anaesthetist or a paediatrician.
- Acute pain is best treated with continuous methods of analgesic administration (eg, infusions (IV/Subcut) or PCA). Mild pain can usually be adequately controlled with intermittent bolus dose administration.
- When faced with unusually high or increasing requirements of pain relief think of alternative causes of pain (eg, compartment syndrome, pressure necrosis or other surgical complications).
- Hospital approved protocols are available for all the common methods and are included in this handbook.
- Any patient requiring morphine should be given **regular** paracetamol and/or NSAIDS (as long as not contra-indicated) as well as the opioid.
- Pain should be managed according to the severity and nature of the pain and using the principles of the **WHO (World Health Organisation) Two Step Analgesic Ladder**.
  This emphasises the concurrent use of different techniques to maximise efficacy and moderate the adverse effects of the medications used.

PRINCIPLE: ALL MODERATE AND SEVERY PAIN IN CHILDREN SHOULD ALWAYS BE ADDRESSED

Mild Pain

Regular Paracetamol
+/- NSAID
Both to be made available

Moderate - Severe Pain

Regular Paracetamol
+/- NSAID

+ parenteral opioids or high bioavailable oral opioids (oro-morph,)

- ***Codeine is no longer recommended for children under 18 years***
- The level of pain should be assessed regularly at least ***every 3 hours*** using a visual pain scale and the medication adjusted accordingly

BALANCED ANALGESIA IS:
The use of regular background paracetamol and/or NSAID with additional use of opioids as required.

3.0 ASSESSING PAIN IN CHILDREN

Children of all age groups experience pain and there are significant physiological and behavioural consequences of inadequately treated pain.

The function of pain assessment is to detect pain, estimate its severity and evaluate the effectiveness of the intervention. It should be routine and one component of the holistic approach to the child. The cause of pain should be sought.

Pain management should be proactive but when confronted with pain, an assessment-intervention reassessment approach is used. Children can be divided into the preverbal, the cognitively impaired and the verbal.

Verbal:
Children older than 3 years are able to communicate pain. Initially it is an all-or-nothing type of response. Self-reporting with words or visual aids e.g. faces pain scale can be used successfully provided the number of choices is limited to around 4 or 5 words, faces or 'pieces of hurt'. The numerical rating scale (NRS) can usually be comprehended by children older than 10 years. So as not to add suggestion into the mix, it is suggested you rephrase the question in a more positive way, e.g. Can you tell me how you are feeling/ your arm (etc) is feeling, while showing them the faces pain scale.

Assessing Pain in Non-Verbal Disabled or Cognitively Impaired Children:
This is the most difficult group and they are most at risk of under treatment as they are unable to communicate pain. They may have no speech, limited or absent communication, cognitive impairment, altered body movement and/or other pre-existing conditions. Ask the carer's opinion
There are many well validated behavioural and physiological pain score systems (CRIES, CHEOPS) that are used in pain research but are difficult to apply in the ward setting.

The Instinctive Behavioural Observation approach can be used in this group e.g., if experienced staff think the child is in pain we will intervene and then reassess. Alternatively the FLACC scale can be used

Common Problems for Disabled Children:

- spasm / spasticity
- positioning issues
- pressure areas
- bowels
- reflux / gastritis
- surgical complications / late diagnosis
- fear / anxiety / sadness
- the environment

3.1 ABC'S OF PAIN MANAGEMENT

(Recommended by the Agency for Health Care Policy and Research (AHCPR), USA)

- **A** - **Ask** about pain regularly. **Assess** pain systematically.
  - Location, duration, onset, description (e.g. sharp, shooting, dull, ache, burning etc)
- **B** - **Believe** the patient and family in their reports of pain and what relieves it.
- **C** - **Choose** pain control options appropriate for the patient, family, and setting.
- **D** - **Deliver** interventions in a timely, logical, coordinated fashion.
- **E** - **Empower** patients and their families. Enable patients to control their course to the greatest extent possible

3.2 ASSESSING PAIN

QUESTT: ***(Wong et al, 1999)***

- **Q**uestion the child
- **U**se a pain rating scale
- **E**valuate the behaviour and physiological changes
- **S**ecure parents involvement
- **T**ake cause of pain into account
- **T**ake action and evaluate results

Question The Child:

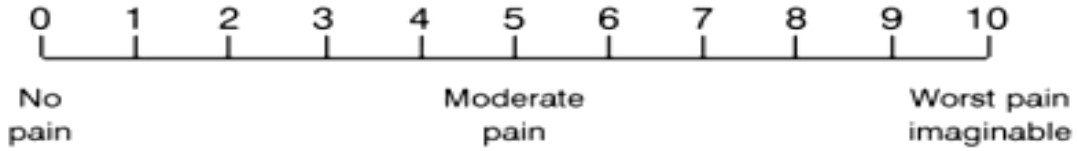
- Use their language (sore, ouch, hurt)
- Be developmentally appropriate
- Consider using dolls/toys as a medium
- Consider other issues
- Non-verbal children are very vulnerable to having their pain under estimated

Use a Pain Rating Scale:

- Faces: >3 years
- Numeric: >5years
- Behavioural/Observational: e.g <3years, unconscious, disabled
- Behavioural/physiological

NUMERCIAL RATING SCALES

Please rate the pain you have right now



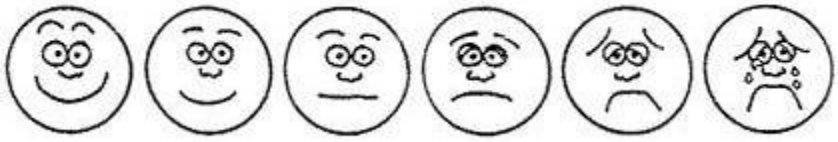
This is one of the most commonly used scales in clinical practice. This is a useful tool to measure changes in pain, and response to pain interventions.

Wong Baker Faces Pain Scale

Using a pain rating scale, like the one below, is helpful for young patients to communicate how much pain they are feeling.

Instructions

Explain to the child that each face is for a person who feels happy because he has no pain (hurt) or sad because he has some or a lot of pain.



0 2 4 6 8 10

NO HURT HURTS HURTS HURT HURTS HURTS

LITTLE BIT LITTLE MORE EVEN MORE WHOLE LOT WORST

Face 0 is very happy because he doesn't hurt at all.
Face 2 hurts just a little bit.
Face 4 hurts a little more (quite sore)
Face 6 hurts even more (very sore)
Face 8 hurts a whole lot more (really, really sore)
Face 10 hurts as much as you can imagine, although you do not have to be crying to feel this bad

Ask the child to choose the face that best describes how he/she is feeling

BEHAVIOURAL SCALE - FLACC

Category	Scoring		
	1	**2**	**3**
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
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; occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort

Evaluate the Behaviour and Physiological Changes:

- Age related behavioural changes
- Physiological changes –altered observations (HR RR BP etc), posture/tone, sleep pattern, skin colour / sweating

*These are **not** good indicators to use in isolation. They may vary enormously and can be due to fear, anger, anxiety, sepsis, hypovolaemia etc*

Take Action / Evaluate Results:

- Administer analgesia
- Utilise other comfort measures
- Review within short period, i.e. at expected peak effect of drug
- Don't assume the analgesia has worked
- Take action if analgesia ineffective
- Document findings clearly for others

Pain – The 5th Vital Sign:

- Pain is important and should be documented
- Choose the appropriate tool
- Document on PEWS chart
- Consider when and how often you should assess pain

OPTIMAL PAIN MANAGEMENT IS THE RIGHT OF ALL PATIENTS AND THE RESPONSIBILITY OF ALL HEALTH PROFESSIONALS

4.0 NON-PHARMACOLOGICAL PAIN MANAGEMENT

Introduction:
During painful procedures children can exhibit stress, fear and anxiety which can result in abnormal pain behaviours and post-traumatic stress disorder in severe cases. This can have enormous implications for the child, family and all hospital staff involved with these children on subsequent encounters.

Non-Pharmacological Interventions:
These can be used with or without pharmacological support. A variety of techniques can lead to effective coping strategies which help make pain more tolerable.

For Optimal Efficacy:
Non-pharmacological interventions need to be taught to parents, children and health professionals
Experience for advanced interventions is necessary for guided imagery and hypnosis techniques (Play Specialist)

Goals of Non-Pharmacological Interventions:
- To minimise fear, anxiety and distress
- To make pain more tolerable
- To give the child a sense of control over the situation and their behaviour
- To teach and enhance coping strategies for the child
- To instruct parents in techniques to assist their child

Outcomes of Successful Non-Pharmacological Strategies:
- To have a cooperative, calm, non-traumatised child
- To complete medical procedures successfully in a timely manner
- To have subsequent procedures performed with reduced fear and anxiety

Indications:
  - The medical procedure should not be complex or prolonged
  - The child needs to be willing to participate
  - Pharmacological strategies should be considered as well

Non-Pharmacological Techniques Everyone Can Implement:
Preparation:
- Information: explain, explain, explain - what is going to happen and what it will feel like - Be honest. Don't say it won't hurt if it might.
- Give information - (Explain at a level the child can understand and the child wants to know. Involve the parents)
- Use:
  - role play
  - calico dolls
  - role modelling
  - discussions
  - videos
  - pictures/leaflets
- Try to give the child as much control as possible over aspects of the procedure. Eg where it will take place, who will be with the child, what they would like to do while procedure takes place, do they want topical analgesia (cream/spray/Coolsense) or none, if possible someone familiar to do the procedure, , where would they like the procedure done (if possible)
- Tell them it is OK to cry or make a noise, but they must keep as still as possible
- Prepare the equipment before the procedure and out of sight of the child
- Parents' presence –
  - Parent coaching on interventions.
  - Minimise the amount of apologising or reassuring (can increase behavioural distress)

Distraction Techniques:
Distraction involves helping a child focus attention away from pain or discomfort. Attention can either be focused internally (fantasy or guided imagery), or externally.

Distraction techniques are more effective if they employ all the senses. Whichever technique is chosen, there needs to be interaction between the child and the person performing the distraction.

Often parents can perform the distraction, giving them an opportunity to actively help their child through a procedure.

- Choices and control
- Laughter and fun
- Musical toys
- Singing
- Puppets,
- Counting
- Play / relaxation, Videos / DVDs / computer games)
- Games (I spy, board games etc)
    - Controlled breathing – (Bubbles, deep breathing, blowing
- Comforting touch - (Cuddles, stroking, massage, comfort positioning, rocking)
- Imagination - (Story telling / books, guided imagery, favourite activity, magic)
- Relaxation – (Deep breathing, relaxing from head to toe, music)
- Is there a reward for compliance? (eg kids love stickers/certificates/lucky dip – Avoid lollipops!!)
- Praise good behaviour and bravery.
- Cognition skills:
    - Thought stopping (repeat word-STOP-or visualise stop sign to alter anxious /negative thoughts)
    - Positive self-talk (repeating positive thoughts – “I can cope with this”)

5.0 LOCAL ANAESTHETICS FOR MINOR PROCEDURES

Local anaesthetic should be used wherever possible for painful procedures such as venepuncture, cannula insertion, lumbar puncture and laceration repair.

Introduction

- Research consistently shows that children receive less analgesia for similar conditions than adults. Remember: children cannot verbalise their pain like adults - if you think it would hurt an older patient (or you!) it will hurt a baby. Anaesthetic and analgesic agents can be used safely in children and infants.
- Local anaesthetic should be used wherever possible for painful procedures such as venipuncture, cannula insertion, lumbar puncture and laceration repair.
- It has been traditional to use local anaesthesia (LA) much less frequently for lumbar puncture than venipuncture - this is illogical.
- Infiltration of lignocaine is painful but there are simple ways to diminish this (see below).
- Always consider tissue adhesive / steristrips as an alternative to suturing for simple lacerations.
- All local anaesthetics (including topical preparations) can cause serious toxicity - know the **safe maximum doses** for any preparations you prescribe.

Topical Local Anaesthetics

The insertion of intravenous cannulas, performance of lumbar punctures and administration of IM injections are potentially very distressing procedures for children. Some of the pain and distress may be reduced by using topical local anaesthetics. The topical LA should be applied under an occlusive dressing and a secondary dressing such as a bandage may help reduce dislodgement/ingestion of the cream or occlusive dressing.

5.1 EMLA CREAM

EMLA cream is a eutectic mixture of local anaesthetics. This is a mixture of 2.5% Lignocaine and 2.5% Prilocaine. **It requires at least 60-90 minutes to provide optimal topical anaesthesia.** It provides anaesthesia down to 3-5mm tissue depth. Remove after 1-4 hours. Remains effective for 2-4 hours after removal.

Methaemaglobinaemia is a rare life threatening complication of EMLA use (haem Fe2+ is oxidised to Fe3+) caused principally by excess prilocaine absorption. Hence application to areas where absorption will be more rapid e.g. broken skin (burns, lacerations), mucous membranes or diseased skin (eczema/dermatitis) should be avoided. The thinner skin of infants can also result in higher absorption - note safe age and dose recommendations. EMLA can be applied safely to small, superficial lacerations to aid cleaning / gluing.

Recommended maximum **daily** doses of EMLA[1] (1 tube = 5 grams).

Age group	Maximum dose (g)	Maximum skin area (cm2)	Period of application (hours)
3 - 11 months	2	20	4
1 - 5 years	10	100	4
6 - 11 years	20	200	4

EMLA can cause local oedema or vasoconstriction making the procedure harder, removing dressing 10 minutes prior will allow this to resolve.

5.2 AMETOP (AMETHOCAINE CREAM) – Currently not available at Hauora Tairawhiti

4% Amethocaine gel is an ester type LA suitable for topical anaesthesia in infants and children prior to painful procedures. Studies in children show a similar success rate for IV cannulation with Amethocaine or EMLA but lower pain sores with Amethocaine. It provides good topical anaesthesia in 30-45 minutes. Do not leave for longer than 60 minutes. Effective skin anaesthesia lasts 4-6hrs after removal. Do not apply to broken skin. No systemic side effects have been noted in children. Amethocaine tends to cause erythema secondary to vasodilatation. A small number of children may get a marked erythema that resolves after removal.

5.3 ETHYL CHLORIDE SPRAY

Used for: Controlling pain associated with injections, minor surgical procedures, and certain other procedures. Ethyl chloride spray is a skin refrigerant. It works by freezing and numbing the skin.

Precautions:
Do not:

- apply to damaged, blistered, broken, or inflamed skin.
- use on children with allergies to medicines, foods, or other substances
- use if pregnant, planning to become pregnant, or are breast-feeding
- some medicines may interact with ethyl chloride spray. However because little, if any, is absorbed into the blood, the risk of it interacting with another medicine is low
- Ethyl chloride spray is for external use only. Do not get it in your eyes, nose, or mouth. If you get it in any of these areas, rinse immediately with cool water.
- Do not inhale ethyl chloride spray. Inhaling it may cause severe drowsiness and may lead to loss of consciousness, severe breathing problems, or coma. Discuss any questions or concerns with your doctor.

5.4 BUZZY® VIBRATION AND COLD DEVICE FOR SUPPORT OF VENEPUNCTURE, CANNULATION AND INJECTIONS -

Definition / Description:
The Buzzy is an alternate means of reducing pain and discomfort to children/young people with the use of a thermo mechanical device. The Buzzy® is a vibrating device that incorporates a cold pack and can be used for venepuncture and cannulation, finger pricks and intramuscular (IM), intradermal and subcutaneous injections.



Recommended Usage By Age:

- Buzzy® without cold pack 6 weeks- 2 years of age
- Buzzy® with cold pack 2 years and above

The use of the Buzzy® device does not supersede the use of other topical products for managing pain such as EMLA (and sucrose for infants <3 months of age). For some children the ice pack can be distressing. The Buzzy® can be used without the icepack.

Procedure:

1. Prepare child/young person for any invasive needle stick procedure. Involve play specialist where available.
2. Introduce child/young person to the Buzzy® device and allow them to handle the equipment
3. Explain the purpose of the Buzzy® device and how it works
4. Collect and assemble specified equipment.
5. Perform hand hygiene pre and post procedure.

Venepuncture and Cannulation:

1. Insert the frozen cold pack into the back of the Buzzy® under the elastic.
2. Strap the Buzzy® over the tourniquet or place the tourniquet through the slot in the Buzzy® and place proximal to the site.
3. Alternatively hold the Buzzy® over the tourniquet with a little pressure.
4. Ensure the wider end of the Buzzy® is closest to the site.
5. The Buzzy® vibration should be activated at least 30 seconds before proceeding with venepuncture or cannulation.
6. Leave Buzzy® in place and activated until procedure is completed.

Intramuscular, Subcutaneous and Intradermal Injections:

1. Insert the frozen pack into the back of the Buzzy® under the elastic
2. Press Buzzy® directly onto site and hold in position, activate vibration for at least 30 seconds.
3. When ready to administer injection slide Buzzy® 2-5cm proximal to the site (press on a bony area directly above the injection site).
4. Keep the wider end of the Buzzy® closer to the site of the proposed injection.
5. Leave Buzzy® in place and activated until the procedure is completed and the needle is removed.

Finger Pricks:

1. Insert the frozen pack into the back of the Buzzy® under the elastic.
2. Locate site for finger prick.
3. Place Buzzy® device in palm of hand with wide end of Buzzy® against the base of finger.
4. Activate vibration for at least 30 seconds before procedure.
5. Leave Buzzy® in place until completion of procedure.

Alert: Contraindications for the use of the Buzzy® device with the cold pack:

- Children/young people with Sickle Cell Disease
- Raynaud's Syndrome – cold sensitivity

The Buzzy® may be used for children/young people with the above conditions without the cold pack

5.5 COOLSENSE - COLD DEVICE FOR SUPPORT OF VENEPUNCTURE, CANULATION AND INJECTIONS

www.balancemedical.com.au

- 1. Remove the device from the freezer. Ensure that the temperature indicated by the flashing light on the side of the device is in the optimal operating range and flashing GREEN. Do this by pressing the button once.

- If the device flashes RED, return to the freezer.
- If the light flashes BLUE, leave out until the light flashes GREEN.
- The light will automatically turn off in approximately 40 seconds.

- **2. Gently press** on the centre of the green-coloured alcohol cartridge once to push the gel through to the metal pin of the device to ensure that the sponge is saturated with the alcohol gel**.**

- 3. Wipe down injection site with a 2% chlorhexidine/70% Isopropyl alcohol wipe as per hospital policies**.**

- 4. Unscrew the alcohol cartridge with a twisting motion and put it aside.

- 5. Visually check that there is alcohol gel on the metal pin before placing the device onto the site of injection/cannulation

- Apply Coolsense device to site according to the below:

a. Aesthetic applications on the face: Place the surface of the metal pin to the site of injection for up to a maximum of **3 seconds**

b. Cannulation/Venipuncture: Place the surface of the metal pin to the site of injection for up to a maximum of 10 seconds

- The device can be used multiple times for up to **8 minutes** after being removed from the freezer.

- After applying the Coolsense to the site of injection, the injection procedure should follow immediately or shortly after removing the device from the site of injection.

- Ensure that the metal pin is wiped with a new 2% chlorhexidine/70% Isopropyl alcohol wipe before replacing the cartridge onto the device.

- 10. Return the device to the freezer for future use, storing the device on its side or cap down.

- The product may be reused after being stored in the freezer for 20 minutes, or when the light

flashes **green** in colour.

Warning:

- Failure to follow the instructions outlined can cause adverse effects and/or injury
- The CoolSense device may also be wiped down prior to replacing it back into the freezer with a

2% chlorhexidine/70% Isopropyl alcohol wipe. Pure Chlorhexidine may cause discolouration of the device and compromise the device's structural integrity

6.0 USE OF SUCROSE FOR PAIN MANAGEMENT

https://www.starship.org.nz/guidelines/sucrose-analgesia November 2020)

Aim

Neonates and infants feel pain as intensely as adults do. Oral sucrose has been shown to be an effective and safe treatment for reducing the pain response of neonates and infants. The effects of sucrose and non-nutritive suckling are thought to be mediated by the endogenous and non-opioid systems. A neonatal/infant admission will typically involve between 2 and several hundred painful procedures. The aim is to reduce the discomfort caused by these procedures.

Criteria

Prior to any invasive procedure consideration should be made on how to minimize any resulting pain. Painful procedures include, but are not limited to; venepuncture, peripheral venous line placement, heel prick, arterial stab, and peripheral arterial line placement. Ways to reduce pain can be through the use of pharmacological and non-pharmacological measures. Non pharmacological measures include ensuring, where possible, the patient (neonate/infant) is calm, relaxed, warm, fed and that all necessary equipment for the procedure is at hand.

Once non-pharmacological measures have been implemented, oral sucrose analgesia may be considered for patients (neonate/infant) in the clinical setting. Oral sucrose will not always eliminate all crying, but is known to significantly reduce the physiological stress of pain.

Indications for Use

Any procedural pain: heel stick, blood procurement, venepuncture, intravenous line insertion, dressing changes, adhesive tape removal, immunisations, suture removal, urinary catheter insertion, nasogastric tube insertion, etc.

Contraindications

- Neonates with known fructose intolerance
- Glucose-galactose malabsorption
- Sucrase-isomaltase deficiency
- Oesophageal atresia or tracheal oesophageal fistula
- Suspected or proven necrotising enterocolitis
- Altered gag/swallow reflexes
- Pre-op sedated patients due to risk of aspiration
- Neonates <1500g and <31 weeks postconceptional age.
- Age > 18 months
- Parental refusal

Dose and Administration

Patient Group	Dose to be given
Neonates > 31 weeks post conception - 1 month	0.2 - 0.5mL (max 4 doses in 24hrs)
Infants 1 - 18 months	0.5 - 1 mL (max 4 doses in 24hrs)

Note: The concentration used at Hauora Tairawhiti is a 66.7% Sucrose Solution (Syrup BP, 0.667g/L)

- Administer with a 1mL syringe onto the front of the tongue. Offer a pacifier if part of the infants care.
- Administration through a nipple or teat not recommended
- **There is no analgesic effect if the sucrose is given directly into the stomach via a nasogastric tube**
- Administer 2 minutes prior to a painful procedure
- There is no minimum interval time between doses of oral sucrose.
- The analgesic effects last 5-8 minutes

- Effect is independent of volume of sucrose given
- **Sucrose needs to be prescribed by medical staff prior to administration**

Prescription
Sucrose will be prescribed on the medication chart as PRN but with a maximum of 4 doses to be administered in a 24 hour period.

Safety
Parents should be advised sucrose is to be used in hospital only.

Storage
Oral Sucrose Solution 66.7% preservative free (Syrup BP) should be stored at room temperature (below 25 degrees) once opened and discarded 30 days after the bottle has been opened. The unopened bottle has a shelf life of 12 months from manufacture.

7.0 INFILTRATION OF LIGNOCAINE

- Local infiltration is more appropriate when the procedure involves deeper or larger cuts, topical anaesthesia has had only a partial effect or it is not possible to wait before performing the procedure.
- Lignocaine without adrenaline is the standard agent and is available in 0.5% and 1% strengths.
- Bupivacaine 0.5% is used in special situations where a prolonged action is desired (e.g. nerve blocks) but must be used with care as it is **markedly cardiotoxic** compared with lignocaine. Ropivacaine is a safer alternative, if available. At Starship, ropivacaine is available in 0.75% strength.

Use of adrenaline

The addition of adrenaline to local anaesthetic has two useful effects:

- Increases the duration of effect by 50 - 100%
- Helps provide haemostasis
- It is **contraindicated** for perivascular infiltration at peripheral end arteries e.g. fingers, toes, ears, nose, penis, wrist or ankle.
- It should be viewed as something to add when required, rather than omit when contraindicated

The pain of local infiltration is greatly diminished by:

- Using a fine needle and minimum number of injections (25G in 2.5cm length standard or 29G on 1ml 'tuberculin' syringes when only a small area of infiltration required).
- Infiltrating slowly, with gentle pressure.
- Warming the lignocaine solution to near body temperature.
- Buffering lignocaine with $NaHCO_3$ (1 part neat 8.4% $NaHCO_3$ to 9 parts lignocaine)
- Injecting through exposed subcutaneous tissue in lacerations
- Use of adjuncts e.g. topical local anaesthetics prior to or Entonox during injection
- Anxiety heightens the perception of painful stimuli. Environmental/behavioural methods to reduce distress are very effective, safe, and work for the parents as well as the child. Nursing Staff and Play Specialists are able to assist considerably with the use of distraction and other techniques

Onset of local anaesthesia after local infiltration or for block of small nerves (e.g. digital n.) is rapid, however it is best to wait 3-5 minutes before starting the procedure for full effect. Reliable duration of action is 30-40 minutes for plain lignocaine, and 2-3 hours for bupivacaine. For large nerves (e.g. femoral n.) time to maximal effect is slower (5-10 mins for lignocaine, 10-15 for bupivacaine, 10-15 minutes for ropivacaine) and duration longer (1-2 hours for lignocaine, 4-6 hours for bupivacaine, 4-8 hours for ropivacaine)

It is important to be aware of the maximum safe dose of local anaesthetics, since it is possible to exceed this in small children with local infiltration. It is equally important to avoid direct injection into blood vessels (**aspirate before and during infiltration**).

Lignocaine 0.5%	0.8ml/kg (4mg/kg)
Lignocaine 1.0%	0.4ml/kg (4mg/kg)
Bupivicaine 0.5%	0.4ml/kg (2mg/kg)
Ropivacaine 0.75%	0.5ml/kg (3mg/kg)

*Maximum safe dose can be increased by 50% when used with adrenaline

Signs of local anaesthetic toxicity

Local anaesthetics are neurotoxic and cardiotoxic.

Early symptoms:

- Perioral tingling, perioral/tongue numbness, tinnitus, agitation/anxiety, dizziness, flushing

Progresses to:

Muscle twitches, nystagmus, hypertonia, seizures, CNS depression, coma, bradycardia, hypotension, widened QRS preceding arrhythmias (VT with bupivacaine)

8.0 MANAGING PAIN USING NITROUS OXIDE (ENTONOX)

(2020) https://www.starship.org.nz/guidelines/procedural-pain-management

Entonox™ (nitrous oxide 50% and oxygen 50%)

Entonox is a self-administered, inhaled agent that provides quick and effective analgesia for procedures of short duration. It is a homogenous gas containing 50% nitrous oxide (N_2O) and 50% oxygen (O_2) compressed into a cylinder. Nitrous oxide is a sweet smelling colourless gas. It is a weak anaesthetic agent but a potent analgesic.

Entonox is self-administered using a demand regulator, which safeguards the user from overdose of nitrous oxide. When the child becomes drowsy, the mask or mouthpiece drops away from the face and the flow of gas ceases. This allows the child to control the dose and prevents the onset of deeper stages of anaesthesia and the loss of the protective laryngeal reflexes.

The advantage of Entonox is that it provides analgesia whilst retaining verbal contact with the child. Some children may become drowsy and/or disinhibited, however it allows a greater degree of co-operation throughout the procedure.

Indications

- Changing dressings
- Removing drains
- Removing sutures
- Redressing burns
- Invasive procedures, e.g. catheterisation, sigmoidoscopy
- Initial management of some traumatic injuries
- Applying traction
- Insertion, cleaning and removal of skeletal pins
- Application of plaster of paris
- Physiotherapy
- Suturing wounds

This list represents only a cross section of established uses.

Child suitability

Children over 5 years should be able to self-administer Entonox effectively, depending on their cognitive and physical ability.

Contraindications

Entonox should not be used:

- Where there is a decrease in the level of consciousness, e.g.
    - Head Injuries
    - Intoxication
    - Diabetic coma or other metabolic disease
- Where there is air trapped within the body and where expansion might be dangerous
    - Pneumothorax
    - Air embolism
    - Decompression sickness
    - Following a recent underwater dive
    - Gross abdominal distension
    - Following myringoplasty
    - Recent eye surgery with the use of intraocular gas
- When a child is not able to understand and co-operate
- During the first trimester of pregnancy
- When a child is immunosuppressed

Cautions
Entonox should be used in caution in the following:

- Patients with severe pulmonary hypertension and/or severe myocardial impairment. In these circumstances an airway skilled physician should be immediately available. (see Entonox in sedation guidelines).
- Frequent repeated administration, more than once every four days, may lead to irreversible inhibition of vitamin B12, which inhibits methionine synthetase, folate metabolism and deoxyribonucleic acid synthesis. If frequent use is needed, a full blood count should be performed. This can be corrected with Vitamin B12 and Folic acid.
- Immunosuppressed patients - Administered only after consultation with an oncologist and pain service consultant as nitrous oxide affects white blood cell production and function.

Side effects

- Potential for loss of consciousness.
- Expansion of air-filled spaces. It is therefore dangerous in any condition where air is trapped within the body and further expansion may occur.
- Minor side effects such as euphoria, disorientation, sedation, generalised tingling, dizziness, tiredness or nausea and vomiting may occur but are rapidly reversible.

Occupational hazards
Nursing or Medical Staff Pregnancy:

- **First trimester** - should not administer nitrous oxide because there is a small risk of miscarriage associated with exposure. (This includes staff who think they may be pregnant)
- **Second and third trimesters** - may supervise the self-administration of Entonox on an occasional basis

Administration of Entonox™

- Quick acting due to the insoluble nature of nitrous oxide
- Equally rapid offset when administration ceases
- It can be used alone or in combination with:
    - Opiates
    - Oral analgesia
    - Oral sedation (eg. Midazolam)
- Use in caution when in combination with opiates or oral sedation as there is an increased risk of decreased level of consciousness and respiratory complications

Fasting
It is preferable that patients have not had any food or drink for at least an hour prior to the administration of Entonox due to an increased risk of vomiting and aspiration.

Observations
Patient should be monitored using a pulse oximeter when opiates or oral sedatives are used in combination with Entonox. See Sedation Guidelines.

Documentation
Entonox should be prescribed on the oxygen therapy & medical gases section of the National Medication Chart.
If opiates or oral sedatives are used in combination with Entonox, a Sedation Record Chart - CR8762 should also be completed.
Details around the procedure and the use of Entonox should be documented in the patients' clinical notes.

Self-administration management steps for Entonox™
A Registered nurse, who has had their Entonox competency signed off, can supervise the self-administration of Entonox.
The procedure must be performed in the presence of a second nurse to closely monitor the vital signs.

Follow the steps below to **supervise the Self Administration of Entonox.**

1. Assess the need for the use of Entonox for a short procedure.
   If the degree of pain is high, Entonox may be augmented by the use of opiates but additional monitoring (pulse oximetry) will be required.
   Remember to administer any additional analgesia in adequate time before the procedure commences
2. Ensure Entonox and any additional analgesia is prescribed.
3. Check whether there are any precautions to be considered prior to administration, i.e.exclude contraindications.
4. Ensure patient is fasted for a minimum of 1 hour. If the procedure is planned, a 2 hour fast from food is preferred.
5. Gather and prepare the equipment.
   - Check delivery system.
   - Fit a new filter
6. Explain how the equipment works and how the gas will make them feel.
7. A member of staff should be observing the child self-administering Entonox while the procedure is being carried out by a second member of staff.
8. Do not allow the painful procedure to start until the child is receiving the full effects of the Entonox and is able to co-operate.
9. Continue to assess the child during the procedure
   - Ask if they are comfortable with the Entonox equipment and
   - If they are feeling any pain
   - Check for drowsiness.

   If the child drops the hand piece, remember the effects of Entonox wear off quite quickly.
   If further pain relief is required, ensure the child continues to use the equipment.
10. When the procedure is completed:
    - Dispose of the filter
    - Close the cylinder valve and
    - Exhaust the residual pressure in the system by depressing the:
      - Test button or
      - Purge diaphragm
11. Ensure that the face mask or mouthpiece is disposed of (single patient use only).
    If the patient is having a repeat procedure the mask or mouthpiece can be cleaned and kept for their use at a later date.
12. Monitor the patient until the effects of Entonox have completely worn off, i.e. Dizziness or disorientation.
13. Document the procedure and the use of Entonox in the designated notes.
14. If a child requires Entonox more than once every four days:
    - Medical staff should be informed and
    - Full blood counts monitored

9.0 MANAGING PAIN USING SIMPLE OR ORAL ANALGESICS

9.1 PARACETAMOL

Paracetamol is an antipyretic as well as an analgesic but it has no significant anti-inflammatory effect. The action is mainly in the central nervous system. It is useful for **mild pain** or used in conjunction with other analgesics for more severe pain. Its mechanism of action is not clear. Paracetamol's main strength is its excellent side effect profile, with serious complications being very rare despite extensive worldwide use over a long period of time.

Liver damage from Paracetamol is a very rare problem despite its widespread use.

Considerations:

- Jaundice
- Hepatic impairment
- Renal Impairment
- Hepatotoxicity with doses exceeding 150mg/kg/24hrs

If children are considered at risk, consideration should be given to decreasing the dose of Paracetamol if given for more than 1-2 days. Dosing limits will always be controversial.

Before administering, check when paracetamol was last administered and the cumulative paracetamol dose over previous 24 hours.

Preparation:

- Tablets (500mg)
- Syrup (120mg/5ml and 250mg/5ml)
- Suppositories (50, 125, 250 and 500mg)
- Intravenous (Perfalgan)500mg/50ml, 1000mg/100ml

Dosage: https://nzfchildren.org.nz/
Oral:
Neonate 28–32 weeks corrected gestational age 20 mg/kg as a single dose, then 10–15 mg/kg every 8–12 hours as necessary; maximum 30 mg/kg per day
Neonate over 32 weeks corrected gestational age 20 mg/kg as a single dose, then 10–15 mg/kg every 6–8 hours as necessary; maximum 60 mg/kg per day
Child 1 month–18 years 15 mg/kg per dose (maximum 1 g) every four hours; maximum 75 mg/kg per day for 48 hours, maximum of 60 mg/kg per day thereafter

Note:
A loading dose of 30 mg/kg (maximum 1.5 g) may be given provided there has been no paracetamol given within the preceding 12 hours.

Rectal: https://nzfchildren.org.nz/
Child 1 month–18 years 15–20 mg/kg per dose (maximum 1 g) every four hours; maximum 75 mg/kg per day for 48 hours, maximum of 60 mg/kg per day thereafter

Note:
A loading dose of 30 mg/kg (maximum 1.5 g) may be given provided there has been no paracetamol given within the preceding 12 hours.

- Absorption is slow and variable - the oral route should be used when possible.
- Max daily dose is same as oral route.

Intravenous (Perfalgan)

- IV Paracetamol is now available in New Zealand. While it has some advantages over enteral Paracetamol there are also disadvantages including a not insignificant cost differential. Its specific role in clinical practice is still being established.
- IV Paracetamol may be considered in patients unable to take or absorb Paracetamol by the oral route - it may be the preferred option ahead of the rectal route which has a very slow onset with poor and variable absorption.
- **It should only be charted if oral intake is impossible and rectal is unacceptable.**
- Chart only for 1 day then review.
- Diaphoresis can be a side-effect
- Convert to oral as soon as possible.

Dosage: https://nzfchildren.org.nz/
Preterm neonate over 32 weeks corrected gestational age 7.5 mg/kg every 8 hours
Neonate 10 mg/kg every 4–6 hours; maximum 30 mg/kg daily
Child under 10 kg 10 mg/kg every 4–6 hours; maximum 30 mg/kg daily
Child 10–33 kg 15 mg/kg every 4–6 hours; maximum 60 mg/kg daily, without exceeding 2 g
Child 33–50 kg 15 mg/kg every 4–6 hours; maximum 60 mg/kg daily, without exceeding 3 g
Child over 50 kg 1 g every 4–6 hours; maximum 4 g daily (see also cautions)

9.2 NON STEROIDAL ANTI INFLAMMATORY DRUGS (NSAIDS)

NSAIDs act mainly at the peripheral nervous system by interfering with the chemicals that sensitise the nerve endings to the pain. They have anti-inflammatory, antipyretic and analgesic properties. These drugs include ibuprofen and diclofenac.

They are effective for **mild to moderate pain.**

Considerations:

- hypovolaemia,
- severe and unstable asthma
- renal dysfunction,
- coagulation defects
- severe liver disease
- GI bleeding,

9.2.1 IBUPROFEN (BRUFEN)

Ibuprofen is an NSAID that has a syrup preparation and can be used in children **older than 6 months.** NSAIDS differ in their nociceptive, anti-inflammatory and side effect profiles. Ibuprofen has been well validated as an analgesic. The usual cautions apply in patients with hypovolaemia, renal dysfunction, coagulopathy, GI bleeding, aminoglycosides and the immediate post-operative period. NSAID's appear to be tolerated better by children than adults and GI side effects are less common. Use of gastro-protective drugs may not be necessary. Ibuprofen carries the lowest risk of GI side effects.
Do not use in children <6mths or <5kg

Dosage: https://nzfchildren.org.nz/
Child 1–3 months 5 mg/kg 6-8hourly
Child 3 months–18 years 5–10 mg/kg 6-8 hourly up to 30 mg/kg daily (maximum 2.4 g daily)
Max 40mg/kg/24hrs.
Do not exceed 1600mg/24hrs

9.2.2 DICLOFENAC (VOLTAREN)

Diclofenac is an NSAID that is **not approved in children under 14 years**

Consider Prophylactic Acid Suppression (Omeprazole)

Dosage: https://nzfchildren.org.nz/
Child 9–14 years and body-weight over 35 kg up to 2 mg/kg (maximum 100 mg) daily in 3 divided doses
Child 14–18 years 75–100 mg daily in 2–3 divided doses

9.2.3 PARACOXIB (Dynastat) is not approved for use in children

Paracoxib is a COX2 selective inhibitor. It is licensed for a single perioperative dose and should not be used in conjunction with any other NSAIDs
It is important to remember that rare but severe allergic reactions (Stevens - Johnson syndrome, Lyell Syndrome) have been described with valdecoxib, the molecule in which parecoxib is converted.
NB. Do NOT give other NSAIDS (voltaren, ibuprofen etc.) for 12 hours after paracoxib has been given.

9.3 DIAZEPAM for # FEMUR

Muscle spasms are common in the first two to three days following a fractured femur and can cause significant pain and distress for a child. Diazepam is a muscle relaxant and is useful for alleviating these spasms. It should be prescribed routinely for children along with paracetamol, ibuprofen and po morphine.

DOSAGE:
Diazepam 0.2mg/kg orally
http://kidshealthwa.com/guidelines/femur-fracture/

9.4 ORAL MORPHINE PREPARATIONS

Act mainly in the brain and spinal cord by inhibiting the transmission of pain impulses. They are powerful analgesics.
These include drugs such as tramadol and morphine and are effective for **moderate to severe pain.**

Oral Morphine is widely used and highly effective for acute and chronic severe pain but requires a functional gastrointestinal tract. It has a low bioavailability (30-40%) and thus requires higher doses than parenteral Morphine. All oral opioid prescriptions should be for a limited duration.

Considerations:

- **Opiates are respiratory depressants**
- **Young infants are highly sensitive to respiratory depressant effects of opiates. Monitoring of respiratory rate, sedation level, and oxygenation are important**
- **Respiratory disease**
- **CNS depression**
- **Hypovolaemic shock**
- **Other sedative drugs**
- **Hypothyroidism**
- **Seizures**
- **Hepatic dysfunction**

Monitoring of patients is required following doses of oral opioids. Respirations (especially), HR oxygen saturations and sedation score must be taken half hourly for at least one hour following a dose of oral morphine.
Half-life t ½ = 4 hours. If the child still has significant pain half an hour after an oral dose, consult with a doctor and if no contraindications, an IV bolus dose may be given. Use smaller increments, titrate to effect and monitor closely.

9.4.1 MORPHINE ELIXIR: (or IMMEDIATE RELEASE TABLETS e.g. sevredol)

Morphine elixir indicated for children unable to swallow tablets.

Preparation:
Syrup 2mg/ml only

Dosage: https://nzfchildren.org.nz/
Child 1–3 months initially 50–100 micrograms/kg every 4 hours, adjusted according to response
Child 3–6 months initially 100–150 micrograms/kg every 4 hours, adjusted according to response
Child 6–12 months initially 200 micrograms/kg every 4 hours, adjusted according to response
Child 1–2 years initially 200–300 micrograms/kg every 4 hours, adjusted according to response
Child 2–12 years initially 200–300 micrograms/kg (maximum 10 mg) every 4 hours, adjusted according to response
Child 12–18 years initially 5–10 mg every 4 hours, adjusted according to response

Note:
The Medication Safety Expert Advisory Group recommends the brand is specified when this medicine is prescribed.

9.4.2 SEVREDOL

Sevredol is morphine sulphate in tablet form. Use for children who are able to/prefer to take tablets. Dosing, monitoring and precautions are as for morphine elixir.

9.4.3 MORPHINE TABS - CONTROLLED RELEASED (LA MORPH)

Indicated for children that are able to swallow tablets that have prolonged severe opioid responsive pain eg, cancer pain or post-operative pain. **Once swallowed LA morph is like an infusion that cannot be stopped!**

Preparation:
Tablets (10, 30, 60 & 100mg, 200mg)

Dosage:
Calculate the amount of Morphine used in the previous 24 hours then chart this orally as a divided dose (BD).
Eg: If the patient used 60mg of IV Morphine in the previous 24 hours then chart LA Morph (controlled release morphine) 30mg BD.

Monitoring:
Following doses of oral controlled release Morphine, monitoring must continue until 12 hours after last dose administered. See Section 8.0 of the Handbook.

Whenever prescribing slow released preparations, it is useful to prescribe an immediate release opioid on a PRN basis for “break-through pain”. This dose is usually equal to 10% of the daily Morphine requirement.

9.4.4 OXYCODONE

Oxycodone is a semi-synthetic opioid, useful for treatment of moderate to severe pain. The analgesic effects of Oxycodone are similar to Morphine, though in adults it is said to have a more rapid onset and longer duration. Both drugs Morphine and Oxycodone, cause typical opioid side-effects but several reports suggest that hallucinations may be less frequent with Oxycodone. Oxycodone releases significantly less histamine than Morphine. Oxycodone has a good oral bioavailability (80% compared to Morphine 25% and Codeine 50-60%). Oxycodone is eliminated more slowly $t_{1/2}$ 3 hours) than Morphine. Metabolism of Oxycodone does not produce significant levels of active metabolites,

however clearance of Oxycodone may be reduced in renal and hepatic impairment. In renal failure clearance is reduced, with a resultant increase in half-life ($t_{1/2}$ 3.9 hours in uraemic patients). In liver failure, changes in clearance and half-life are more marked. Duration of action is 3-4 hours with onset of action 45 minutes. Kappa action may provide good visceral analgesia.
Oxycodone like Morphine comes in both immediate release and modified (controlled) release preparations - **it is important that the two preparations are not confused**

OXYCODONE – IMMEDIATE RELEASE AND MODIFIED RELEASE
Preparation:
- Syrup (5mg/5ml)
- Tablet (5, 10, 20mg)

Dosage: https://nzfchildren.org.nz/

Oral, immediate release
Child 1 month–1 year initially 50–125 micrograms/kg every 4 hours, dose increased if necessary according to severity of pain
Child 1–12 years initially 125–200 micrograms/kg (maximum 5 mg) every 4 hours, dose increased if necessary according to severity of pain
Child 12–18 years initially 5 mg every 4–6 hours, dose increased if necessary according to severity of pain

Oral, modified release
Child over 8 years initially 5 mg every 12 hours, increased if necessary according to severity of pain

Suggested Uses:
Inpatients - Oxycodone is a useful analgesic for acute post-operative pain and may be used as an alternative to codeine and for 'stepping down' from intravenous opioids.

Day-stay surgery - Oxycodone may be useful in infants and children who have moderate to severe pain and who are likely to need only one dose of oral opioids (it should not be dispensed for "out of hospital use" following day surgery). Typically:
- Hyposadias repair
- Tonsillectomy

Converting to Oxycodone
Total mg/day Oxycodone = Total mg/day of Previous Opioid x *f*

Previous Opioid	Conversion Factor *f*	
	Intravenous	**Oral**
Morphine	2	0.5
Fentanyl	100	NA
Codeine	NA	0.1
Tramadol	0.2	0.2
Methadone	2	1.3

e.g.: If the patient used 60mg of IV Morphine in the previous 24 hours then chart Total of 120mg/day of Oxycodone ie, 60 x (*f* = 2) = 120. This could be charted as Oxycodone (immediate release) 20mg 4 hourly prn, orally.

9.4.5 TRAMADOL

Tramadol is contraindicated in children under two years of age due to limited data on efficacy and safety. https://www.medsafe.govt.nz/

NB. Caution in Recent tonsillectomy, adenoidectomy or throat surgery

Patients are more susceptible to the effects of tramadol following recent tonsillectomy, adenoidectomy, or throat surgery. The lowest effective dose for the shortest period of time should be prescribed. Patients should be monitored for toxicity or overdose and tramadol should be stopped immediately if these occur.

Dosage: https://www.nzfchildren.org.nz

Moderate to severe pain

Oral, immediate release

Child 2–12 years 1–2 mg/kg (maximum 100 mg) every 6 hours

Child 12–18 years 50–100 mg not more often than every 4 hours; total of more than 400 mg daily not usually required

Oral, modified release 12-hourly preparations

Tramal SR®

Child 12–18 years 50–100 mg twice daily increased if necessary to 150–200 mg twice daily; maximum of 400 mg daily

Important

Do not confuse with modified release 24-hourly preparations.

9.4.6 CODEINE PHOSPHATE - Removed from use in paediatrics at Gisborne Hospital

Codeine is a pro-drug (it must be metabolised to morphine in order to provide analgesia). It is metabolised by CYP2D6, which is polymorphic so has variable metabolism (5-15%) to morphine. Some people (5-10%) are unable to metabolise codeine to its active form, (ie, it will not work), while some will be ultra-fast metabolisers. Because of this variability and unreliability in metabolism, codeine phosphate has been removed from use in Paediatric patients at Gisborne Hospital as from August 2015. There have been documented deaths worldwide recorded after administration of codeine in children who have been ultrafast metabolisers.

10.0 USE OF MIDAZOLAM IN PAEDIATRIC WOUND CARE MANAGEMENT

Sedation of children during diagnostic and therapeutic procedures is used to reduce fear and anxiety, to control pain, and to minimise excessive movement.
Oral midazolam is the drug of choice for children requiring sedation for stressful or painful dressing procedures. Midazolam has an amnesic quality and is effective in lessening a child's awareness but retains the ability for the child to respond to both verbal/physical stimuli. As the child is conscious, the airway and protective reflexes are not compromised.
The injection solution can be given orally. The injection solution may be diluted with apple or blackcurrant juice, chocolate sauce, or cola.

- As with all procedures a physical evaluation prior to treatment should be completed as per TDH assessment policy. Midazolam will be prescribed by a doctor on the child's medication chart.
- It is preferable that the child has been NBM 2 hours before procedure commences. In an acute situation, clear oral fluids 2 hours before procedure will be acceptable.
- Any child considered for Midazolam sedation requires pre sedation observations including oxygen saturations, weight, heart rate and respiratory rate. The Planet Sunshine sedation assessment and monitoring form is to be used for this. Monitoring equipment, O2 and suction will be available and ready for use at all times.
- Monitoring should continue during and post procedure until the patient is fully awake and coherent and until it is unlikely that there would be respiratory compromise, at least one hour post procedure.

Recommended Oral Dose of Midazolam: https://www.nzfchildren.org.nz

Child 1 month–18 years 500 micrograms/kg (maximum 20 mg) 30–60 minutes before procedure

Onset: 20min
Duration: 60-90min

ANTIDOTE: Flumazenil:
Dose:

a. **Anaesthetic reversal:**

Neonate - 10 micrograms/kg intravenous injection over 15 seconds. Repeat at 1 minute intervals if required
Child 1 month–18 years 10 micrograms/kg (maximum 200 micrograms), repeated at 1 minute intervals if required; maximum total dose of 50 micrograms/kg (1 mg) (2 mg in intensive care)
Intravenous infusion, if drowsiness recurs after injection

b. **Overdose:**

Neonate - 2–10 micrograms/kg/hour, adjusted according to response
Child 1 month–18 years 2–10 micrograms/kg/hour, adjusted according to response; maximum 400 micrograms/hour

11.0 MANAGING PAIN USING PARENTERAL ANALGESICS

Please use in conjunction with the Hauora Tairawhiti Pain management Manual

Introduction

A standard for the administration of Intravenous morphine should allow effective relief of pain with an acceptable nursing workload, while increasing patient safety.

Individualised Administration:

In children, the need to individualise opioid therapy is particularly challenging because of the need to consider developmental issues in terms of both pharmacokinetics and pharmacodynamics. Of particular concern is the immaturity of elimination pathways and of ventilatory control in neonates. Bolus dosing only should be used for neonates. Use under 6 month flow chart.

Drug of Choice:

Morphine is considered the 'gold standard' opioid analgesic for management of pain in children unless contraindicated. (e.g. if in renal failure)

A step-wise approach to managing pain should be considered for optimal management of pain in children unless contraindicated. (ie the WHO analgesic ladder see section 2.0 - ensure Paracetamol and/or NSAID's are given REGULARLY

Route of Administration:

- The preferred route for Morphine administration is oral. This route is convenient, administration is painless and a number of preparations are available. (See section 5.5)
- However many patients who have acute pain or expect to have severe post-operative pain, will initially require Morphine by intravenous route because either the oral route is contraindicated (eg. vomiting, fasting, oral ulceration), or because a rapid response is needed.
- IV injections are preferred over intramuscular (IM) or intermittent subcutaneous (SC) injections for management of acute pain. This is because the IV effect is rapid and thus easily titrateable. In addition, respiratory depression, if it occurs, will occur rapidly. In contrast, IM and SC administration may result in drug absorption that varies according to peripheral perfusion and the effects may be considerably delayed after administration. Intermittent IM injections to manage pain are painful and children may deny they have pain to avoid "the needle". Continuous subcutaneous infusions are useful in palliative pain management when the IV or oral route is not appropriate.
- The IV route carries the risk of respiratory depression, but the use of IV morphine as per protocol (APP) is expected to minimise the danger

Team Management:

The primary team should manage patients receiving IV Morphine as per protocol.

Patients who require consideration for a PCA/ Continuous Opioid Infusion should be referred to the Anaesthetist / (Pain Service) by the primary team. However if nursing staff are not satisfied with the primary team approach to the child's pain management, please contact the on call Anaesthetist directly.

11.1 INTERMITTENT BOLUS IV MORPHINE

Introduction:
This technique of analgesia is suitable where there is a need for short term intravenous analgesic therapy. This is prescribed by medical staff. Administration is by medical or nursing staff certificated for IV opioids. Administering small boluses of Morphine every five minutes makes it possible to carefully titrate pain relief while observing for the side effects of sedation and respiratory depression.

Prescription:
This is prescribed on the Inpatient Medication Chart as well as on the TDH Paediatric IV Morphine Bolus Chart.

Usual Dose Range:
- **Infants < 6 months** 0.02 mg/kg at 5 minute intervals
- **Child over 6 months but < 50kg 0.04 mg/kg at 5 minute intervals**
- **Child over 50kg 1-2 mg at 5 minute intervals**

If the patient is in moderate or severe pain, this dose to be given directly into an IV port and the patient monitored closely for the next 15 minutes.

Larger doses may be required at times, but they remove the safety offered by titration and are hazardous in the absence of immediate availability of artificial ventilation.

For patients unable to tolerate Morphine, Fentanyl or rarely Pethidine may be used.

Administration of Intermittent IV Morphine Bolus:
- The patient's level of sedation and respiratory rate must be fully assessed prior to giving each morphine bolus.

Check patient BEFORE administering IV morphine bolus:
Moderate or severe pain **OR** anticipated pain
AND
Sedation Level: awake *or* easily roused to voice
AND
Respiratory rate: >20/min if under 12 months
>15/min if under 50 kg
>15/min if over 50 kg
Heart Rate – appropriate for age

DO **NOT** ADMINISTER BOLUS IF PATIENT DOES NOT MEET **ALL** THESE CRITERIA

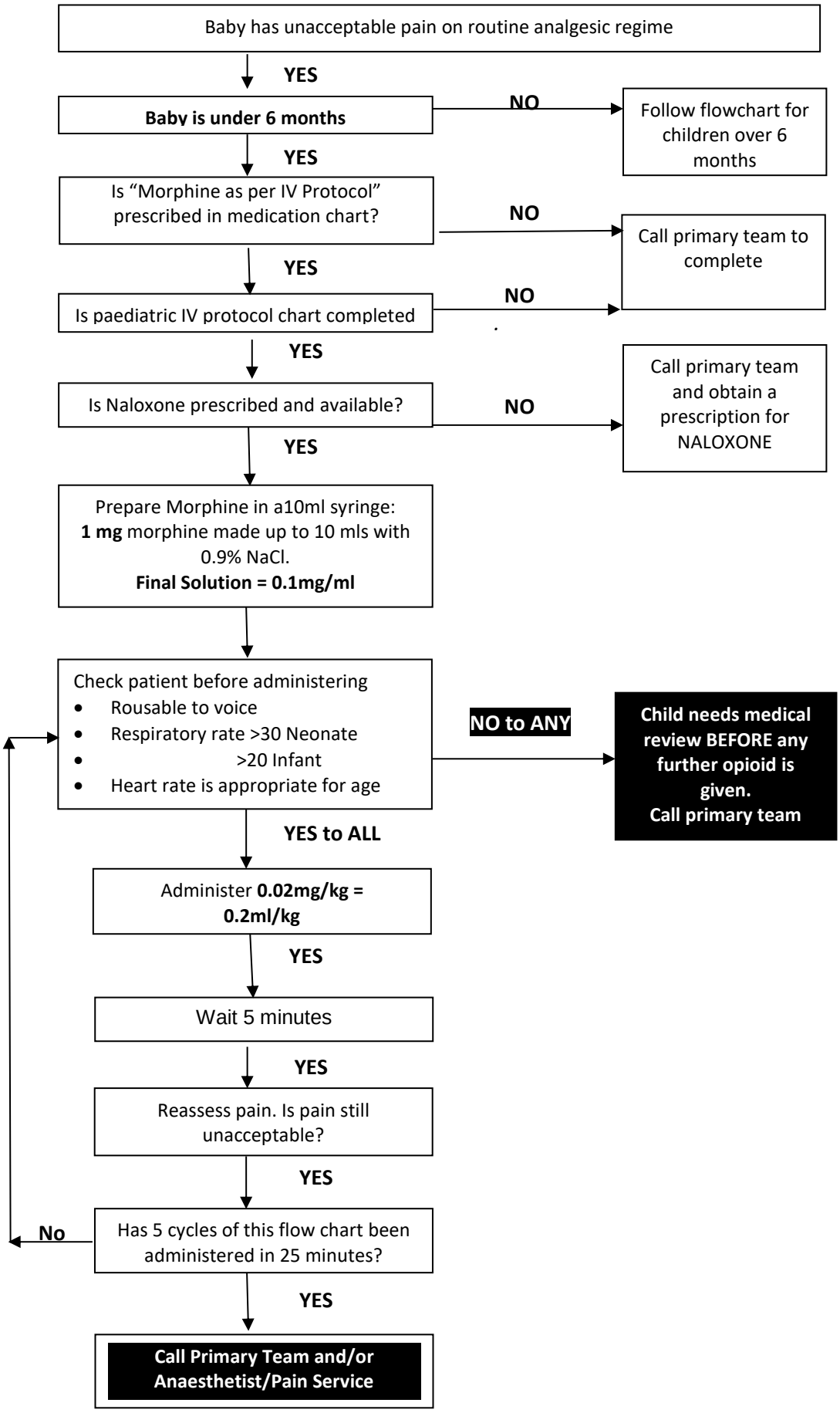
- The IV line must be checked for patency prior to delivering the morphine bolus.
- The morphine bolus is to be given slowly over 1 minute
- A normal saline flush must be given between morphine boluses and after the last dose to ensure the morphine dose has reached the patient.
- The nurse administering the morphine bolus is responsible for the morphine syringe, which must not be left unattended
- If the pain is unresolved after the permitted boluses have been given, contact the primary or on call team or the on call anaesthetist to consider ongoing pain management.

11.1.1 BOLUS IV MORPHINE PROTOCOL FLOW CHART

BABIES UNDER 6 MONTHS

The flow chart will enable safe administration of Bolus intravenous Morphine.

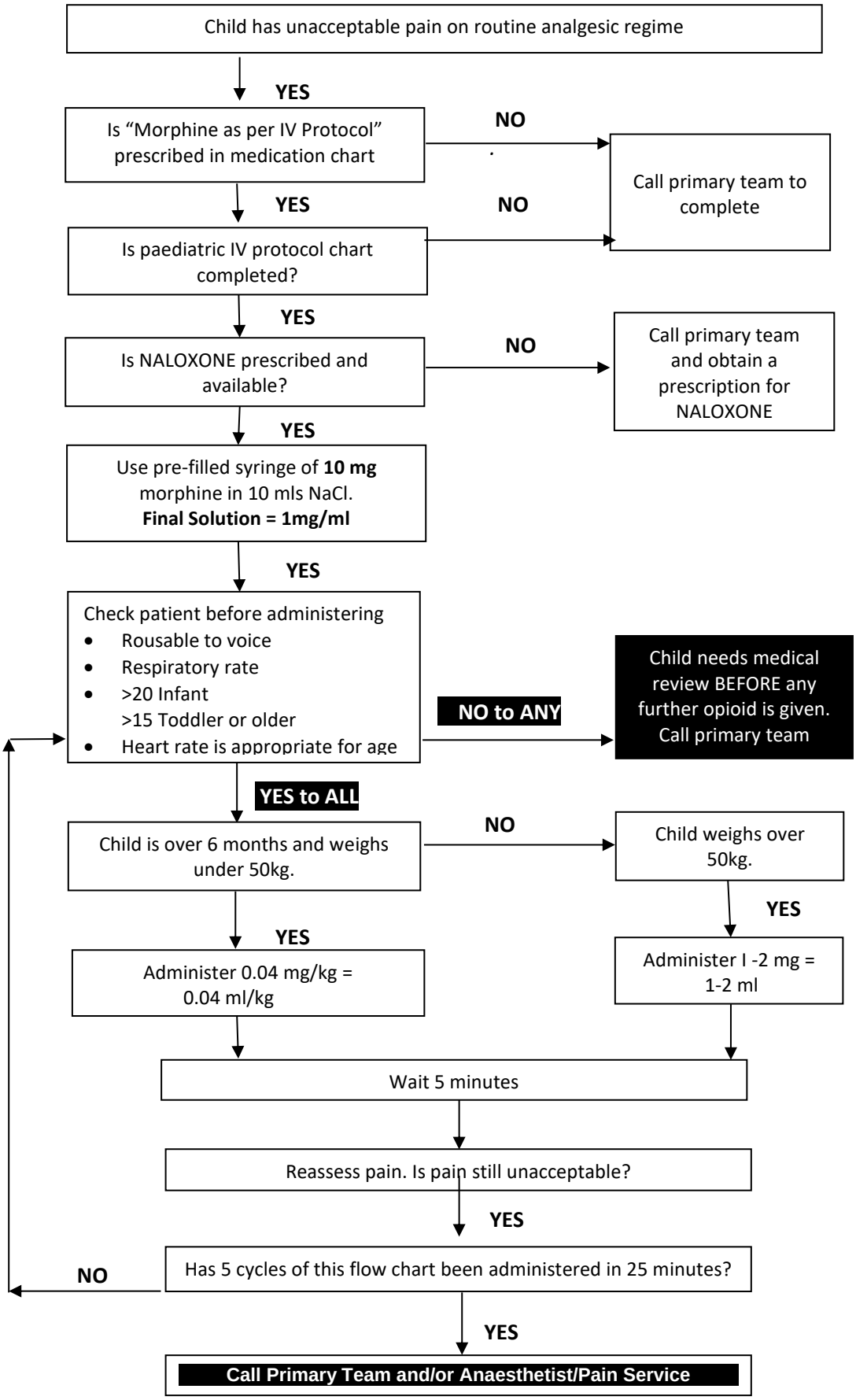
Only to be administered by an (IV) Registered Nurse/midwife who has completed the morphine administration competency, or by a medical practitioner



11.1.2 BOLUS IV MORPHINE PROTOCOL FLOW CHART

CHILDREN OVER 6 MONTHS

The flow chart will enable safe administration of Bolus intravenous Morphine.
Only to be administered by an (IV) Registered Nurse who has completed the morphine administration competency, or by a medical practitioner



Monitoring:
See Section **12.0** of this Handbook.

INITIAL MORPHINE BOLUS ADMINISTRATION EMERGENCY DEPARTMENT / THEATRE:
Larger doses may initially be administered to children over 6 months of age as prescribed by medical staff on an individual basis in the Emergency Department (ED)/ and Operating Rooms (OR) where there is the immediate availability of artificial ventilation.

- For children over 6 months and less than 50kg the initial administration dose may be 0.1mg/kg.
- For children less than 6 months the initial administration dose may be 0.02 – 0.05 mg/kg (20-50 micrograms/kg
- For children over 50kg the initial administration dose may be a standard bolus of 5mg.
- Further doses may then be administered as per IV Morphine protocol.
- Smaller doses are advisable under some circumstances.

11.2 PATIENT CONTROLLED ANALGESIA (PCA)

Introduction:
Frequent Morphine Bolus Administration vs PCA/ Continuous Opioid Infusions
If a child requires more than five titrations of bolus administration of morphine within a 25 minute period as described in this protocol and who is likely to have/ has on going pain, or who is anticipated could have moderate to severe post-operative pain, then a patient controlled analgesia (PCA) pump or a continuous opioid infusion should be considered.

PCA is a technique of managing acute pain which utilises a programmable pump to allow patients to self-administer their own intravenous opioid analgesics. It can be used by any child who is able to understand the concept of pressing a button when it hurts. Most children of normal intellect over 5 years can use PCA. The child's developmental age should be appropriate for the chronological age.
A PCA allows a continuous low dose background infusion to be added to the patient driven intermittent bolus administration if required.

Advantages of PCA:
- Patients can titrate their analgesia to their pain
- Patients are "in control"
- Rapid response to demand for analgesia (vs calling for RN, request for analgesia, RN
- getting analgesia, analgesia being administered)
- Reduced patient anxiety compared with other analgesia techniques
- Fewer complications when opioids are administered this way
- Excellent analgesia for the majority of patients
- Increased staff, patient and family satisfaction
- Decreased staff workload

Safety Factors:
PCA has a clear safety record provided it is programmed correctly and only the patient presses the button. The inherent safety of PCA arises because a patient will become sedated if the demand button is pressed too often and thus the patient will stop pressing it. PCA is safer than IM or IV opioid boluses. The PCA should be set up and supervised by experienced staff and the program should be standardised according to a fixed protocol to eliminate error. At TDH, Recovery Room nurses and Duty Nurse managers are able to program PCA's. Other PCA certificated RN's may also be able to do this.

Understanding PCA:
The PCA device is a programmable pump that delivers the opioid infusions according to individualised settings: bolus dose, lockout time, dose duration and background infusion.

Bolus Dose:
When the patient presses the remote button, the PCA delivers the programmed bolus dose. In cases of severe pain or in patients with large opioid requirements, the bolus dose may be set higher than the usual protocol by the anaesthetist.

Lockout Time:
Lockout time is usually set at 5-10 minutes. The PCA will not deliver a dose during lockout time, even if the patient presses the button. This allows each bolus to reach peak effect before the patient has another bolus. Lockout time reduces the risk of overdose.

Total Dosage:
The current monitoring requirements are for total dosage and is recorded in either mg or micrograms (not mls)

Background Infusion:
A background infusion (continuous infusion) may be added to improve analgesia. Generally a background infusion would only be required for patients following major surgery, with major trauma, or patients with oncology-related pain and high opioid requirements. A background infusion may increase the risk of the side effects associated with opioids: (sedation, respiratory depression, itch, nausea).
NB. If utilizing a background infusion the patient must be nursed in the Paediatric HDU

Who Should Be Considered for PCA?
A PCA is the preferred device for children who understand the concept and are physically able to use it. This includes most school-aged children.

Consider for:
- Major trauma
- Major surgery (including complex appendectomies)
- Fractured femur
- Burns
- Oncology

Reasons:
In these clinical conditions, severe pain is to be expected. Effective pain control from the beginning is a must. Children have the right to it.
- It reduces stress so enhances recovery.
- Without effective pain control children become hypersensitive to movement, wound care etc. in the initial days. This increases stress on the child and makes nursing care difficult. Often have children screaming during daily cares such as traction cares, placing on bedpans etc. This behaviour often continues on for much longer than could be reasonably expected pain to be an issue.
- With effective pain control this sensitivity may not develop.
- It is known that the development of a post-traumatic stress syndrome after burns is inversely related to the amount of Morphine used over the time of hospitalisation.

Contraindications to PCA:
The inability to understand the concept of PCA and children not wishing to control their own analgesia.

Pre-Operative Education:
The anaesthetist should discuss PCA with the parents and child pre-operatively if possible. It is helpful if nurses also explain the basic principles of PCA to the child prior to surgery. Many children need further reminding post-operatively about using PCA effectively.

What to Tell Children about PCA:
The nurse teaching the child and their family about using PCA should give the child/parents a PCA patient handout and cover the following topics:

- how the PCA pump works,
- when to push the button,
- how the PCA helps the child get the right amount of pain relief medicine
- how the PCA stops the child getting too much pain relief medicine.

Children should not be told to expect complete pain relief but instead to use the PCA to reduce pain to a level where they feel comfortable. If the child is experiencing problems with using the PCA, notify the primary team and/or Anaesthetist for review.

Pre-Emptive Analgesia:
The PCA device can be used in a pre-emptive manner to reduce pain from physiotherapy, dressing changes, turning and ambulation. Children should be reminded to use their PCA once or twice before the painful event occurs. It is helpful that staff remember to give the child enough time so the analgesia peaks prior to the painful event.

ADDITIONAL ANALGESIA
Non-opiate analgesics such as paracetamol and non-steroidal anti-inflammatory drugs (if not contraindicated) can also be administered to a child on a PCA/NCA. This has the potential to decrease the amount of opiate required and in return limit opioid induced side effects.
With the exception of tramadol, no other opioid analgesia should be administered unless discussed with the anaesthetist or pain service.

Prescription of PCA:

- Morphine is the drug of choice for PCA and continuous opioid infusions unless contraindicated.
- Alternative opioid analgesic modality prescriptions should be discussed with the Anaesthetist/Pain Service.
- PCA orders are prescribed on the Paediatric PCA/NCA Prescription Chart by the Anaesthetist.
- It must include appropriate prescribing of PCA or NCA and correct parameters for the age of the child

<u>Protocols for Children:</u>
Morphine Protocol

- Use pre mixed 100ml bags of morphine 100 mg in 100ml of normal saline which are obtained from Pharmacy or PACU
- An Anti-reflux valve is necessary with all intravenous PCA Background infusions are not a common occurrence.

Morphine PCA	**INITIAL PROGRAMMING**	
Solution	100mg/ 100mls	1ml = 1mg
Bolus Dose	10-20mcg/kg	0.01-0.02ml/kg
Lockout	5-10mins	
Background Infusion (if used)	0-10mcg/kg/hr	0 - 0.01ml/kg/hr
Hourly Dose Limit	100mcg/kg	0.1ml/kg

Fentanyl Protocol

- Used for patients who are unable to tolerate Morphine or who have renal impairment.
- Use pre mixed 100ml bags of fentanyl 1000 mcg in 100 ml of normal saline which are obtained from Pharmacy

Fentanyl PCA	**INITIAL PROGRAMMING**	
Solution	1000mcg/100mls	1ml = 10mcg
Bolus Dose	0.1 – 0.2mcg/kg	0.01 – 0.02 ml/kg
Lockout	5mins	
Background Infusion (if used)	0.05-0.1mcg/kg/hr	0.001 – 0.002ml/kg/hr
Hourly Dose Limit	4mcg/kg	0.04ml/kg

Equipment

PCA pumps and tubing are supplied from PACU who will set up them up.
Call PACU staff if you have any problems or questions
Premixed bags of opiates are made up and supplied from Pharmacy

Commencement

The PCA/NCA pump may be commenced once pump settings have been reviewed against the prescription and tubing line primed and connected to the patient via the appropriate peripheral or central access point.

Changing medication bag and tubing

Premixed medication bags require changing every 72 hours.
The tubing line must be changed every 72 hours. A sticker with the date and time the line was changed should be applied to the tubing.

Documentation

- Commencement and cessation of the PCA/NCA should be documented on the back of the Paediatric PCA/NCA Chart
- Rate changes
- Bolus changes
- Bag changes (including bag volume discards)
    - The total dose of opioid received is recorded
    - **Observations** required should be documented on the paediatric early warning signs (PEWS) chart. All other details should be documented in the patient's clinical notes.
    - **Line changes** should be documented in the clinical notes by the nursing staff. If the patient has a central access line the line change should be documented on their CLAB form.
    - **Volume administered** should be read and documented hourly in the fluid balance chart if a background infusion running.

Safety

Patients with a PCA/NCA should not leave the ward environment without a registered nurse in attendance.

Where possible the patient should be educated around the PCA and NCA. Patients using a PCA should be aware of the green light showing a bolus dose is available and the lockout times with the PCA.

The child's parents must not under any circumstances push the PCA or NCA bolus button, however, they can encourage the child to use it or request the medical staff to press the button

Observations

Hourly	4 Hourly	Observe and document every shift
HR, RR, SP02 – Any observations > 1 on Paediatric Early Warning Score (PEWS) chart, a full set of PEWS is required. **BP** – hourly for 1st 4 hours **Level of consciousness** **Pain Assessment**	**PEWS** **Nausea/Vomiting**	Urinary retention Itching Constipation
• **Continuous oximetry for patients 'at risk' or requiring oxygen** • If asleep and PEWS are stable for over 6 hours: document level of consciousness and pain assessment 4 hourly • Continue observations for 4 hours after stopping intravenous analgesia infusion		

Essential requirements
For all patients on a PCA or NCA;
- No prescription changes to be made except by anaesthetist
- With the exception of tramadol, no other opioids to be prescribed except by an anaesthetist.

Troubleshooting:
See Section **13.0** of this Handbook or refer to PCA Prescription Form (trouble shooting guidelines).

11.2.1 ADOLESCENT PCA

Adolescent patients especially those close to 50kg have physiology and responses approaching those of adult patients and should be considered for a standard adult PCA set-up. Opioid naïve adults have been shown to have increased satisfaction and fewer side effects when given PCAs with a larger bolus but no initial basal rate.

Morphine Protocol

- Use pre mixed 100ml bags of morphine 100 mg in 100 ml of normal saline which are obtained from Pharmacy

Morphine PCA	**Standard Adult PCA**	
Solution	100mg/ 100mls NaCl	1ml = 1mg
Bolus Dose	1 mg	1ml
Lockout	5 mins	
Background Infusion		
Hourly Dose Limit	10mg	10ml

Fentanyl Protocol

- Use pre mixed 100ml bags of fentanyl 1000 mcg in 100 ml of normal saline which are obtained from Pharmacy

Fentanyl PCA	**Standard Adult PCA**	
Solution	1000mcg/ 100mls NaCl	1ml = 10mcg
Bolus Dose	10 mcg	1ml
Lockout	5 mins	
Background Infusion		
Hourly Dose Limit	120mcg/hr (no more than 1mcg/kg)	12ml

NB. Monitor for signs of respiratory depression

11.3 NURSE CONTROLLED ANALGESIA (NCA)

Introduction:
NCA is appropriate for the control of pain in infants, pre-verbal children and children that cannot use a PCA. It is useful for moderate to severe pain that has a significant incident/movement component.

NCA takes the equipment and principals of PCA and puts the control in the hands of the nurses. NCA allows continuous low dose background infusion and/or intermittent boluses at specified intervals. The patient is protected from overdose by routine monitoring, a longer lockout interval than with PCA, and the principal of assess-intervene-reassess. There is no place for a parent or guardian to press the button.

Prescription:
NCA orders are prescribed on the Paediatric PCA Prescription Form by an Anaesthetist only.
Syringe changes are recorded in the Drug Administration Record of this Prescription Form.

Morphine Protocol

- Use pre mixed 100ml bags of morphine 100 mg in 100 ml of normal saline which are obtained from Pharmacy

Morphine NCA	**INITIAL PROGRAMMING**	
Solution	100mg/ 100mls	1ml = 1mg
Bolus Dose	10-20mcg/kg	0.01-0.02ml/kg
Lockout	10-30mins	
Background Infusion	0-20mcg/kg/hr	0- 0.02ml/kg/hr
Hourly Dose Limit	80mcg/kg	0.08ml/kg

Fentanyl Protocol

- Use pre mixed 100ml bags of fentanyl 1000 mcg in 100 ml of normal saline which are obtained from Pharmacy

Fentanyl NCA	**INITIAL PROGRAMMING**	
Solution	1000mcg/mls	1ml = 10mcg
Bolus Dose	0.4-0.8mcg.kg	0.04 – 0.08ml/kg
Lockout	10-30mins	
Background Infusion	0-0.8mcg/kg/hr	0.08ml/kg/hr
Hourly Dose Limit	3.2mcg/kg	ml/kg

Monitoring:

- See Section 9.0 of this Handbook.
- Observations must be recorded on the Paediatric PCA/NCA chart as per PCA/NCA guidelines
- Children on an NCA MUST have continuous Oximetry.

Troubleshooting:
See Section **13.0** of this Handbook and /or refer to PCA Prescription Form (trouble shooting guidelines).

11.4 CONTINUOUS OPIOID INFUSIONS

A syringe driver, using a non-return valve is the preferred device for a continuous opioid infusion in children unsuitable for PCA/NCA use. Devices such as burettes and simple volumetric pumps are not to be used for this purpose. Continuous opioids are to be prescribed by an Anaesthetist/Pain Service

Equipment:
The infusion is delivered via a syringe driver. The PCA giving sets are connected to the IV line. The giving set incorporates a one way valve in the IV line preventing backflow of the analgesia up the line and an anti-syphon valve which prevents uncontrolled flow of analgesia to the patient.

Concentration of Infusion Solution:

- A premixed bag is obtained from Pharmacy of **Morphine 100mg in 100mls** Normal Saline=**1mg/ml.** Draw out the volume required into the syringe to be connected to the syringe driver.
- A premixed bag is obtained from Pharmacy of Fentanyl 1,000micrograms in 100mls Normal Saline =10mcg/1ml Draw out the volume required into the syringe to be connected to the syringe driver

Dosage: (>3months old)

	Microgram dose	Milligram dose	Max dose	Usual Bolus dose
Morphine:	10- 30 mcg/kg/hr	0.01-0.03mg/kg/hr	30mcg/kg/hr	10-20mcg/kg/15min intervals
Fentanyl:	0.4 - 1.2 mcg/kg/hr		1.2mcg/kg/hr	0-2 - 0-4mcg/kg/15min intervals

Prior to commencing the infusion the patient should be titrated to comfort with intravenous boluses of the same opioid. Infusions can be varied at the discretion of the ward nursing staff according to the degree of analgesia or sedation of the patient.

Monitoring:

- These children will require continuous observation and monitoring as per continuous opioid infusion prescription chart and recommended best practice.
- They must be monitored in the Paediatric HDU
- See also Section 9.0 of this Handbook.

11.5 BOLUS DOSES GIVEN IN ADDITION TO BACKGROUND OPIOID INFUSIONS

Bolus doses can be given in two situations:

- If pain relief is inadequate, a prescribed bolus dose should be administered followed by an increasing infusion rate within the prescribed limits
- To cover anticipated "incident pain" e.g., pulling out drain, physiotherapy movement, procedures, dressing etc) we suggest that a bolus dose be given 10 - 15 minutes prior to the anticipated painful procedure.

Before bolus doses are given:
Exclude alternative causes of pain e.g. urinary retention, compartment syndrome. The patient should be awake and coherent

Recommended Bolus Doses: (as per table above)
Can be given every 15 minutes and must be documented on the infusion prescription. Bolus doses are given using the syringe pump

Monitoring: (as above)
Vital signs must be assessed and recorded prior to and after bolus administration as per usual bolus guidelines (every 5 minutes for 15mins)

11.6 SUBCUTANEOUS MORPHINE BOLUSES

Introduction:
This is ideally avoided because of the irritant nature of subcutaneous (SC) Morphine, but it may be useful for post-operative pain of short duration in the older child. A narrow gauge plastic cannula can be left in position usually just below the clavicle, obviating the need for repeated skin puncture. Morphine is the drug of choice.
In the shocked patient the absorption from the SC (and IM) site is erratic and this form of analgesia should not be used.
Because it is necessary to prime the line with Morphine prior to the first injection, it is important to use Morphine of the same concentration for all injections. (concentration 10mg/ml (ie **undiluted**)

Prescription:
This is prescribed on the Inpatient Medication Chart.

Dosage:
Morphine 0.1mg/kg SC 1-2 hourly prn. (0.01ml/kg)

Equipment:
- 24g BD Saf-T-Intima cannula
- Alcohol swabs
- Small Transparent dressing e.g., Opsite, Tegaderm

Insertion of SC Cannula: - (may already be in situ from theatre)
- Prime the infusion line with Morphine (concentration 10mg/ml)
- Clean the site in the sub clavicular region thoroughly with alcohol swab
- Insert the cannula through the skin at shallow angle. It is best to pinch up a fold of skin to do this.
- Cover with the transparent dressing
- All patients should have IV access

Injection Procedures:
- Check the drug order for the dose of Morphine (0.1mg/kg or less – 0.01ml/kg)
- Draw the appropriate dose of Morphine into a 1ml syringe. Do not dilute.
- Wipe the bung with an alcohol swab and then inject. The slower the rate of injection the less discomfort the patient experiences (give over 1-2 minutes).
- Do not flush the cannula either before or after the injection.

Monitoring:
- See Section **12.0** of the Handbook.
- Observations must be recorded on the Paediatric Pain Recording Chart.

Troubleshooting:
See Section **13.0** of the Handbook or refer to the Morphine Prescription Form (trouble shooting guidelines)

12.0 MONITORING

- Children taking opioids by **any route** require the following:
- Observations are to be recorded on the Paediatric Early Warning Score (PEWS) Chart.
- Prior to administration of an IV morphine bolus the patient should have a baseline set of observations. - BP, pulse, respiratory rate, sedation score, pain assessment, oxygen saturation
- The patient should be awake or easily roused to voice (Sedation score of 0 to 1) prior to each IV bolus or oral dose.
- Heart rate, respiratory rate, oxygen saturation, pain score & sedation score every 5 minutes during IV boluses, (or use a continuous monitoring monitor).
- After the last bolus has been given, three further sets of observations at 5 minute intervals should be completed.
- The effectiveness of the analgesia is to be documented in the patient's medical record and on the observation chart.
- For opioid infusions, NCA, PCA and single dose opioids (PO, IV, SC, or IM) observations may stop 2 hours after discontinuing / last dose. For controlled release oral opioids observations may stop 12 hours after last dose.
- Those on a continuous infusion/NCA must have continuous oximetry
- **Children on continuous infusions must be monitored in the Paediatric HDU**

Pain Assessment - Faces Pain Scale	
0	No pain
2	Hurts a little
4	Quite sore
6	Very sore
8	Really, really sore
10	Too much pain

Sedation Score – (Starship Hospital)	
0	Awake and alert
1	Sleeping but easily arouses to voice or light touch
2	Arouses to loud voice or vigorous stimulation
3	Arouses with painful stimuli only.
4	Unrousable
S	Patient is sleeping

12.1 MONITORING OF NEONATES AND AT RISK PATIENTS:

- Neonates in particular and infants less than 6 months of age have an increased risk of opioid induced respiratory depression.
- **Infants less than 6 months of age must have continuous monitoring after opioid administration.**
- The preferred monitor is a pulse oximeter. An apnoea alarm is a suitable alternative.
- **There must be a nurse available to respond to the monitor.**
- Monitoring must continue after the last opioid administration. The period of observation should be:
  - Infants < 1month = 9 hours
  - Infants >1month to 6 months of age = 4 hours
  - Special consideration should be taken of ex-premature infants with a post conceptual age of less than 60 weeks. These infants will require continuous observation until they have a 24 hour "apnoea free" period.

  Caution should also be taken in morphine administration in children with known **renal impairment**. Children with renal impairment have the potential to accumulate morphine metabolites and therefore have an increased risk of respiratory depression and sedation. It is advisable that consultation with Senior Medical Staff occurs prior to the administration of morphine.

Other children at high risk of respiratory depression that may require continuous monitoring while receiving opioids include those with:

- central neurological diseases
- sleep apnoea
- pre - existing respiratory failure
- renal impairment
- children receiving sedatives (i.e. diazepam)

13.0 MANAGING ADVERSE EFFECTS & TROUBLESHOOTING

13.1 RESPIRATORY DEPRESSION/ OVERDOSE

Opioid overdose may be suspected if there are slow shallow respirations and deep sedation or loss of consciousness.

Sedation Score 3 or 4 or Respirations < minimum for age:
Suspect opioid overdose:
- Stop giving the Opioid
- Stimulation and encouragement to breathe may be all that is required.
- Give Oxygen, assist ventilation (bag and mask) if necessary
- Call medical staff
- Observations every 5 minutes or continuous monitoring
- **If cardio-respiratory arrest / minimal respirations / or unconscious**
- Give Oxygen, and assist ventilation (bag and mask 100% O2)
- Call arrest team **777**, and commence APLS
- Give Naloxone 10 mcg/kg IV prn every 1-2 minutes

Pain score of 6 or more on two consecutive recordings:
- Call Medical Staff

Hypotension or heart rate extremes:
- Stop giving the opioid
- Give Oxygen
- Call Medical Staff
- Observations every 5 minutes or continuously
- Hypotension – position head down 10 degrees and feet up

13.2 PRURITUS

This is a very common symptom in infants and children receiving opioid analgesia.
Recommendations to attempt to reduce distress:

- Optimize general skin care ie, change old dressings, adequate skin washing, use skin moisturisers etc
- Try antihistamine
  - Promethazine 0.5mg/kg IV/MI/PO 8 hourly prn (max 10-25mg); or
  - Trimeprazine 0.5mg/kg PO 8 hourly prn
- Try Ondansetron 100mcg/kg IV or PO (max 4mg) - if effective, it may be repeated 8 hourly (max 3 doses for pruritus)
- Change opioid ie, Morphine to Fentanyl
- Try Naloxone
  - Bolus 0.5mcg/kg IV up to 3 doses over 15 minutes
  - Infusion 1mcg/kg/hr if successful
- Stop opioid altogether.

13.3 MANAGEMENT OF NAUSEA AND VOMITING

Introduction:
Antiemetics may be used prophylactically in theatre if the patient is considered to be significantly at risk of postoperative nausea and vomiting (PONV), or they may be used to treat patients with PONV.

Studies suggest that independent risk factors for PONV in children include:
- History of PONV in patient, sibling, or parent
- Age ≥ 3 years
- Surgery ≥ 30 mins
- Strabismus surgery (others include adenotonsillectomy)

When 0, 1, 2, 3 or 4 factors are present, risk equates to 10%, 10%, 30%, 55%, or 70%.

Antiemetic	Dose	Maximum	Frequency	Class
Ondansetron	50-100 mcg/kg	Max 4mg	8hrly prn	5 HT3 antagonist
Cyclizine	0.5-1mg/kg	Max 50mg	6hrly prn	Histamine antagonist
Dexamethasone	150-200mcg/kg	Max 8mg	Once only	Steroid
Droperidol	**Child 2–18 years** 20–50 micrograms/kg (maximum 1.25 mg) 30 minutes before the end of surgery, repeated every 6 hours as necessary			
Metoclopramide	150mcg/kg	Max 10mg	8hrly prn	Dopamine antagonist

PONV Prophylaxis:
In children at moderate or high risk of PONV, combination therapy with 2 or 3 antiemetics from different classes should be used. Combination therapy may also be appropriate for patients in whom PONV poses a particular morbidity (jaws wired, raised intracranial pressure, gastric / oesophageal surgery, or day surgery).

Antiemetics are not all equal in their effectiveness.

Numbers Need To Treat (NNT) For POV Prophylaxis In Children:

Antiemetic	Dose	NNT
Ondansetron	50-100 mcg/kg	2-3 (early & late POV)
Dexamethasone	150mcg/kg	4 (early & late POV)
Droperidol	50-75mcg/kg	4-5 (early & late POV)
Metoclopramide	150mcg/kg	Little evidence to show useful

Taken from GAN 2007

Early POV = postoperative vomiting 0-6hrs
Late POV = postoperative vomiting 0-24 hrs

Recommendations for PONV Prophylaxis:

- **Ondansetron and Dexamethasone**
  - First line combination
- **Cyclizine**
  - May cause sedation, caution if <2 years old.
- **Droperidol**
  - Potential for extrapyramidal symptoms and high levels of sedation
  - Should probably be reserved for children who have failed other therapies and are being admitted overnight.
- **Metoclopramide**
  - Combinations with Metoclopramide are no better than monotherapy

PONV Treatment:
When PONV occurs treatment should be given with an antiemetic from a different class than any prophylactic agents already used.

- Ondansetron
  - First line agent if not already given
  - Doses for treatment are lower than doses required for prophylaxis
- May give a repeat dose of an antiemetic if greater than 6 hours since last dose.
  - Do not give repeat dose of Dexamethasone
- May consider small dose of Propofol if still in PACU (effect probably brief)

Recommendations for Persistent PONV

- Exclude correctable causes (eg, unnecessary opioids, ingested blood, abdominal obstruction, hypotension).
- Ensure adequate hydration, analgesia, blood pressure, blood sugar
- Ensure triple therapy (Ondansetron, Dexamethasone, Droperidol)
  - Give Dexamethasone slowly if conscious - may cause discomfort
- Consider:
  - Cyclizine - may cause sedation, caution if <2 yrs old
  - Metoclopramide

13.4 MANAGEMENT OF CONSTIPATION

- Consider laxatives

13.5 MANAGEMENT OF URINARY RETENTION:

- Determine if the bladder is full
- Consider indwelling catheter
- Consider decreasing the opioid dose
- Contact anaesthetist

14.0 INTRANASAL FENTANYL

https://www.starship.org.nz/for-health-professionals/starship-clinical-guidelines/i/intranasal-fentanyl/(June 1 2014)

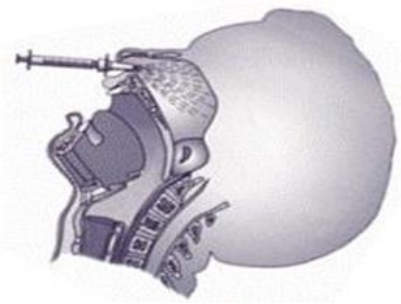
NB: Intranasal Fentanyl can be given in Planet Sunshine providing a paediatrician or anaesthetist is in attendance.

Background:

- Narcotics are used for their analgesic, anxiolytic and euphoric actions. The analgesic dose is lower than the sedative dose.
- Morphine is usually given via the intravenous route with the additional discomfort and pain of insertion of an IV cannula. Intranasal fentanyl has the potential to eliminate this disadvantage and provide significant reduction in pain scores by 5 minutes. It has a duration of action of at least 30 minutes.
- It has been shown to give equivalent analgesia to IM morphine, IV morphine.
- The intranasal delivery of fentanyl provides rapid absorption (therapeutic levels within 2 minutes) and excellent bioavailability (at least 50%).

Preparation:

- Use IV preparation – 100mcg/2ml.
- Use a 1mL syringe and a Mucosal Atomiser Device (MAD)



Dosage:

- 1.5 micrograms/kg (minimum dose of 20 micrograms, maximum dose of 100 micrograms)
- A second dose of 0.5 micrograms/kg can be given after 10 minutes if significant pain persists.

Technique:

- The patient should be reclining at 45 degrees and the syringe should be held horizontal and the contents expelled as a mist into the nares in one rapid dose. Do not ask patient to sniff.
- Doses of 1 mL (50 micrograms) or more should be divided between nares.
- The volume to be insufflated limits use of intranasal fentanyl to children under 70kg.

Indications:

- Children older than 1 year with moderate to severe pain eg burns, suspected fractures.
- Particularly useful to allow topical anaesthetic application prior to IV insertion or in situations where IV access is not likely to be required eg burns, dressing changes, foreign body removal, POP application.

Relative Contraindications:

- Age less than 1 year (limited data on safety or efficacy in this age group and minimum practical dose of 20mcg is likely to be too high)
- Head trauma, chest trauma, abdominal trauma and hypovolaemia

Precautions:

- Condition or injury requiring immediate IV access
- URTI or other cause of blocked nose - may cause unreliable delivery of drug.
- Prior dosing with narcotic may produce drug accumulation
- Co-administered sedatives and co-morbid medical conditions may require modified dose schedules

Possible Adverse Effects:

- Uncommon – Nausea, vomiting, sedation. (Prophylactic antiemetic use is not required in paediatrics)
- Rare (not described with IN use) – respiratory depression, muscle rigidity (including chest wall)

Monitoring and Recovery in ED:

- Observe for 20 minutes post dose.
- Suitable for discharge one hour post dose if responding appropriately.
- Provide caregiver with information regarding transport and observation at home

15.0 PREOPERATIVE MEDICATIONS

15.1 PREMEDICATIONS

These drugs may be prescribed preoperatively by the Anaesthetist to reduce anxiety and cause some sedation. These drugs are often better tolerated if given in cordial / soft drink or paracetamol to help disguise their bitter taste. Once children have received sedative / anxiolytic premedication they must not leave the ward and must remain supervised. Children premeditated with Ketamine require close observation in a quiet environment.

Midazolam
Child 1 month – 18 years
500 micrograms/kg (maximum 20 mg) 15–30 minutes before the procedure

Effects may start to wear off after 40 mins.

15.2 PRE- EMPTIVE ANALGESIA

- Paracetamol. 20mg/kg in children over 1yr, no gastro-intestinal obstruction, or risk for reflux.
- Paracetamol elixir 250ml/5 mls to be given
- Non Steroidals

16.0 SEDATION IN CHILDREN

https://www.starship.org.nz/guidelines/sedation-in-children (May 2018)

Definition:
Sedation means the sedation of a patient for diagnostic, interventional, medical or surgical procedures, with or without local anaesthesia, for the purpose of producing a degree of sedation without loss of consciousness.
Sedation includes the administration, by any route, of all forms of drugs which result in depression of the central nervous system

Scope
These guidelines are intended for use in patients who are generally healthy or have only mild systemic disease.
The following patients should not be sedated without the involvement of senior medical staff and the department of anaesthesia,

- More severely ill patients
- Ex-premature infants (less than 60 weeks post conceptual age)
- Neonates (< 4 weeks of age)

Indications:
Sedation should be employed for procedures that children find stressful or painful. Non-pharmacological techniques to achieve anxiolysis (behavioral anxiolysis) should always be considered. In many instances these can eliminate the requirement for drug sedation.
Topical anaesthetics where appropriate, such as EMLA should be used as these will reduce the amount of sedation required.
The drug(s) used will depend on:

- The age of the patient
- The procedure
- The goals of sedation

Risks:
Sedation is not without risk because of:

- Potential for unintentional loss of consciousness (i.e. loss of verbal contact with the patient), which carries the same risks as general anaesthesia
- Depression of protective airway and pain reflexes
- Depression of respiration
- Depression of the cardiovascular system
- Wide variety and combinations of drugs which may be used, with the potential for drug interactions
- Possibility of excessive amounts of these drugs being used to compensate for inadequate analgesia
- Individual variations in response to the drugs used, particularly in children, and those with pre-existing medical disease
- Wide variety of procedures performed
- Differing standards of equipment and staffing at the locations where these procedures may be performed

The drugs and techniques used should provide a margin of safety wide enough to render loss of consciousness unlikely.

Variability of Effects:
It is important to recognise the variability of effects which may occur with sedative drugs, however administered and that over-sedation, airway obstruction or cardiovascular complications may occur at any time.
If sedation is not easily achieved, the case should be cancelled and rebooked with an alternative plan e.g. with the assistance of an airway-skilled physician or for a general anaesthetic.

Contraindications:
These can be relative or absolute.
Patient risk factors for adverse events have been shown to include patients less than one year of age and ASA physical status (see below) 3 &4
In paediatric patients this could include:

- Congenital heart disease (associated with cyanosis or CHF) - see ASA physical status classification
- The neurologically impaired (with poor pharyngeal co-ordination)
- Severe obesity
- Airway abnormalities (including an intercurrent URTI).

Deep Sedation Should Not Be Used In The Following Circumstances Without Expert Assistance:

- Neonates (<4 weeks) or Ex Prem infants less than 60 weeks post conceptual age.
- ASA Physical status 3 or 4 (severe cyanotic CHD or CHF - cardiologist must be present).
- Airway abnormalities which may cause obstruction (patients with stridor, craniofacial abnormalities).
- Obstructive sleep apnoea.
- Neurologically impaired or raised ICP.
- Severe obesity.

Sedation Is Unlikely To Be Successful In Patients:

- Requiring prolonged sedation (>45mins) or excessively painful procedures.
- In whom sedation has failed in the past for the same procedure.

Pre-Sedation Evaluation:
A directed history taking and physical examination should precede sedation.
Relevant history includes:

- Acute illness/injury
- Prior illness e.g. recent URTI
- Medications
- Drug allergies
- Nil by Mouth status
- Weight
- Previous sedation experiences, drugs used etc

Physical Examination for:

- Airway abnormalities
- Respiratory rate and oxygen saturation
- Heart rate and blood pressure
- Level of Consciousness / Baseline Sedation Score

NBM / Fasting recommendations for elective procedures:

- **Moderate Sedation**
  Fasting is not mandatory but preferably no solids or liquid 2 hours prior. However, it may be easier to get a baby into a deep sleep if they have been fed (bottle or breastfed)
- **Deep Sedation**
  Any planned sedation method where the child may not retain the ability to respond appropriately to verbal stimuli
    - Clear fluids - 2 hours
    - Non-clear fluids or Solids - 4 hours

Informed consent
Informed consent should be obtained for sedation as well as the procedure

Documentation

- Consent form signed
- Short Stay Assessment Sedation Chart completed as appropriate including the prescription of sedative agent (s) to be used
- Section 29 Consent form filled out if Chloral hydrate used

Responsible Physician

If a physician is not performing the procedure, a designated responsible physician must be available within the hospital to be able to manage complications. This physician must be available until the expected peak effect of sedation has passed and during any period where the sedation score (see below) is greater than 2 (i.e. does not arouse to voice or light touch).

The practitioner administering sedation requires sufficient knowledge to be able to:

- Understand the actions of the drugs being administered
- Detect and manage appropriately any complications arising from these actions. In particular medical practitioners administering sedation must be skilled in airway management and cardiovascular resuscitation
- Anticipate and manage appropriately the modification of sedative drug actions by any concurrent therapeutic regimen or disease process which may be present

Independent Observer

For procedures requiring deep sedation one individual must be present whose primary responsibility is the observation and monitoring of the patient. This person may also perform minor, interruptible tasks, but their primary responsibility is to remain focused on the patient's airway patency, cardio respiratory status and level of sedation.

This staff member must have undergone training in, and be competent at, basic life support.

IV 'short acting' sedatives should only be administered by an airway-skilled physician, who is capable of advanced paediatric life support. Specifically, IV propofol should not be administered outside of a highly monitored environment unless under the direct supervision of a specialist anaesthetist

Equipment

In any circumstances where a patient may be sedated the following age appropriate equipment must be available:

- Suction apparatus with Yankeur sucker attached.
- Oxygen with age appropriate bag, mask and tubing.
- Resuscitation trolley with age appropriate equipment
- Audible pulse oximeter
- Blood pressure monitoring equipment
- An emergency call system to summon additional help
- Facilities for observation until the child has recovered from sedation to a point where it is safe to be discharged from that area

Monitoring

Monitoring should be tailored to the level of sedation required. Patients are at highest risk immediately after the end of a procedure when procedural stimuli are discontinued.

<u>Moderate Sedation</u>

As a minimum the patient should have a sedation score performed at

- Baseline
- After the administration of the drug
- On completion of the procedure
- During early recovery
- At completion of recovery.

If at any time the patient progresses to a deeper level of sedation than responding to voice (sedation score >2) then monitoring should be as per deep sedation.

Deep Sedation
The patient should be monitored continuously for:
- Oxygen saturation

Airway Patency
And every 5 mins:
- Respiratory rate
- Heart rate
- Sedation score (deferred for a 'reasonable' period if stimulating the child would be likely to interfere with the satisfactory completion of a diagnostic procedure e.g. CT, Echo).

Note: Blood pressure monitoring is recommended but not considered mandatory. An initial blood pressure is advisable

IV access
IV access is not mandatory for patients undergoing oral sedation. However when deeper levels of sedation are anticipated (such as chloral hydrate), or the patient has significant comorbidity, IV access is encouraged. As a minimum the expertise/equipment for rapid establishment of IV access must be immediately available.

Transport
Ideally patients should not be transported around the hospital while under deep sedation, however this may be necessary to travel e.g. from a ward to radiology. In such circumstances these patients must have:
- Continuous audible pulse oximetry
- A self-inflating resuscitation bag/mask with oxygen.
- A competent staff member present continuously throughout the transport. That person must be able to monitor the patient as previously described and know how to initiate resuscitation/call for help.

CALL FOR HELP
Help should be summoned if Staff are seriously worried about the patient regardless of the criteria below:
- Obstructed breathing occurs that is not responsive to simple airway maneuvers.
- SpO2 <90% (or <60% if known cyanotic congenital heart disease) despite supplemental oxygen.
- Respiratory rate change by >6/min from baseline.
- Heart Rate >160 or <60/min.
- Marked/sudden decrease in sedation score.
    - Resuscitation/Call for Help Procedure:
- Call for help: Ring emergency bell or initiate 777
- Stimulate patient with verbal/painful stimuli
- Airway: assess/manage and administer O2 at 8-10 L/min.
- Breathing: assess/manage e.g. with bag/mask ventilation.
- Circulation: support as needed.
- Observe patient and monitor oximeter readings for signs of changes in oxygen saturation.

RECOVERY AND DISCHARGE
Monitoring
All patients must be monitored until they are no longer at risk of cardio respiratory depression. The recovery area must have:
- Enough space for a bed and observer
- Oxygen
- Suction
- Access to emergency equipment

If the child is to be recovered in an area different from the area of the procedure, the same equipment and monitoring must be available. The child should be monitored as for deep sedation until meeting the criteria for discharge to a non-monitored environment. A transfer to a 'high care' area should be considered if there were difficulties or antagonists were required.

Criteria for discharge from immediate Sedation Area
Criteria for discharge from the immediate sedation area i.e. to a non-monitored area:

- Oxygen saturation >95% on air (or back to pre-sedation level).
- Airway patency and protection satisfactory (including ability to take a deep breath/cough freely).
- Sedation score 1 or 2 (i.e. arouses with voice or light touch stimuli).
- RR, HR back to pre-sedation levels.
- At least 2 hours have passed since the administration of any sedation reversal agents.

Criteria for Discharge from Hospital
All of the above, plus:

- Patient orientated and can talk (if age appropriate) or back to pre-sedation level.
- Patient can sit unaided (if age appropriate).
- Patient can tolerate oral fluids without vomiting.
- A responsible adult is available to care for the patient and discharge instructions given.

Examples of sedation regimens
Sedation requirements can be broadly categorized as shown in the table below

Procedure Type	Example	Goal	Suggested Sedative or Agent
Non-Invasive	CT Echocardiography EEG Ultrasonography Skeletal Survey	Motion Control	Chloral hydrate PO (if under 20kg) Midazolam PO +/- PO Ketamine (if >20kg) Clonidine
Mildly Painful & Stressful	IV Cannulation LP Venesection NGT insertion ICD removal Port access Urinary catheter MCU Dressing changes Foreign body removal pH probe insertion	Analgesia Anxiolysis Sedation Motion control	Topical/Local analgesia Midazolam PO +/- PO Ketamine Nitrous oxide - Entonox-Nitrous oxide 50% oxygen 50%
Painful Procedures	Suture of lacerations Simple fracture reduction Joint relocation	Analgesia Anxiolysis Sedation Motion Control	Topical/Local analgesia IV Fentanyl/Morphine, Midazolam or Ketamine Nitrous oxide- Entonox-Nitrous oxide 50% oxygen 50%

Note:
Paradoxical agitation may occur after the administration of some agents. In these cases the procedure should be cancelled and rebooked with an alternative plan.

<u>Sedation Terminology:</u>
Minimal Sedation (anxiolysis)
A drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination might be impaired, ventilatory and cardiovascular functions are unaffected.

Moderate Sedation (formerly conscious sedation)
A drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. Reflex withdrawal from a painful stimulus is not considered a purposeful response. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained

Dissociative Sedation
A trance-like cataleptic state induced by the dissociative drug ketamine characterised by profound analgesia and amnesia, with retention of protective airway reflexes, spontaneous respirations, and cardiopulmonary stability.

Deep Sedation
A drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. The ability to independently maintain ventilatory function could be impaired. Patients might require assistance in maintaining a patent airway and spontaneous ventilation might be inadequate. Cardiovascular function is usually maintained.

General Anaesthesia
A drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation might be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function can be impaired.

ASA* Physical Status Classification

Description	Examples	Suitability for Sedation
1 Healthy	Unremarkable medical history	Excellent
2 Mild systemic disease	Mild Asthma Acyanotic CHD Controlled Epilepsy Controlled IDDM	Generally good
3 Severe systemic disease Definite functional Limitation	Severe Asthma CHD with cyanosis or CHF Poorly controlled epilepsy Poorly controlled IDDM	Intermediate to poor (Consider benefit vs risk)
4 Severe systemic disease Constant threat to life	Advanced respiratory, cardiac, hepatic or renal insufficiency	Poor (benefits rarely outweigh risks)
5 Moribund	Septic shock, severe trauma	Extremely poor

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Sedation Score

- Awake and alert
- Sleeping but easily arouses to voice or light touch.
- Arouses to loud voice or shaking.
- Arouses with painful stimuli only.
- Unrousable

16.1 SEDATION FOR EEG USING CLONIDINE

https://www.starship.org.nz/guidelines/sedation-for-eeg-using-clonidine (March 2017)

For sedated EEG in children or other neurophysiology procedures, clonidine is the preferred agent as it is an effective sedative that does not alter the EEG recording, has a shorter duration of sedation than chloral hydrate with prompt recovery after sedation, and can be given in small oral volumes.

Clonidine dosage for sedation

Weight of Child	Clonidine Dosage
<10 kg	0.05 mg (=50 micrograms)
10-30kg	0.1mg (=100 micrograms)
>30 kg	0.15-0.2 mg (=150-200 micrograms)
In New Zealand clonidine is available in 25 microgram and 150 microgram tablets	

17.0 SOME NORMAL PHYSIOLOGICAL VALUES FOR CHILDREN 0-16 YEARS

Age	Mean Weight(kg) (+/- 2SD)	Minimum Systolic Blood Pressure	Normal HR	Normal RR
Premature	2.5kg	40	120-170	40-60
Term	3.5kg	60	110-160	30-60
3 months	6kg	60	110-160	30-50
6 months	8kg	70-90	110-160	30-40
1 year	10kg (9-11)	70-90	110-160	25-35
2 years	13kg (11-14)	80-110	100-150	25-30
4 years	17kg (15-19)	80-110	95-140	25-30
6 years	21kg (18-24)	90-110	80-120	20-25
8 years	27kg (23-30)	90-110	80-120	20-25
10 years	30kg (28-38)	90-110	80-120	20-25
12 yrs	40kg	90-120	60-100	15-20
13-16 years	40-54kg	100-120	60-100	15

OPTIMAL PAIN MANAGEMENT IS THE RIGHT OF ALL PATIENTS AND THE RESPONSIBILITY OF ALL HEALTH PROFESSIONAL

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