

## Patient Controlled Analgesia (PCA) for Children and Young People

### Key Points

- Frimley Health NHS Foundation Trust acknowledges that access to appropriate pain control is an important part of individualised care for each child and aims to ensure that the service is fair and accessible to all.
- This guideline applies to all Trust staff at who are directly involved in the care of Children and Young People with a PCA.
- Children and young people have unique needs in terms of pain management requiring consideration of anatomical, physiological, and psychological factors alongside their pain perception, pain experiences and biological responses.

|                     |                                                                      |
|---------------------|----------------------------------------------------------------------|
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### Abbreviations

|                   |                                                                                                            |
|-------------------|------------------------------------------------------------------------------------------------------------|
| Acute pain        | Sudden onset of pain that can range from mild to severe in definition but is potentially of short duration |
| Breakthrough pain | Pain that occurs between periods of pain relief when analgesics are being used on a regular basis          |
| BNFC              | British National Formulary for Children                                                                    |
| Epic              | Name of the electronic patient record at Frimley Health                                                    |
| FHFT              | Frimley Health NHS Foundation Trust                                                                        |
| FPH               | Frimley Park Hospital                                                                                      |

|      |                                        |
|------|----------------------------------------|
| GOSH | Great Ormond Street Hospital           |
| IV   | Intravenous                            |
| MAR  | Medication Administration Record       |
| NBM  | Nil by mouth                           |
| PCA  | Patient Controlled Analgesia           |
| PEWS | Paediatric Early Warning Score         |
| PICC | Peripherally Inserted Central Catheter |
| SC   | Subcutaneous                           |
| TDS  | Three times daily                      |
| WPH  | Wexham Park Hospital                   |

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## 1. Introduction

- 1.1. Pain is an unpleasant, sensory, and emotional experience associated with actual or potential tissue damage or described in terms of such damage<sup>1</sup>.
- 1.2. Children and young people have unique needs in terms of pain management: requiring consideration of anatomical, physiological, and psychological factors alongside their pain perception, pain experiences and biological responses.
- 1.3. The long-term negative effects of untreated and inadequately managed acute and persistent pain, associated with actual and potential nerve and tissue damage include delayed recovery, delayed discharge, and adverse psychological effects.
- 1.4. Patient Controlled Analgesia (PCA) is a safe and effective method of individualised pain management; and should be considered for patients where frequent doses of parenteral; subcutaneous (SC) or intravenous (IV) opioid (for example morphine or oxycodone) are anticipated or are unable to tolerate oral analgesia. This may include, but is not exclusive to, children and young people undergoing surgery, episodes of acute illness, trauma, HIV, sickle cell crisis, oncology associated pain and oncology associated conditions such as mucositis.
- 1.5. Morphine and oxycodone are strong opioids which bind to receptors in the brain and spinal cord to alter the transmission of pain along the pain pathway. Intravenous morphine is the 'gold standard' route of administration due to its rapid onset (2-3 minutes), peak effect and short half-life. Oxycodone is an alternative opioid which can be used when appropriate to do so.

## 2. Purpose of the guideline

- 2.1. The purpose of this guideline is to set a standardised protocol and support professionals in the safe and effective prescribing, administration, and management of PCA morphine or oxycodone to children and young people across Frimley Health. There are designated PCA pumps for this purpose.
- 2.2. There is a separate Trust-wide PCA guideline that applies to teenage and adult patients.

## 3. Patient Selection

- 3.1. To use the PCA, children must consent and have the manual dexterity to press the demand button independently and be able to understand what happens when the demand button is pressed. This is expected to be in children of approximately 5 years and over<sup>2,3,4</sup>.
- 3.2. Children, young people, and their parent/carer must be given a full explanation of what a PCA is and how it works by one of the following: anaesthetist, nurse specialist for pain management, paediatric medical or nursing teams or PACU/recovery staff.

This must include that the demand button should only be pressed by the patient and this information reinforced as needed during use. If the child cannot press the button or is not able to understand PCA then alternative analgesia must be sought.

- 3.3. PCA must **NOT** be given via a port or single lumen PICC or Hickman line. Multiple lumen lines be more appropriate if these are needed to be used.
- 3.4. Patients who may benefit from PCA include:
- Those who are unable to absorb or tolerate oral analgesia.
  - Those with severe pain that is not controlled by oral analgesia – for example post-surgery, following trauma, pancreatitis, sickle cell crisis, mucositis.

## 4. Contraindications

- 4.1. The following must be considered as a contraindication to the use of a PCA:
- Allergy to morphine or oxycodone
  - Head Injury
  - Inability to comply with guideline.
  - Lack of appropriate IV access
  - Patient / parent / carer refusal
  - Patient inability to comprehend techniques (such as cognitive impairment or language barriers)
  - Physical inability to operate the PCA demand button independently (this may be due to age or cognition dependant)
  - Inadequate levels of appropriately trained staff on ward to ensure safe monitoring – day and night.
- 4.2. Extra precautions may be required in patients with:
- Marked electrolyte imbalance.
  - Multiple drug sensitivities or allergies
  - Previous history of opioid related side effects
  - Renal / hepatic dysfunction
  - Severe respiratory problems

## 5. Equipment

- 5.1. There is dedicated equipment that must be used for a PCA:
- Arcomed PCA Pump labelled for the protocol in use either paediatric pump or adult pump depending on which protocol is selected.
  - 50mL syringe with luer lock

- Anti-syphon valve IV giving set line

## 6. Prescription

- 6.1. The PCA can **only** be prescribed on the MAR by an appropriately trained prescriber.
- 6.2. FHFT has agreed on a standardised protocol (see below) for children above 50kg or over 12 years of age and below 50kg or under 12 years of age.

### 6.3. Choice of Drugs

- Morphine is an example of a pure opioid agonist and is the first-line drug for PCA at FHFT.
- Oxycodone may be used, as a second line, for patients allergic or unable to tolerate morphine or **for patients with renal impairment** but there must be a robust clinical rationale documented.
- Oxycodone is not licenced in patients under 12 years of age and therefore if it is to be used this decision should be made by a consultant paediatrician / anaesthetist and clinical rationale documented.

#### **INTRAVENOUS OPIOID PROTOCOL (adapted from GOSH<sup>5</sup>).**

### **6.4. Only the 10mg/mL vials of morphine or oxycodone should be used.**

If these vials are not available, then please speak to the pharmacist about the most appropriate vial to use.

### **6.5. FOR CHILDREN BELOW 50KG or UNDER 12 years of age:**

- Utilise the PCA pump programmed for paediatric protocols found on the paediatric wards.
- Morphine sulfate or oxycodone hydrochloride (utilising the 10mg/ml vials)
- **1mg/kg** made up to **50mL** with sodium chloride 0.9% up to a **maximum of 50mg/50ml**.
- **If patients weigh more than 50kg then the solution would still be 50mg/50ml.**
- resulting a solution where 1mL = 20micrograms/kg
- Example: Child weighs 20kg
  - Morphine or oxycodone 1mg/kg = 20mg made up to 50mL in syringe with sodium chloride 0.9% (concentration =0.4mg/mL).
  - For concentration of solution divide weight by volume in syringe.

### **6.6. FOR CHILDREN ABOVE 50kg or OVER 12 years of age:**

- 6.6.1. Utilise the pump programmed for adult protocols found in PACU / recovery / equipment library (WPH).
- 6.6.2. 1st line: Morphine

- Morphine sulfate 100mg made up to a total volume of 50ml with 0.9% sodium chloride.
- Bolus dose 1mg (0.5ml)
- Lockout 5 minutes
- 4 Hourly maximum limit 40mg

6.6.3. Pre-filled syringes are available from pharmacy and can be left in situ (with the giving set) for 72 hours. The syringe and line should be changed at the 72-hour mark regardless of how much medication is left in the syringe. If the syringe requires change before 72 hours, then the line will not have to be changed but both line and syringe should then be changed at the 72-hour mark.

6.6.4. 2nd line: Oxycodone

- Oxycodone 100mg made up to a total volume of 50ml with 0.9% sodium chloride. (see section 7.21 or best practice in making up the oxycodone syringe)
- Bolus dose 1mg (0.5ml)
- Lockout 5 minutes
- 4 Hourly maximum limit 40mg

6.6.5. Oxycodone syringes are made up locally and must be changed (with the giving set also being changed) every 24 hours. **The syringe and line should be changed at the 24-hour mark regardless of how much medication is left in the syringe.**

6.7. The prescription should contain information about

- Bolus dose
- Lockout time (standard of 5 minutes but can be extended to up to 15 minutes as needed)
- 4 hourly maximum limit
- Paediatric protocols ask for this information in mls (millilitres)
- Adult protocols ask for this information in mg (milligrams)

**6.8. For children who are under 12 years of age but over 50kg, the clinician deciding to start a PCA should clearly document which protocol is to be followed and the rationale.**

## 7. Preparation and Administration of PCA

7.1. Prior to commencement of the PCA the patient's pain must be controlled, for example, by utilising an IV morphine or oxycodone bolus and / or other adjuvant analgesia. Full PCA education should have been carried out by a suitably trained health professional and an understanding of the PCA demonstrated. There must be a dedicated IV cannula in situ for PCA use only.

7.2. The PCA must have been prescribed by an appropriately trained prescriber.

- 7.3. The initial set up of the PCA must only be undertaken by clinical staff that have been specifically trained to do so.
- 7.4. If additional bolus doses and programme changes are required then this should only be undertaken and administered by the pain team, anaesthetist, competent PACU nurses (in the recovery/PACU setting) or paediatric medical staff who have been specifically trained to do so.
- 7.5. For locally made syringes the PCA infusion including giving set must be prepared and changed every 24 hours.**
- This must be done in accordance with the current Trust guidelines / policies for medicines management and controlled drug.
- It must be noted that pain specialist nurses will support this intervention but will not connect the PCA to the child / young person unless they are on the adult/teenage PCA guideline. Connection will need to be carried out by a paediatric registered or experienced nurse who holds the paediatric IV medicines management pathway / competency.
- 7.6. The PCA must be prepared using only the morphine or oxycodone vials of 10mg/mL and made up according to the outlined protocols for the patient's weight (see section 6). The syringe and giving set must be labelled as per hospital protocol.
- 7.7. Both paracetamol and Ibuprofen, unless contraindicated, should be prescribed in addition to the PCA on the MAR and administered at regular intervals alongside the PCA. This should be individualised to each patient's needs and in line with the most recent edition of the BNFC<sup>6</sup>. The use of oxygen should also be considered.
- 7.8. Naloxone must be prescribed with all prescriptions for PCA **before** commencement of PCA. (Please refer to BNFC for dosage under 'Reversal of postoperative respiratory depression').
- 7.9. A suitable antihistamine should also be prescribed. Non drowsy preparations should be used where possible.
- 7.10. Maintenance IV fluids should be prescribed where appropriate and run through a separate cannula to the one carrying the PCA.
- 7.11. There are dedicated PCA machines for paediatric and adult protocols and therefore the correct machine should be sought.
- The paediatric protocol PCA machines are kept on the paediatric wards
  - The adult protocol PCA machines are kept in PACU / recovery / equipment library (WPH).
- 7.12. **The specific PCA giving set MUST be used.** These sets MUST have an **anti-siphon valve** to prevent accidental emptying of the syringe. If there is a side arm to the line, then this MUST have a **one-way valve** to prevent opioid travelling up into any attached IV.
- 7.13. ONLY "clear" fluids such as 0.9% sodium chloride, Plasmalyte® and Hartmann's can be given via the side arm of the PCA giving set. Fluids containing potassium should not be added to PCA line spare port.

- 7.14. The PCA syringe should be labelled with its contents, the patients details and the signatures of the two IV trained nurses making it up as well as the date and time it was made up.
- PCA lines should have a label which indicates the contents of the syringe AND a label which indicates when the line was last changed so that it is clear when the line and syringe are next due to be changed. (Every 24 hours if made up locally and every 72 hours if using a pre-filled syringe).
- 7.15. The PCA should be attached to a **dedicated IV access**. **Y connectors or 3-way taps should NOT be used**. If the peripheral IV cannula has another port this should NOT be used while the PCA is connected.
- 7.16. The PCA may be connected to a dedicated lumen of a PICC or Central Line. "Y" connectors or 3-way taps should NOT be used. The dedicated lumen should be labelled for PCA use only while the PCA is in use.
- 7.17. Once PCA is discontinued or this access no longer being used, it is recommended that to avoid inadvertently delivering unnecessary bolus of opioid to draw back some blood before flushing the line as per the trust protocol.
- 7.18. An IV access device for PCA use should be monitored and managed as per the Trust VAD and VIP guidelines.
- 7.19. If the use of a giving set or cannula with an integrated spare port is unavoidable, then the spare giving port should be labelled 'Do Not Use'.
- 7.20. When preparing the syringe, where able, prefilled syringes of morphine should be used. If not available, then vials of morphine may be used however please note if the syringe is locally made up then the syringe and line will require changing every 24 hours.

**7.21. When preparing oxycodone PCA:**

- Utilising the **10mg/1ml oxycodone** vials, draw up 100mg oxycodone in a 10ml syringe (100mg/10ml)
- Draw up 40ml of 0.9% normal saline in a 50ml syringe.
- Inject the 100mg/10ml of oxycodone into the 50ml syringe to make 100mg/50ml.
- Prime the PCA line ensuring that side arm was primed first with 0.9% normal saline if one is present.

## **8. Management, Monitoring and Documentation of PCA**

- 8.1. Parents, visitors, and clinical staff **must not** press the demand button on behalf of the patient.
- 8.2. Patients requiring a PCA can **only** be cared for by nursing staff that have received training and education in the use PCA and associated equipment and hold an up-to-date competency assessment. Competency assessments for the management of PCA and equipment will be carried out by the PD team, Pain Team or a Level 5 sign off assessor for the paediatric ward. Patient allocation and location on the paediatric ward will be determined by the nurse in charge.

- 8.3. At every set of PCA observations, shift handover and whenever the patient moves area the “3 P Check” should be performed including:
- Prescription
  - Pump
  - Patient
- 8.4. Nursing staff should also check at the beginning of each shift:
- The patient has additional venous access where appropriate.
  - Additional analgesic medications (opioids) have not been prescribed or given without prior consultation with the paediatric medical team, pain team or anaesthetist.
- 8.5. Physiological observations should be performed alongside the checking of the PCA pump and should be documented and acted on appropriately. These include:
- Respiratory rate
  - Oxygen saturations
  - Pain assessment at rest and on movement.
  - Sedation score.
  - Nausea.
  - Pruritus.
- 8.6. Pump information should be documented in the relevant flowsheet on Epic including:
- Good Demands / Patient bolus
  - Bad Demands / Refused Bolus
  - Physician Bolus
  - Total Dose in milligrams (mg) for adult protocols or millilitres (ml) for paediatric protocols
  - Total volume infused in millilitres (mL)
  - Amount left in syringe in millilitres (mL)
- 8.7. Frequency of observations

| Monitoring frequency from start of Paediatric PCA |                  |
|---------------------------------------------------|------------------|
| 0 – 2 hour                                        | Every 15 minutes |
| 2 – 4 hours                                       | Every 30 minutes |
| 4 - 12 hours                                      | Every 1 hour     |
| > 12 hours                                        | Every 2 hours    |

|                                                                                                     |                                                                                           |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| After an additional clinician bolus has been administered                                           | Every 15 minutes for 1 hour<br>Every 30 minutes for 1 hour<br>4 hourly                    |
| After a change in pump protocol<br>(for example, change in bolus dose or change of opioid infusate) | Every 30 minutes for 2 hours<br>4 hourly                                                  |
| If patient condition deteriorates                                                                   | Minimum of 1 hourly or as clinical condition / doctor indicated until condition improves. |

- 8.8. All observations must be documented on an age-appropriate Paediatric Early Warning Score (PEWS) section on Epic. This is a medico-legal document and can be referred to in cases of complaint or litigation. If clinical observations are not recorded, then legally they were not performed.
- 8.9. On completion of the PCA therapy any remaining morphine or oxycodone must be recorded on Epic and in the controlled drug register on the ward as "PCA Waste" stating the patient's name, medicine, concentration, and the quantity wasted. This must be carried out by 2 appropriately trained nurses and the drug wasted into an appropriate receptacle.

## 9. Who to contact for advice?

- 9.1. Every patient on a PCA should be referred to the inpatient pain team. This can be done by completing an order through Epic or contacting the team directly. It should be clearly communicated that this is a paediatric PCA review.

### 9.2. At Frimley Park Hospital

- Inpatient Pain Team on Bleep **5252** (Monday – Saturday 08:30-16:30)
- Out of hours contact:
  - Owning medical team to contact On-Call Anaesthetist on Bleep **5002**
  - PACU may be contacted for advice on extension 134211 /134181.
- If necessary, the following staff may also be contacted:
  - Critical Care Outreach Nurse Practitioner on Bleep **5467**
  - Night Nurse Practitioner (NNP) on Bleep **5454**

### 9.3. At Wexham Park Hospital

- Inpatient Pain Team on Bleep **4820** (Monday – Saturday 08:30-16:30)
- Out of hours contact:
  - Owning medical team to contact CEPOD Anaesthetist on **07768463877**
- If necessary, the following staff may also be contacted:

- Critical Care Outreach Nurse Practitioner on Bleep **4186**
- Clinical Site Manager Bleep through switchboard
- PACU may be contacted for advice on extension 154528

## **10. Potential side effects and management of side effects**

10.1. The use of PCA morphine or oxycodone can cause some troublesome and unwanted side effects. The most common side effects include nausea and vomiting, constipation, dry mouth and biliary spasm, bradycardia, tachycardia, hallucinations, vertigo, euphoria, dysphoria drowsiness, confusion, sweating, miosis, flushing, rash, pruritus, and urinary retention. Respiratory Depression can also be noted particularly with higher doses of morphine. (BNFC<sup>6</sup>).

### **10.2. Respiratory Depression**

Respiratory depression is defined as “a respiratory rate lower than child’s anticipatory and oxygen saturation <94%”. If this occurs, then you must:

- Remove the handset (button) from the child.
- Apply oxygen.
- Undertake and record a full set of observation and increase these observations to a 15-minute interval.
- Seek senior review by the paediatric registrar or consultant or an appropriately trained anaesthetist.
- Consider naloxone.
- Consider Paediatric NEWS call (2222)

### **10.3. Sedation**

If the child/young person’s sedation score is 3 (unroutable), regardless of respiratory rate you must:

- Start basic life support.
- Call the resuscitation Team on 2222 and state that a paediatric cardiac arrest team is required.
- Stop the PCA
- Administer naloxone.

### **10.4. Nausea and Vomiting**

- First Line Treatment: ondansetron (please refer to BNFC<sup>6</sup> for dosage).
- Second Line Treatment: cyclizine (Please refer to the BNFC<sup>6</sup> for dosage).

### **10.5. Pruritus (Itching)**

Pruritus is caused by the stimulation of neurones in the central nervous system in the majority of patients. It is not the result of histamine release unless associated with a rash and therefore not or minimally responsive to treatment with antihistamines. To treat the following can be considered:

- First Line Treatment: chlorphenamine (Please refer to BNFC<sup>6</sup> for dosage).
- Second Line Treatment (if chlorphenamine associated drowsiness occurs): consider alternative non drowsy antihistamines such as cetirizine.

In adults (which may be appropriate for the young person) ondansetron 4mg TDS may be considered (this is an off license use and therefore patient / parent consent must be gained and documented clearly in the patient's medical record).

## 11. Inadequate Analgesia

11.1. If the patient has an elevated pain score (variable depending on pain assessment tool used) or if the pain is compromising their ability to breathe deeply and cough (for example following abdominal surgery) or move their joint (for example following orthopaedic surgery) then the following actions should occur:

- Check IV site, line and pump for extravasation, leakage, and patency.
- Check the bolus dose given history on the pump and re-educate the patient on effective use of PCA.
- Where appropriate arrange for a bolus dose of morphine or oxycodone to be administered.
- Ensure regular multi-modal analgesia is administered via an appropriate route.
- Utilise non-pharmacological methods of pain management such as repositioning and distraction.
- Reassure patient and parent / carer.
- Ensure patient is reviewed by the pain team or an appropriately trained anaesthetist.

## 12. Discontinuation of the PCA

- 12.1. it is likely that the PCA may be required for the first 24-48 hours post-surgery (this may be longer in patients during other conditions such as sickle cell crisis or post trauma).
- 12.2. The PCA should be continued while the patient is Nil by Mouth (NBM) or on very limited fluid intake or experiencing uncontrolled nausea and / or vomiting.
- 12.3. Prior to removal of the PCA alternative oral analgesia must be prescribed on both a regular and PRN basis.
- 12.4. Dispose of all PCA morphine or oxycodone waste according to current controlled drug policies and ensure decontamination of equipment prior to return to equipment library.

## 13. Monitoring of Guideline

- 13.1. Regular audit of PCA practice and monitoring will be carried out by the inpatient pain team on a regular basis and results published throughout paediatrics and the anaesthetic department.
- 13.2. All clinical staff have a professional responsibility to ensure that they undergo the mandatory PCA Training and hold an up-to-date PCA pump competency assessment.

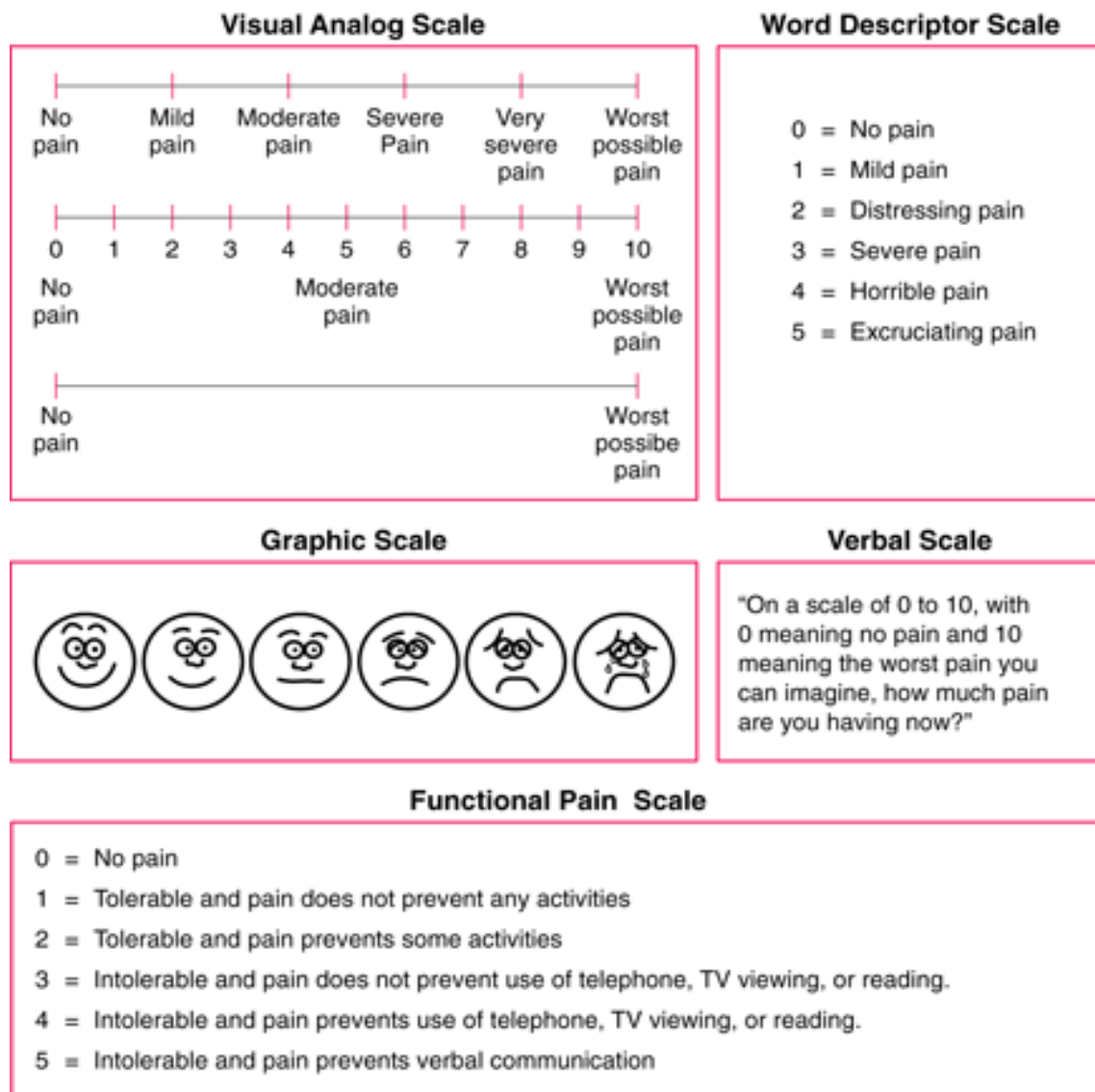
## 14. Equality Impact Assessment

- 14.1. This policy has been subject to an Equality Impact Assessment and is not anticipated to group have an adverse impact on any group.

## 15. References

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## 1. Appendix 1: Pain Assessment Tools



## FLACC Behavioural

Suggested age range 2mnths to 7 years

|                      | Scoring                                      |                                                                             |                                                         |
|----------------------|----------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------|
| Categories           | 0                                            | 1                                                                           | 2                                                       |
| <b>Face</b>          | No particular expression or smile            | Occasional grimace or frown, withdrawn, disinterested                       | Frequent to constant frown, quivering chin clenched jaw |
| <b>Legs</b>          | Normal position or relaxed                   | Uneasy, restless, tense                                                     | Kicking or legs drawn up                                |
| <b>Activity</b>      | Lying quietly, normal position, moves easily | Squirming, shifting back and forth, tense                                   | Arched, rigid, or jerking                               |
| <b>Cry</b>           | No cry (awake or asleep)                     | Moans or whimpers; occasional complaint                                     | Crying steadily, screams or sobs, frequent complaints   |
| <b>Consolability</b> | Content, relaxed                             | Reassured by occasional touching, hugging, or being talked to; distractible | Difficult to console or comfort                         |

Note: Each of the five categories Face (F), Legs (L), Activity (A), Cry (C) and Consolability (C) is scored from 0-2, which results in a total score between 0-10 (Merkel et al 1997)

- Full version control record

|                                                                          |                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>Pharmaceutical dosing advice and formulary compliance checked by:</b> | Chido Mukoko                                                                                                                                                                                                                                                                                                     |
| <b>Key words:</b>                                                        | Pain, PCA, Children and young people                                                                                                                                                                                                                                                                             |

This guideline has been registered with the Trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt, contact a senior colleague or expert. Caution is advised when using guidelines after the review date.

This guideline is for use in Frimley Health NHS Foundation Trust hospitals only. Any use outside this location will not be supported by the Trust and will be at the risk of the individual using it.

### Version History

| Version | Date       | Guideline Lead(s)            | Status  | Comment                                                                                   |
|---------|------------|------------------------------|---------|-------------------------------------------------------------------------------------------|
| 1.0     | March 2021 | Karin Cannons                | Final   | Published                                                                                 |
| 2.0     | May 2024   | Karin Cannons                | Final   | Updated V1 for publication                                                                |
| 2.1     | April 2025 | Helen Say & Elizabeth Murphy | Interim | Update of oxycodone for Paediatric protocols. Approved at CG 15 July 2025. DTC 11/09/2025 |

**Related Documents**

| Document Type | Document Name                                                      |
|---------------|--------------------------------------------------------------------|
| Guideline     | Medusa Injectable Medicines Guide                                  |
| Policy        | Medicines Policy – in Pharmacy folder                              |
| Policy        | Controlled Drugs Policy - in Pharmacy folder                       |
| Policy        | Medical Devices Policy - in Patient Care folder                    |
| Assessment    | Pain Assessment Tools - Paediatric IV Medicines Management Pathway |
| Guideline     | <a href="#">Acute Pain in Paediatric Patients</a>                  |
| Guideline     | <a href="#">PCA guidelines for teenage and adult patients</a>      |