PAEDIATRIC PCA, CO-ANALGESIA & ANTIEMETIC GUIDELINES

TARGET AUDIENCE	Paediatrics, Secondary Care. All staff looking after paediatric in patients including nursing and medical paediatric ward staff, anaesthetic, theatre and surgical teams.
PATIENT GROUP	All paediatric in patients (as only paediatric inpatient beds are in University Hospital Wishaw then only applies there)

Clinical Guidelines Summary

These evidence based guidelines are for paediatric in patients to guide management of acute pain episodes, particularly in the perioperative period, utilising morphine Patient Controlled Analgesia (PCA) and/or other analgesics, with the aim of minimising opioid consumption and side effects, controlling pain and promoting functional recovery. All nursing and medical staff involved in care of paediatric patients prescribed a PCA should be familiar with, and refer to, these guidelines.

Advice on antiemetics is provided to enable treatment as nausea and vomiting is a common side effect of opioids, though may also be due to the nature of the illness (for example acute appendicitis)

Regular simple analgesia paracetamol and NSAID (Non Steroidal Anti Inflammatory Drug) should be given along with PCA if not contraindicated as they improve pain control, reduce opioid requirements, and opioid side effects including nausea and vomiting. If oral route unavailable use alternative route – iv or PR see below co-analgesia.

These are guidelines only and these recommendations may not be appropriate for use in all circumstances. If in doubt discuss with the acute pain service, anaesthetist or the responsible senior clinician.

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Aim

To enable the child to safely operate and administer analgesia, e.g. morphine, via a Patient Controlled Analgesia (PCA) Device (Fresenius Kabi Agilia syringe pump) under the supervision of trained staff.

Indications for Paediatric PCA

Severe pain (or anticipated) with oral route unavailable or unreliable when pain is, or likely to be, uncontrolled by simple regular analgesia such as iv paracetamol and iv/PR diclofenac. For example, child with acute abdomen/appendicitis pre or immediately post operatively where anticipated severe post op pain with risk of ileus.

Inclusion criteria for using PCA:

Patient inclusion criteria: all 3 must be met

1. Age 5 years and over.
2. The child can physically operate the PCA device.
3. The child has a basic understanding of what happens when the PCA button is pressed.

Exclusion criteria

Patient allergy to morphine.

Minimum Requirements for care of child on PCA

1. Staff appropriately trained in use of Fresenius Kabi Agilia PCA device.

2. Hourly recordings carried out as per PCA prescription and monitoring chart with use of the correct age appropriate PEWS chart (Healthcare Improvement Scotland/NHSL) for assessment of acute pain, recording of respiratory rate and sedation.

3. Continuous pulse oximetry.

4. Daily visit by member of pain control team (Pain Nurse or Anaesthetist).

5. Use dedicated cannula or anti-reflux valve if on IV fluids.

6. Resuscitation equipment available.

7. Naloxone available on ward (dose: see below and/or BNFc dosing for reversal of post-operative respiratory depression).

Loading/rescue intravenous morphine dosing.

As there will be a delay in prescribing, preparing and attaching a PCA, and PCAs are only effective in controlling pain once patient is loaded with morphine, then patients in severe pain despite simple analgesia require a doctor to titrate a loading dose of intravenous morphine. Give 50microgram per Kg increments, 5 to 10 minutely to max 200micrograms/Kg with continuous monitoring. Make up morphine in 10ml syringe at concentration of 1mg per ml by diluting 1ml vial of morphine 10mg/ml using 9ml of normal saline. Aim for mild pain unless limited by sedation or respiratory depression.

Prescription

Paediatric PCA should be prescribed by an anaesthetist, or paediatric specialist doctor on the advice of an anaesthetist or resident intensive care doctor.

Advise patient and parent/guardian of need to give opioid analgesia in order to control pain when required, in addition to paracetamol, NSAID and local anaesthetic wound/blocks as appropriate. Delivered in as safe manner as possible with intention to wean and stop before discharge. Advise that for safety only child should press PCA button to deliver dose when pain exceeds moderate or unable to cough/move freely. Prescription should be both on Cardex and the dedicated Paediatric PCA chart, which has instructions for prescriber, summarised as below (Do not use adult chart).

Morphine in mg for weight of child in Kg is diluted up to 50ml with normal saline to give a concentration of 20micrograms per Kg per ml. (If child weight over 50Kg then maximum is 50mg in 50ml) Prescription is for a 1ml bolus with lockout of 5 minutes. Zero background rate. No loading dose via PCA pump.

PCA Pump programming

Only medical or nursing staff who have completed Fresenius Kabi Agilia SP PCA competency based training can programme the pump and/or change syringes in the PCA device. This requires 2 trained nurses who must both check prescription and preparation of drug syringe and device settings.

Only the Acute pain nurse or an anaesthetist can program (*or reprogram*) and initiate a PCA on the paediatric ward, and they are required to check the prescription, syringe preparation and pump settings with a staff member who has received PCA training.

Fresenius Kabi Agilia PCA syringe pump

Bolus dose: 1ml bolus, with above dilution, 20microgram/Kg bolus

Lockout interval: 5 minutes

Morphine Solution Concentration: 20microgram/Kg/ml

Loading dose: Zero usually

Background infusion: Zero usually (*only consider a background of 4 micrograms/Kg/hr = 0.2ml per hour which can be useful in the first 24hours post op to improve sleep pattern*)

Syringe Preparation

When commencing a Paediatric PCA - Theatre recovery staff may use 50mg in 50ml vials for preparation if child of weight above 50kgs. For changing syringe within Paediatric Ward the monograph (Appendix 1) will be used.

See Appendix 1: Morphine for Patient Controlled Analgesia in Paediatrics syringe preparation monograph. Our current stock leur lock syringe is BD Plastipak.

Use dedicated anti-syphon and anti-reflux giving set (*for example Alaris Extension Set* [*Ref 30852]*) Maintenance fluids can be run using the y connector on the PCA extension set via an infusion pump and with anti-reflux valve on the line this will avoid reflux and unintended morphine bolus with intravenous fluids.

Patient Controlled Analgesia Observations

From Theatre

When collecting a child from theatre, the ward nurse is responsible for checking the following details are complete:

1. PCA CHART: Check the PCA prescription and observation chart has:

- Patient details correct. Name, Chi Number, date of birth.
- Doctor's prescription legible: Drug name, concentration, bolus dose, lockout and doctors signature.
- Form dated & timed.
- Drug Batch number and PCA device Serial Number recorded
- 2 staff signatures
- First set of observations completed

2. PCA DEVICE: Check:

50ml Syringe clearly labelled with

- Patient name.
- CHI Number.
- Drug Name, Dose & Batch number.
- Date & Time prepared.
- Date & Time of expiry (*24 hours*).
- 2 trained staff signatures.

& Program, check device program matches PCA prescription and observation chart.

3. Cardex Ensure PCA also prescribed on Medicine cardex as well as PCA chart, this is required to document & sign syringe changes

Once above details are correct, both ward and theatre/recovery nurse to sign anaesthetic form.

On return to Ward the following observations must be carried out hourly:

- Respiratory rate.
- Saturation rate (*continuous*).
- Temperature - can decrease to 4hrly prn.
- Pulse.
- Blood pressure can decrease to 4hrly prn.
- Pain score (*0-10 as per age appropriate PEWS chart guidance*).
- Sedation score.
- Nausea and vomiting score.
- Total dose infused and check of intravenous cannulation site.
- Volume remaining in syringe.
- Signature.

Observations & Troubleshooting Potential Problems - NB Only the child can activate the PCA Device.

1. Respiratory Depression: Observe for signs of respiratory depression.

Actions if the respiratory rate falls below: Age 5 - 8yrs: 15/min or Age 9 and over: 12/min

- Stop PCA.
- Seek medical help - inform paediatric ward doctor
- Consider intravenous titrated naloxone bolus. (Dose as per BNFc for reversal of post-operative respiratory depression. Age 1 month to 11 years. 1 microgram per Kg. Child 12 to 17 years initially 100-200 micrograms/kg. If inadequate response repeat every 2 to 3 minutes.) Naloxone can be diluted to 10ml with sodium chloride 0.9% and titrated to obtain sufficient respiratory response. Caution as naloxone antagonises analgesic effect.
- Consider naloxone infusion. As naloxone has a shorter duration of action than morphine repeated boluses or infusion may be necessary. Monitor patient. Medusa injectable guide naloxone monograph

2. Oxygen Saturations: Continuous monitoring.

- Record hourly on PCA form.
- Minimum saturation level 95% - give O2 if not already being administered 1 - 2 litres via nasal cannula. Refer to previous readings to establish if any deterioration, if consistently recorded at minimum level or below. Seek medical advice.

3. Pain Score: Record hourly on PCA form use 0 – 10 PEWS acute pain assessment scale.

- Record pain scores on movement.
- If the child is consistently scoring high (*above 6 out of 10*) check PCA usage via chart and pump history this may indicate that they are perhaps not understanding PCA or are reluctant to use it for some reason which should be sought (*fear, dysphoria, nausea, itch*) and reassurance given, or much less likely that the analgesia may need increased.
- Check PCA device is working properly and cannula site satisfactory.
- If the child can tolerate oral give co-analgesia if appropriate, though do not give any other opioids.
- If pain scores continue to be high - contact pain team/anaesthetist or ICU resident Dr. Consider also review by surgeon in case of surgical complication.

4. Sedation Score:

- Record hourly on PCA form using 0 - 3 assessment scale - always compare previous readings.
- If sedation score consistently high (*2 or above*) seek medical advice.

5. Nausea & Vomiting:

- Record hourly on PCA form using scale.
- If child is nauseated or vomiting give anti-emetics as prescribed.
- Seek medical advice if nausea & vomiting persists.

6. Total dose Infused:

- Record hourly the total dose infused and volume remaining in the device.
- If a new syringe is required, this may be prepared by the ward nurses and changed if they have completed Fresenius Kabi Agilia PCA competency training otherwise contact acute pain team or if unavailable on call anaesthetist.
- PCA syringes should be changed every 24 hours if prescription to continue. PCA giving sets can be in situ for up to 72 hours and then require renewal if prescription to continue.

7. IV Site: Check site hourly for any problems.

Co-Analgesia for severe postoperative pain –

Administer Paracetamol and an NSAID (unless contraindicated) with PCA as improves pain and reduces PCA morphine consumption and opioid side effects

Consider using Ideal Body Weight for Paracetamol and Ibuprofen dosing in Obese children

Paracetamol – give iv if oral route unavailable

Age	ORAL		RECTAL		MAXIMUM DAILY DOSE ORAL OR RECTAL
	Loading Dose	Maintenance Dose	Loading Dose	Maintenance Dose	
>3 months to 18years	20 to 30mg/kg (max 1g)	15 - 20mg/kg up to 4-6hrly (to max 1g)	40mg/kg (max 1g)	20mg/kg up to 4-6hrly (max 1g)	75mg/kg/day (up to max 4g/day)

Table adapted from BNFc app 2024 doses for post-operative pain.

Licensed use: not licensed for use in children under 2 months by mouth; doses for severe symptoms not licensed.

Cautions: Hepatic impairment, Renal impairment, Preterm & neonates less than 1 month - see BNFc for iv dosing see BNFc (*extract below*)

Paracetamol: by intravenous infusion over 15 minutes - only if oral route unavailable

Child body weight 10 - 50kg: 15mg/kg every 4-6 hours; max. 60mg/kg daily

Child body weight over 50kg: 1g every 4-6 hours; max. 4g daily

Ibuprofen:

age over 1. Oral 7.5mg/kg per dose up to 6 hourly with a max daily dose of 30mg/kg/day

Syrup 100mgs/5mls or Tablet 200mg or 400mg

Caution: if bleeding risk, asthma, renal dysfunction, GI ulceration/bleeding, on anticoagulants, age <1 year.

Diclofenac: alternative NSAID, can be given by iv or PR routes

Oral/Rectal 1mg/Kg 8 hourly. Maximum single oral dose 50mg. Maximum 50mg PR

If oral route unavailable (e.g. NBM, Ileus or Nausea/Vomiting) consider intravenous dosing. 0.3 to 1mg/Kg once or twice daily for maximum 48hours. For intravenous infusion see BNFc or Medusa via Firstport. Maximum daily dose by any route 150mg.

Tablet (*Enteric coated*) 25mg or 50mg, Tablet (*Soluble*) 50mg or Suppository 12.5mg, 25mg or 50mg

Caution: if bleeding risk, asthma, renal dysfunction, GI ulceration/bleeding, on anticoagulants, age <1 year.

Anti-Emetics

Ondansetron

- 0.1mg/kg to 0.15mg/Kg (higher dose unlicensed) (*100micrograms/kg to maximum single dose 4mg*) 0.1mg/Kg can be repeated 8hourly. However, if has been given try another agent from a different class for rescue.
- 4mg in 2ml vial, Tablet 4mg

Dexamethasone

- a one off prophylactic or rescue dose, only if not already received in theatre.
- 0.1 to 0.15mg/Kg up to max. 8mg given intravenously slowly
- Warn of transient perineal warmth/paraesthesia on iv bolus injection.
- Beware insomnia if given in evening. Not for use in those at risk of tumour lysis syndrome.

Droperidol:

- 25micrograms/Kg (max 1.25mg per dose), can be repeated 6 hourly.
- vial 2.5mg in 1ml
- contraindicated in patients with known Long QT syndrome

Cyclizine:

- Historically used but accumulating poor evidence for efficacy so 4th line.
- 1mg/kg 8-12hourly oral/iv, to maximum single dose 25mg under 12 years, over 12 years 50mg per dose.
- 50mg in 1ml vial, Tablet 50mg

Please note if one anti-emetic is ineffective consider using another anti-emetic.

Discontinuing PCA

Decision should be made by medical staff once oral route available. Consider whether step down regular tds or qds doses as well as prn “oramorph” is required along with continuation of regular co-analgesia. Review iv morphine consumption, pain and side effects over last 24 hours along with parent and patient wishes. Calculate oral morphine equivalent by doubling previous 24hours iv consumption. Then taper this by half or third to give likely next 24hour oral morphine requirement. If in doubt involve senior clinician, Acute Pain Service/Anaesthetist for advice. Aim to wean off oral morphine before discharge.

Nursing staff should record remaining volume in PCA syringe and 2 nurses sign chart recording destruction as per NMC codes of practice. File PCA chart in notes.

References

1. Summary Product Characteristics, Morphine 10mg/ml injection. Last Accessed 15/10/2024. Wockhardt. https://www.medicines.org.uk/emc/product/2244
2. Royal College of Paediatrics and Child Health (2010) The use of unlicensed medicines or licensed medicines for unlicensed applications in Paediatric Practice. Policy Statement produced by the joint RCPCH/NPPG Standing Committee on Medicines
3. BNF for Children 2024
4. The Association of Paediatric Anaesthetists of Great Britain & Ireland (2016). Guidelines on the Prevention of Post-operative Vomiting in Children.

Appendix 1
0-10 Paediatric Pain Scale

Assessment of Acute Pain in Children

	No Pain	Mild Pain	Moderate Pain	Severe Pain
Faces Scale Score				
Ladder Score	0	1-3	4-6	7-10
Behaviour	* Normal activity * No ↓movement * Happy	* Rubbing affected area * Decreased movement * Neutral expression * Able to play/talk normally	* Protective of affected area * ↓movement/quiet * Complaining of pain * Consolable crying * Grimaces when affected part moved/touched	* No movement or defensive of affected part * Looking frightened * Very quiet * Restless/unsettled * Complaining of lots of pain * Inconsolable crying

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Appendix 2

Morphine Patient Controlled Analgesia in Paediatrics: Syringe Preparation Monograph

Presentation: 10mg in 1ml Morphine sulphate ampoules

Dosage: As per guideline via Fresenius Kabi Agilia PCA syringe pump

Licensed Status: Morphine 10mg/ml solution for injection is a licensed product not licensed for use in children under 12 years.

Compatibility: Solution compatibility Glucose 5%, Glucose 10%, Sodium chloride 0.9%

Also see Medusa online injectable medicines guidance

Method of Administration[3]

Only the acute pain nurse or an anaesthetist can program and initiate a PCA on the Paediatric Wards.

1. Preparation	The final concentration of morphine in the 50ml syringe for a paediatric PCA delivered via the Fresenius Kabi Agilia PCA pump is determined by the child's weight such that the final concentration is always 20micrograms/kg/ml, **except when weight over 50Kg**. Dose (mg) morphine = patients weight (kg), if weight over 50Kg take maximum dose of 50mg Volume (ml) of morphine 10mg/ml = ...mg divided by 10 Dilute calculated volume (ml) of morphine up to 50ml with sodium chloride 0.9% using a 50ml BD luer lock syringe.
Example:	**A child weighing 23kg** *Dose (mg) morphine = patients weight (kg) = 23mg* *Volume (ml) of morphine 10mg/ml = 23mg divided by 10 = 2.3ml* *Dilute calculated volume = 2.3ml of morphine up to 50ml with sodium chloride 0.9% using a 50ml BD Plastipak luer lock syringe.*
2. Administration	To be administered via Fresenius Kabi Agilia PCA SP. Only medical or nursing staff that have completed Fresenius Kabi Agilia pump training competency based training can change syringes in the Fresenius Kabi Agilia device. The PCA device will be programmed to deliver a bolus dose when required by the patient. A further dose can only be delivered after a 5 minute lockout delay. A 1ml bolus dose delivers 20micrograms/kg/ml morphine, except when the child's weight is more than or equal to 50kg when the final concentration will be 50mg in 50ml, equalling 1mg/ml and a 1ml bolus dose will deliver 1mg.
Example:	**A child weighing 23kg** *1ml bolus dose delivers 20micrograms/kg morphine* *1ml bolus dose delivers 20micrograms x 23 morphine* *1ml bolus dose delivers 460micrograms morphine*

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Contributing Author / Authors	Dr Colum Slorach, Acute Pain Lead Clinician, Consultant Anaesthetist, University Hospital Wishaw Sharon Anderson, Acute Pain Nurse Specialist, University Hospital Wishaw
Consultation Process / Stakeholders:	- Entire Anaesthetic Dept. UH Wishaw including all Consultant Anaesthetists and Dept Clinical Director, Dr Gordon Peters. - Dr Adrienne Sullivan, Consultant Paediatrician and Clinical Director of Paediatrics in Lanarkshire -Annie Thomson, Senior Charge Nurse, Paediatrics Ward 19 UHW - Lynsay McAulay, UHW Pharmacist Paediatrics - Jane Thomson, Charge Nurse, Paediatrics Ward 20 UHW - Mr Gavin Bryce, Clinical Director of Surgery UHW & Consultant Surgeon
Distribution	

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15/10/2024	Colum Slorach	Content review due by date. Reformat required from medical illustration produced pdf of PCA 14 to app style word format & changes as requested by ADTC June 2024. Plus incorporation of 0-10 paediatric pain scale in line PEWS charts from March 2023 HIS/NHSL.	16
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