Belfast Health and Social Care Trust
caring supporting improving together

Reference No: SG 19/16

Title:	**Patient controlled analgesia (PCA) and Nurse controlled analgesia (NCA) in children (0-16 years) in RBHSC.**			
Author(s)	Mrs Louise Macdonald Paediatric Acute Pain Nurse RBHSC, Ms Patricia Coulter Paediatric Acute Pain Nurse RBHSC, Mrs Anne Burns Senior Clinical Pharmacist RBHSC, Dr Aideen Keaney Consultant Paediatric Anaesthetist, RBHSC Dr Brian Foster Consultant Paediatric Anaesthetist, RBHSC			
Ownership:	Mr Brian Barry, Director Specialist Hospitals and Women's Health, Paediatric Acute Pain Team			
Approval by:	Drugs and Therapeutics Standards and Guidelines Policy Committee Executive Team Meeting		**Approval date:**	25/01/2016 20/01/2016 03/02/2016 17/02/2016
Operational Date:	February 2016		**Next Review:**	February 2019
Version No.	V1	**Supersedes**	None	
Key words	Patient and Nurse controlled analgesia			
Links to other policies	BHSCT Policies: Controlled drug policy, ANTT policy, Medical devices policy, Medicines Administration policy, Fluid Management policy, Medicines Code			

Date	Version	Author	Comments
01/04/2015	0.1	L Macdonald, P Coulter	Initial Draft
24/07/2015	0.2	B Foster, L Macdonald, A Keaney, A Burns	Revised draft
01/08/2015	0.3	A Burns	Further revised draft
09/10/2015	0.4	A Burns, A Keaney L Macdonald	Further revised draft
16/10/2015	0.5	A Burns, L Macdonald	Further revised draft
27/10/15	0.6	A Burns, A Keaney B Foster	Further revised draft
15/01/16		A Keaney, L Macdonald	Revised draft after comments from D&T Committee 04/12/15

INDEX

APPENDICES

Clinical Guideline for The Management and Care of Children with Patient or Nurse Controlled Analgesia 0-16 Years

1. INTRODUCTION / PURPOSE OF POLICY

1.1 Background

Patient controlled (PCA) and nurse controlled analgesia (NCA) are available primarily for children following major surgery. However they may also be used in the management of moderate to severe pain when analgesia via another route would result in inadequate pain relief. PCA/NCA can be used to treat pre-operative and non-surgical pain. While this is an effective analgesic technique it is not without potential for adverse complications. It is therefore important to standardise the clinical management of this analgesic technique and to ensure that all health care professionals (HCP) involved in the care of children with PCA/NCA have appropriate training and guidance. Within this document a HCP is defined as a registered nurse or registered doctor.

1.2 Purpose:

To ensure the safe and effective management of children with Patient controlled and Nurse controlled analgesia

1.3 Objectives:

To ensure safe and effective management of children with PCA/NCA analgesia by providing an evidence based clinical practice guideline.

2.0 SCOPE OF THE POLICY

This guideline is concerned with the management of PCA/NCA analgesia for children up to 16 years of age in the Royal Belfast Hospital for Sick children (RBHSC). **It is not concerned with**

- The management of opioid infusions for obstetrics, gynaecology, and palliative care.
- Opioid infusions via a syringe driver in the paediatric intensive care setting or in the neonatal intensive care setting.
- The pain management of neonates in the neonatal unit.

This guideline needs to be read in conjunction with the following BHSCT policies:

- Controlled Drug policy
- ANTT policy
- Medical Device policy
- Fluid Management policy
- Medicines Code

3.0 ROLES/RESPONSIBILITIES

The author (Paediatric Acute Pain Team BHSCT) will be responsible for:

- Drafting and obtaining approval for the document.
- Updating the policy when and if new analgesic technology, techniques or drugs become available.
- Disseminating the policy to the Paediatric/Anaesthetic Clinical Director and all Paediatric/Anaesthetic Clinical Leads throughout the BHSCT and the Paediatric Service Manager.

The Clinical Directors/Clinical Leads and Paediatric Service Manager will be responsible for disseminating the policy to all staff who manage and care for children with PCA/NCA analgesia throughout the BHSCT.

Clinicians within the four hospitals of the Belfast Trust will be informed via the Trust intranet Policies and Guidelines site.

Roles and responsibilities of Paediatric/Anaesthetic staff are outlined in policy below

4.0 KEY POLICY PRINCIPLES

The definition and background of the policy:
This information has been written to provide detailed, practical, evidence based information for all HCPs involved in the management and care of children with PCA/NCA analgesia for pain relief. The information has been developed from existing information in the Belfast Health and Social Care Trust, a literature search, an evaluation of other hospital guidelines and guidance from professional bodies.

5.0 IMPLEMENTATION OF POLICY

IMPLEMENTATION / RESOURCE REQUIREMENTS:

- Observation charts.
- Laminated paediatric pain tool assessment charts
- Education of staff regarding the management and care of: PCA/NCA 1-hour sessions with regular updates and time away from the clinical area.
- Team of experienced acute pain nurses with advanced nursing skills to complement the role of the anaesthetic staff in the management of children with PCA/NCA.
- Training and education for acute pain nurses to manage and care for children on PCA/ NCA with regard to advanced skills.
- Team of PACU / HDU / PICU / surgical nursing staff trained in the management and care of PCA/NCA's
- Dedicated PCA/NCA infusion pumps.
- Dedicated PCA/NCA giving sets.
- PCA/NCA labels for lines.
- Pharmacy standardised ready-prepared Morphine infusion bags.
- Opioid drug protocols (see appendices 1-6).
- Audit of implementation of guideline.
- Consultation with other paediatric areas within hospitals in the Belfast Health and Social Care Trust (BHSCT).
- Consultation with paediatric drug and therapeutics committee and BHSCT drugs and therapeutics committee

5.1 Dissemination

This policy should be disseminated to all staff who are responsible for the management and care of children with PCA/NCA analgesia throughout the BHSCT. When this revised policy has been approved by BHSCT Drugs and Therapeutic Committee and the BHSCT Standards and Guidelines Committee this policy should be implemented immediately.

6.0 MONITORING

The effectiveness of this policy will be continuously monitored by regular audits by the paediatric acute pain team and receipt of complaints or Adverse Patient Incident Reporting (Datix).

7.0 EVIDENCE BASE/REFERENCES

Source(s)/Evidence Base:
Royal College of Anaesthetists.
Royal College of Paediatrics and Child Health.
Great Ormond Street Hospital for Sick Children.
The Royal Children's Hospital Melbourne.

References, including relevant external guidelines:

- Howard, R. F., Lloyd-Thomas, A., Thomas, M., Williams, D. G., Saul, R., Bruce, E., et al. (2010). Nurse controlled analgesia (NCA) following major surgery in 10,000 patients in a children's hopsital. *Pediatric Anesthesia* , 126-134.

- Schecter, N. L., Berde, C. B., & Yaster, M. (2003). *Pain in infants children and adolesecents.* Philadelphia: Lipincott Williams and Wilkins.

- Bell, R. F., Dahl, J. B., Moore, R. A. & Kalso, E., 2005. Peri operative ketamine for acute post-operative pain: a quantitative and qualitiative systematic review (Cochrane review). *Acta Anaesthesiology Scand,* Nov, 49(10), pp. 1405-28.

- Carstensen, M. & Moller, A. M., 2010. Adding ketamine to morphine for intravenous patient controlled analgesia for acute postoperative pain: a qualitative review of randomized trials. *British Journal of Anaesthesia,* 104(4), pp. 401-406.

- James, P. J., Howard, R. F. & Williams, D. G., 2010. The addition of Ketamine to a morphine nurse or patient controlled analgesia infusion (PCA/NCA) increases analgesic efficacy in children with mucositis pain). *Paediatric anaesthesia,* Sep, 20(9), pp. 805-11.

- Lahtinen, P., Kokki, H., Hakala, T. & Hynynen, M., 2004. S (+)- ketamine as an analgesci adjunct reduces opioid consumption after cardiac surgery. *Anesthesia Analgesia,* Nov 99(5), pp. 1295-301.

- Schrum, S. & Bland, J., n.d. Effect of Low dose Ketamine with Morphine PCA on postoperative experience in paediatrics: A Prospective, Randomised Double Blind Placebo controlled study of children undergoing posterior spinal fusion. *Pain ,* Volume 79

- Stanley, G., Appadu, B., Mead, M. & Rowbottom, D. J., 1996. Dose requirements, efficacy and side effects of morphine and pethidine delivered by patients- controlled analgesia after gynaecological surgery. *British Journal of Anaesthesia,* Volume 76, pp. 484-486.

- Subramaniam, K., Subramaniam, B. & Steinbrook, R. A., 2004. Ketamine as an adjuvant analgesic to opioids: a quantitative and qualitative systematic review. *Anesthesia Analgesia,* Aug 99(2), pp. 482-95.

- Sveticic, G., Eichenberger, U. & Curatolo, M., 2005. Safety of mixture of morphine with ketamine for postoperative patient controlled analgesia: an audit of 1026 patients. *Acta Anaesthesia Scandanavia,* 49(6), pp. 870-5.

- White, M. C., Homers, C., Parry, S. & Stoddart, P. A., 2011. Pain Management in 100 episodes of severe mucositis in children.. *Paediatric Anaesthesia,* April 21(4), pp. 411-6.

- Great ormond street Hopsital for sick children, n.d. *www.gosh.nhs.uk.* [Online] Available at: ww.gosh.nhs.uk/health professionals/clinical specialities/pain-control-service-information-for-health-professionals [Accessed 14 February 2013].

- APAGBI Guidelines for the Prevention of Post-operative Vomiting in Children 2009.

- Annex: Revised wording for Zofran Summary of Product Characteristics (SPC) and Patient information Leaflet (PIL). UK/ONT/0005/12 August 2012. (http://www.mhra.gov.uk/home/groups/commsic/documents/websiteresources/con183919.pdf)

8.0 CONSULTATION PROCESS

- Discussion with colleagues in the UK Paediatric Pain Travelling Club with membership from all the major Paediatric centres in the UK and Ireland
- Intranet search regarding PCA/NCA guidelines and search of international paediatric centres.
- Discussion with Consultant anaesthetic staff in R.B.H.S.C
- Literature search with regard to specific best practice points for management of PCA/NCA infusions in paediatric patients.
- Trust acute pain nurses
- Consultation with other hospitals in The Belfast Health and Social Care Trust.
- Consultation with Standards and Guidelines & Drug and Therapeutics committees.

9.0 APPENDICES/ATTACHMENTS

Appendix 1 = Morphine PCA/NCA protocol.
Appendix 2 = Morphine and Ketamine PCA/NCA protocol
Appendix 3 = Fentanyl PCA/NCA protocol
Appendix 4 = Fentanyl and Ketamine PCA/NCA protocol

Reference: Note the protocols outlined in the appendices are adapted from Great Ormond Street Hospital for Children, London, pain management protocols http://www.gosh.nhs.uk/health-professionals/clinical-specialties/paediatric-psychology-information-health-professionals

10.0 EQUALITY STATEMENT

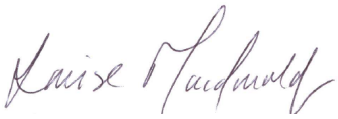
In line with duties under the equality legislation (Section 75 of the Northern Ireland Act 1998), Targeting Social Need Initiative, Disability discrimination and the Human Rights Act 1998, an initial screening exercise to ascertain if this policy should be subject to a full impact assessment has been carried out.
The outcome of the Equality screening for this policy is:

Major impact

Minor impact

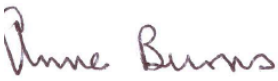
No impact.

SIGNATORIES
(Policy – Guidance should be signed off by the author of the policy and the identified responsible director).



_____ **Date: ____February 2016**
Author

_____ **Date: ____February 2016**
Author



_____ **Date: ____February 2016**
Author

_____ **Date: ____February 2016**
Author

_____ **Date: ____February 2016**
Author

_____ **Date: ____February 2016**
Director

Clinical definitions:

PCA:

Patient controlled analgesia is a method of self-administering intravenous opioids via a designated infusion pump, by pressing a button. This technique has been widely used in children as young as six, since the late 1980s, ((Schechter, Berde, & Yaster, 2003). The PCA/NCA pump is programmed with the dose of opioid to be administered by the button (**bolus dose**). The pump is also programmed to determine the time before another bolus dose of analgesic solution can be given by the button, (**lock-out interval**). Depending on the patients' age, weight and analgesic requirements they may also receive a continuous infusion of the analgesic solution from the pump at a lower dose than the bolus (**background rate**). A member of the anaesthetic team or acute pain team determines this rate. If the child requires additional analgesia a bolus of analgesic solution may be given from the pump (**extra bolus**) at the discretion of a member of the acute pain team.

NCA:

Nurse controlled analgesia is a method by which a nurse may administer intravenous opioids via a designated infusion pump, by pressing a button. This is specifically for infants and young children or children, unwilling or unable to press the button themselves. Unlike PCA, these patients may be given a larger continuous infusion (**background rate**) of the analgesic solution but this is counterbalanced by the patient receiving a longer **lock-out interval** than a PCA. A member of the anaesthetic team or Acute Pain Team determines this. Like PCA if the child requires additional analgesia a bolus of analgesic solution may be given from the pump (**extra bolus**) at the discretion of a clinician from the anaesthetic team or acute pain team.

Indications:

- Analgesia following major surgery
- Analgesia for moderate to severe acute pain – with exceptions as stated in 2.0

Contraindications:

- Lack of parental consent
- Allergy to a specific drug (e.g. morphine)

Cautions:

Be aware that an initial dose of opiate may have been administered prior to commencement of PCA/NCA, e.g. in theatre.

While receiving a PCA or NCA, there are certain known high-risk groups of children who require close monitoring; these include neonates and older children with special needs.
As stated by Howard et al (2010) a serious adverse event (i.e. apnoea / respiratory depression) in the post-operative period is nine times greater in infants less than 1 month of age with an NCA infusion than in older children. This report also highlighted an increased incidence of serious adverse events in children greater than 11 years of age with special needs.

Preoperative Assessment:

- A member of the paediatric acute pain team can be contacted 24/7 by bleeping the following numbers: **2450 or 2003**
- Preoperatively an anaesthetist should discuss the options for postoperative analgesia with the parents (and child where appropriate), including the risks and benefits of each option.
- Written parent / patient information on PCA/NCA analgesia is available and should be given to the family preoperatively.
- A preoperative visit with a member of the acute pain team can be arranged, if necessary.
- Parents should give verbal consent for the PCA/NCA.
- It is recommended that once verbal consent has been obtained this should be documented in the medical notes.
- All parents and children should be given information about pain assessment, ideally prior to painful procedures. Children that are old enough to communicate their own

pain scores (self-report) should be given a pain score and taught how to use this. Parents should be encouraged to be involved in their child's pain assessment and pain management, especially when the child is preverbal or has special needs.
- All children should have the following baseline observations recorded in the medical and nursing notes, prior to going to theatre/before commencing PCA/NCA in Recovery or on a ward: temperature, respiratory rate, heart rate, and blood pressure, pain score. This is in order to establish normal parameters to compare future observations against.

- **Setting up a PCA infusion**
- **Equipment for infusion:**
  - Dedicated PCA pump- lockable & programmable
  - PCA infusion set (blue line)
  - Prepared infusion bag
  - The pump serial number must be written on the patient's pain protocol chart.

- **Initial set up of infusion**
  - PCA/NCA must always be prepared and connected by two HCP with appropriate skills and competencies. In keeping with the BHSCT Controlled Drug Policy only two practitioners authorised to administer medicines (one of these practitioners **must** be a registered nurse) and who have appropriate skills and competencies should erect a PCA/NCA bag. These two practitioners **must** check the PCA/NCA bag and ensure that the following information has been written on the PCA/NCA bag: the child's name, date of birth, H&C number, date, time and signature of the two practitioners. Refer to the BHSCT Controlled Drugs Policy for guidance on who can administer a Controlled Drug and who can act as a witness.
  - Infusion must be set up according to the BHSCT Aseptic Non Touch Technique (ANTT) policy.

- **Programming the PCA/NCA device**
  - The PCA pump should only be programmed by two HCPs (one of these practitioners **must** be a registered nurse) with appropriate skills and competencies.

- **PCA/NCA giving sets / lines**
  - All PCA sets/ lines have a blue stripe
  - All PCA/NCA giving sets are labelled patient controlled analgesia or nurse controlled analgesia.
  - All lines must be labelled clearly with the regional PCA/NCA labels.
  - All PCA/NCA infusions must run via a dedicated lockable & programmable pump.
  - This pump must not be used for any other purpose.
  - All sets must be dedicated administration sets with bag spike, clamp, anti-siphon valve with male luer and non-vented stopper.

- **Ordering ward stock:**
  - Pre-filled morphine bags [1mg/ml (100mL)] must be ordered from pharmacy in the controlled drug book if the patient is greater than 50kg.
  - A stock of 2 bags should always be kept on the ward
  - A minimum stock of morphine 10mg/ mL (1 box of 10 ampoules) must always be kept on the ward.
  - A minimum stock of Naloxone 400 microgram/mL (1 box of 10 ampoules) must always be kept on the ward.

Analgesics for PCA/NCA

The most common analgesic used for PCA/NCA is morphine.
However, sometimes the anaesthetist may choose to use an alternative opioid due to a suspected drug allergy or the patients' clinical need.
Standard PCA/NCA regimens can be found in (Appendix 1).

Prescribing the PCA

- The initial PCA/NCA prescription must be completed by an anaesthetist or intensivist. (Appendices1-6)
- All medicines must be prescribed in the medicine kardex as per trust medicines policy.
- The prescription should be written in the regular intravenous medicines section of the kardex stating the dose of the opioid and the solution.
- The detail of the prescription for PCA/NCA must also be written on the PCA/ NCA protocol chart (Appendix 5).
- All changes in the PCA/NCA regime from the initial prescription should be prescribed in the medicine kardex.
- If a new bag is required this can be made up and prepared by two HCP with appropriate training and competencies, in keeping with the BHSCT controlled drug policy.
- When the infusion is completed the prescription must be discontinued in the medicine kardex in keeping with the BHSCT controlled drug policy.

Concurrent opioids

Additional IM, IV, SC, RECTAL or ORAL opioids must not be administered to a child already receiving a PCA/NCA infusion.

Consideration must be given to patients already established on opioid maintenance therapy; their acute pain component may still require a PCA/NCA

Addition of Ketamine to PCA/NCA

In some instances following major surgery a patient may require an additional agent to ensure that optimal analgesia is achieved. Ketamine may be added to the standard morphine regimen to enhance the analgesic effect (Schmid et al 1999). See appendix 2 for Ketamine and Morphine PCA/NCA regime. This decision is at the discretion of the Consultant anaesthetist only.

Supplementary Analgesia

Supplementary analgesia e.g. paracetamol and / or a NSAID as appropriate, should also be prescribed on the medicine kardex. Consideration should be given to prescribing these analgesics in the regular medication section of the kardex.

Naloxone

Naloxone **must** be prescribed with a PCA/NCA infusion [using the dose for respiratory depression (p.15 this guideline]. An indication of minimum acceptable respiratory rate **should** be written in the additional section of the prescription chart.

Anti-emetics

An anti-emetic must be prescribed with all PCA/NCA infusions.

Ondansetron is commonly prescribed as the first line anti-emetic: 100 micrograms/kg (max. 4mg) 8 hourly - by slow intravenous injection over at least 30 seconds.*This dose may need increased to 150mcg/kg (max 8mg) for older children, only following discussion with a Consultant Anaesthetist.

Further guidance can be found in the Association of Paediatric Anaesthetists of Great Britain and Ireland (APAGBI) 2016 Guidelines on the Prevention of Post-operative Vomiting in Children.

Intravenous fluids and PCA/NCA:

- It is common for children with a PCA/NCA to require Intravenous fluids. Opioids ideally should run via a dedicated intravenous line. However, this is not always possible, therefore it may be necessary to run intravenous fluids with a PCA/NCA infusion.
- Fluids and opioids running together **MUST** run through a non-return (one-way) valve or a separate intravenous line must be erected.

- It is **not necessary** to prescribe full maintenance fluids to run along with the PCA/NCA if the child does not require full maintenance fluids.
- However in order to keep the vein open a small volume of continuous intravenous fluid may be required if the PCA/NCA prescription is bolus only (i.e. no continuous background infusion). This intravenous fluid must be prescribed in keeping with BHSCT Fluid Management guideline (2017).
- Consideration must be given to the individual child's fluid management plan and to ensuring that the intravenous line remains patent.

Intravenous access must be available throughout the duration of the infusion and for 4 hours after the infusion has been discontinued.

CARE OF THE PATIENT

Transfer of the patient receiving PCA /NCA within the hospital:

When transferring the patient from theatre to the clinical area a verbal report should be obtained that includes the following information:

- Intra-operative analgesia administered
- PCA/NCA infusion details.
- Any pain or analgesic related complications that have been experienced (E.g. peri-operatively).
- The drug being administered corresponds with what has been prescribed.
- The discharging nurse and the receiving nurse have both checked the cumulative dose of the analgesic(s) administered and documented in the patients record.
- The patient's pain is being managed effectively and the pain score within acceptable limits.
- The anaesthetist is satisfied that the pain assessment scores are satisfactory prior to discharging the child from the recovery ward.
- The patient is not excessively sedated.
- The pain management observation chart has been completed correctly.
- The patient's drug kardex has been completed correctly i.e. it should clearly state the PCA/ NCA solution, the infusion range, and supplementary drugs to prevent side effects.
- When a patient with a controlled drug infusion is transferring between wards and departments two registered nurses must sign the front of the observation chart to verify that they both agree the amount of drug administered and amount of drug remaining at the time of handover.(BHSCT controlled drug policy)

When transferring a patient receiving PCA/NCA to or from another hospital please contact the Pain Team for advice.

CLINICAL CARE OF THE PATIENT RECEIVING PCA/NCA

General instructions:

- A core care plan, if available, should be used for all patients with a PCA/NCA and should be adapted for each individual patient.
- Supplementary analgesia e.g. Paracetamol and either Ibuprofen or Diclofenac where appropriate, should be given regularly.
- A member of the acute pain team should review the patient **at least once daily** and be available to answer any pain related queries.

Clinical Observations

Respiratory rate, heart rate, blood pressure, temperature, oxygen saturation, should be recorded every 15 minutes for the first hour after commencement of PCA/NCA.

If these initial observations are stable then:

- Oxygen saturations are monitored continuously and **recorded hourly** for the duration of the PCA/NCA.

- Blood pressure and temperature are recorded **hourly** for the first **4 hours**. If these observations are stable then blood pressure and temperature may be **reduced to 4-hourly for the duration of the PCA/NCA.**
- If the patient receives a morphine clinician bolus or the rate of the infusion is increased or if there is any deterioration in the patient's clinical condition then **15 min observations must be resumed for the next hour.**
- Reassess when patient's condition has stabilised.
- Respiratory rate and heart rate are **recorded hourly** for the duration of the morphine infusion.
- Pain score is **recorded hourly** while awake using a reliable and valid age appropriate pain assessment tool.
- Please inform a member of the Acute Pain Team if the oxygen saturations drop below 95% and the patient develops an oxygen requirement.
- Sedation and postoperative nausea and vomiting are **recorded hourly** for duration of the PCA/NCA.
- Observation for pruritus **4-hourly**

.

Routine observations should continue for 4 hours after discontinuation of the PCA/NCA infusion.

ADDITIONAL OBSERVATIONS FOR PCA/NCA INFUSIONS

Skin integrity

- It is important that pressure area care is meticulous for all patients receiving analgesic infusions.

- It is advisable to order pressure-relieving aids for patients requiring major surgery and that are likely to be immobile postoperatively.

- Adhere to BHSCT pressure area risk assessment.

Mobilisation

- If on bed rest or reluctant to mobilise regular pressure area care should be given.
- The patient may be encouraged to mobilise if their condition allows.
- Patients must be accompanied at all times when mobilising.
- Older children should be warned that initially they might experience some dizziness when mobilising.

CHANGES TO THE PCA/NCA INFUSION

Changing the infusion rate:

- HCPs with appropriate skills and competencies may adjust the infusion rate within the prescribed range, as determined by the patient's needs.
- Any increase in rate must remain within the prescribed range.
- If the child is still experiencing discomfort after this increase, contact the appropriate HCP.

PCA/NCA clinician boluses from infusion pump

A bolus of opioid may be required if analgesia is inadequate.

- This must be prescribed by an anaesthetist and can be administered from the infusion pump as a "**clinician bolus**".
- Only a HCP with appropriate **pain management** skills and competencies should administer a loading dose by using the **"clinician bolus"** via the infusion pump.
- If a bolus from the infusion pump is delivered by a member of the pain team, they should ensure the nurse looking after the patient is aware that the bolus has been given and the frequency of baseline observations are adjusted in keeping with section 7.2.

PCA/NCA bag changes:
It is important to ensure that adequate stocks of opioid ampoules are available at ward level.

Two practitioners authorised to administer medicines (when an infusion contains a controlled drug one of these practitioners **must** be a registered nurse) and who have appropriate skills and competencies should erect a new PCA/NCA bag. These two practitioners **must** check the new bag and ensure that the following information has been written on the drug label and placed on the bag: the child's name, date of birth, H&C number, date, and time, amount of drug, dilution, route and signature of the two practitioners.

Duration of infusion
It is recommended that a review of the need for continuing the PCA/NCA should be made on a **daily** basis.

Discontinuing PCA/NCA

The PCA/NCA should only be discontinued by an experienced member of nursing staff after ensuring the child can transition to step down analgesia by another route and ensuring it is prescribed to avoid gaps in analgesia dosing. Please contact a member of the Acute Pain Team for advice if there is uncertainty on how to proceed.
However the PCA/NCA **must be stopped in the following circumstances** and medical advice sought:

- over sedation
- respiratory depression
- respiratory arrest
- cardiac arrest
- allergy/sensitivity to opioid

If Intravenous access is lost and the infusion is disconnected it should not be reconnected, as per infection control/intravenous lines policy. If PCA/NCA is still required intravenous access should be established and a new PCA/NCA infusion commenced. Discontinuation of a PCA/NCA should be recorded in the child's medical and nursing notes and discontinued on medicine kardex**.**

Disposal of PCA/NCA solution
Two HCPs (one of whom **MUST** be a registered nurse) with appropriate skills and competencies must record and verify the volume of PCA/NCA solution remaining in the bag at the time of disposal. This volume must be documented and signed for on the PCA/NCA observation chart. (See BHSCT hospital controlled drug policy). The pump should be cleaned as per hospital policy and as specified by the manufacturer.

UNDESIRABLE EFFECTS OF PCA/NCA AND MANAGEMENT

A member of the Paediatric Acute Pain Team can be contacted 24/7 by bleeping the following numbers: **2450 or 2003**

Inadequate pain relief
If the patient complains of pain or appears to be in pain:

- Assess severity and location of pain using an age appropriate pain assessment tool.
- Administer prescribed simple analgesics e.g. Paracetamol and either Ibuprofen (first line) or Diclofenac, if appropriate.

All HCPs should be aware that increased or breakthrough pain while receiving a PCA/NCA may sometimes indicate a surgical complication e.g. infection or haemorrhage. In lower limb surgery breakthrough pain may indicate the development of compartment syndrome, a rare but serious complication. Therefore a surgical review of the patient should be requested **immediately** to exclude these complications.
A member of the acute pain team should be contacted for further advice.

Further management may include:
- Commencing a background infusion rate within the prescribed range.
- Increasing the existing rate within the prescribed range.
- Initiating a clinician bolus.
- Encourage patient or nurse to maximise the number of bolus doses available via the PCA/NCA pump.
- Patient may require an analgesic **adjunct** depending on the type of pain, e.g. muscle spasm, bladder spasm.

Nausea and vomiting
The patient should be observed for nausea and vomiting **hourly.**
If the patient complains of nausea or has been vomiting:
- An anti-emetic should be prescribed for all patients on a PCA/NCA.
- Ondansetron is the first line anti-emetic.
- Ondansetron 100 micrograms/kg I.V. (up to a maximum of 4mgs) administered 8hrly in 24hrs. (Guidelines for the Prevention of Post-operative Vomiting in Children 2009 and MHRA alert (http://www.mhra.gov.uk/home/groups/commsic/documents/websiteresources/con183919.pdf)
- Administer the anti-emetic as prescribed.
- Aspirate the nasogastric tube or gastrostomy tube if appropriate.
- Consider the use of an alternative anti-emetic if the patient is still symptomatic.
- If the above measures are unsuccessful contact a HCP with appropriate skills and competencies to assess the patient further.

Pruritus (itch)
The patient should be observed for pruritus (itch):
- At least four hourly.
- 1-2 hourly if itching becomes a problem.
- **If pruritus is a problem:**
  Consider administering an antihistamine e.g. chlorphenamine
  If pruritus still persists consider use of low dose naloxone after discussion with a member of the acute pain team.

Urinary retention
- Record the patient's urine output hourly on BHSCT fluid balance chart.
- Encourage the patient to pass urine.

COMPLICATIONS OF PCA/NCA OPIOID INFUSION AND MANAGMENT

Respiratory depression / Over sedation
The respiratory rate must be monitored **hourly** for the duration of the analgesic infusion. Sats should be continuously monitored and recoded hourly. The frequency of monitoring the respiratory rate should be **increased** if the patient is excessively sedated or if their condition deteriorates. The acceptable minimum respiratory rate for the individual patient is written on the PCA/NCA observation chart. However this is for guidance only as it does not take into account the following:
- depth of respiration
- respiratory effort

- level of sedation
- peripheral arterial oxygen saturation

Sedation scores must be recorded hourly while the PCA/NCA is in progress.

If over sedation occurs i.e. a sedation score of 3/ AVPU of P or U:

- **Immediately stop** the infusion
- **Administer 100% oxygen**
- **Immediately** contact a HCP with appropriate skills and competencies to assess the patient.
- Simultaneously contact an acute pain nurse and an anaesthetist. Once the sedation level has improved it may be possible to recommence the infusion. It may be necessary to reduce the rate or to remove the continuous infusion and leave the pump bolus only.
- Record these actions in the child's medical and nursing notes and complete a datix incident report form.

If respiratory depression occurs:

- **Immediately stop** the infusion.
- **Administer 100% oxygen**
- **Immediately** contact a HCP with appropriate skill and competencies to assess the patient.
- Administer intravenous naloxone.
  Term neonates & child 1 month-11 years: 1microgram/kg, repeated every 2-3 minutes if required (due to the short half-life of naloxone). Child 12-17 years: 100-200 micrograms; if response inadequate then 100 micrograms every 2 minutes (BNFc 2019).
- Simultaneously contact an acute pain nurse and an anaesthetist.
- Record these actions in the child's medical and nursing notes and complete a datix incident report form.

If respiratory arrest occurs:

- **Immediately stop** the infusion and contact the **cardiac arrest team**.
- Administer 100% oxygen and manage "airway, breathing, circulation" as per paediatric basic life support until the cardiac arrest team arrive.
- Administer intravenous naloxone.
  Term neonates & child 1 month-11 years: 100 micrograms/kg; if no response, repeat at intervals of 1 minute to a total max. 2mg. Child 12-17 years: Initially 400 micrograms; if no response then 800 micrograms for up to 2 doses at 1 minute intervals (BNFc 2015-2016).
- Simultaneously contact an Acute Pain Nurse and an Anaesthetist.
- Record these actions in the child's medical and nursing notes and complete a datix incident report form.

PUMP PROBLEMS AND MANAGEMENT

Technical problems

- If a technical problem occurs with the pump contact a member of the acute pain team.
- If there is a fault with the pump, it must be withdrawn from service **immediately** and held over for interrogation by the acute pain team.
- The faulty pump must be labelled with the time, date and description of the fault.
- Technical problem labels are available from the surgical wards and recovery.
- Complete a datix incident report form.

Common pump alarms:

Occlusion

PCA/NCA pumps are sensitive to high pressure and therefore can occlude easily. If the infusion pump occludes or is not delivering at the programmed rate:

- Check that the PCA/NCA infusion line is not occluded or kinked

- Check that the patient's cannula is patent.
- If the cause for the occlusion is not found, inform a member of the acute pain team.

Low battery
- Change the batteries.
- Spare batteries will be found in the PCA lockbox

Dose limit 4 hour reached
Contact the Pain team to assess the patient. Dose limit may need to be increased.

Upstream occlusion
This means there is an occlusion in the upper part of the line at the pump or above the pump.
- Check the line is not trapped in the lock box.
- If the line is trapped release the line.
- If there is no obvious occlusion observed check the cassette by unlocking and unlatching from the pump and release the occlusion.
- For further information regarding the pump please see the manual.
- Manual available in all ward areas.

MORPHINE PCA/NCA PROTOCOL

Rationale: Morphine is an opioid that can be used as an infusion for the relief of postoperative pain. This protocol is to be used along with EWS observation charts and PCA/NCA opioid guidelines. Please contact the pain team for further advice. ***Prescription of a Morphine NCA for all neonates or a child <5 Kg must be discussed with a consultant anaesthetist**.

Protocol for Children < 50 kg

Protocol for Children < 50 kg		**Morphine 2 mg /kg in 100mls 0.9% NaCl** Concentration: 1mL = 20micrograms / kg; (Maximum 4 hourly dose = [illegible])			
Initial programming		**Continuous infusion (background)** (mL/hour)	**Bolus dose** (mL) [via button]	**Lockout** (minutes)	**Extra Clinician Bolus** (mL)
PCA standard		0, 0.2 or 0.5	0.5 or 1 (10 or 20 microgram/kg)	5 or 10	0.5-5 (10-100 microgram/kg)
NCA standard		0, 0.2, 0.5 or 1	0.5 or 1 (10 or 20 microgram/kg)	20 or 30	0.5-5 (10-100 microgram/kg)
NCA **PICU only**		0, 0.2, 0.5 or 1	0.5 or 1 (10 or 20 microgram/kg)	5	0.5-5 (10-100 microgram/kg)
***NCA Term Neonates & infants <5kg**	<1 month	0	0.2 (4 microgram/kg)	20 or 5 **(PICU only)**	1.25 (25 microgram/kg)
	1-6 months	0	0.5 (10 microgram/kg)	20 or 5 **(PICU only)**	2.5 (50 microgram/kg)

Protocol for Children ≥ 50 kg

Protocol for Children ≥ 50 kg	**Morphine 100mg in 100mLs 0.9% NaCL (ready-prepared 100ml bag)** Concentration: 1mL = 1 mg; (Maximum 4 hourly dose = 20mLs)			
Initial programming	**Continuous infusion (background)** (mL/hour)	**Bolus dose** (mL) [via button]	**Lockout** (minutes)	**Extra Clinician Bolus** (mL)
PCA standard	0, 0.2 or 0.5	0.5 or 1 (0.5 or 1mg)	5 or 10	0.5-5 (0.5-5mg)
NCA standard	0, 0.2, 0.5 or 1	0.5 or 1 (0.5 or 1mg)	20 or 30	0.5-5 (0.5-5mg)

NCA **PICU only**	0, 0.2, 0.5 or 1	0.5 or 1 (0.5 or 1mg)	5	0.5-5 (0.5-5mg)

APPENDIX 1

MORPHINE PCA/NCA PROTOCOL 2015

Suggested possible benefits:
Analgesia for acute moderate to severe pain

Precautions
Patients with Renal or Hepatic impairment: NO BACKGROUND infusion
Reduce loading dose and bolus to 75% if creatinine clearance 10 - 50 mL/minute/1.73m²
Reduce loading dose and bolus to 50% if creatinine clearance < 10 ml/minute/1.73m²
[recommendations from the Paediatric Renal team and Paediatric Gastroenterology]

Do not administer supplementary opioids.
Caution with other medications that have a known sedative effect (e.g. midazolam diazepam, chloral hydrate, some antiepileptic drugs)

Indications for use
Acute moderate to severe pain
Acute post-operative pain

Contraindications
- Allergy to morphine.
- Lack of parental consent.

Side effects
Respiratory depression, nausea and vomiting, sedation, and pruritus.

Optimum dosing
Dosing as per current BNFc

Prescription
The NCA/PCA infusion must be prescribed in the medicine kardex.

Equipment
The infusion must be administered via the standard PCA/NCA infusion pump

General instructions and observations
See observation chart and PCA/NCA guideline

APPENDIX 2

MORPHINE and KETAMINE PCA/NCA PROTOCOL

Rationale: Morphine and Ketamine can be used to provide analgesia for children via a PCA/NCA infusion. This protocol is to be used along with EWS observation charts and PCA/NCA opioid guidelines. Please contact the pain team for further advice. **Prescription of a Morphine/ Ketamine NCA for a child 3 years old or younger must be discussed with a consultant anaesthetist.**

Protocol for Children < 50 kg

Protocol for Children < 50 kg	**Morphine 2 mg / kg & Ketamine 2 mg / kg in 100mLs 0.9% NaCl** **Concentration: 1mL = 20 micrograms/kg morphine & 20 micrograms/kg ketamine (Maximum 4 hourly dose = 20mLs)**			
Initial programming	**Continuous infusion (background)** (mL/hour)	**Bolus dose** (mL) [via button]	**Lockout** (minutes)	**Extra Clinician Bolus** (mL)
PCA standard	0, 0.2, 0.5 or 1	1 (20 microgram/kg morphine & ketamine)	5 or 10	0.5-5 (10-100 microgram/kg morphine & ketamine)
*NCA **Children > 3 years**	0, 0.2, 0.5 or 1	0.5 or 1 (10 or 20 microgram/kg morphine & ketamine)	20 or 30	0.5-5 (10-100 microgram/kg morphine & ketamine)
NCA **PICU only**	0, 0.2, 0.5 or 1	0.5 or 1 (10 or 20 microgram/kg morphine & ketamine)	5	0.5-5 (10-100 microgram/kg morphine & ketamine)

Protocol for Children < 50 kg	**Morphine 2 mg / kg & Ketamine 4 mg / kg in 100mLs 0.9% NaCl** **Concentration: 1mL = 20 micrograms/kg morphine & 40 micrograms /kg Ketamine (Maximum 4 hourly dose = 20mLs)**			
Initial programming	**Continuous infusion (background)** (mL/hour)	**Bolus dose** (mL) [via button]	**Lockout** (minutes)	**Extra Clinician Bolus** (mL)
PCA standard	0, 0.2, 0.5 or 1	1 (20 microgram/kg morphine & 40 microgram/kg ketamine)	5 or 10	0.5-5 (10-100 microgram/kg morphine & 20-200 microgram/kg ketamine)

*NCA **Children > 3 years**	0, 0.2, 0.5 or 1	0.5 or 1 (10 microgram/kg morphine & 20 microgram/kg ketamine **or** (20 microgram/kg morphine & 40 microgram/kg ketamine)	20 or 30	0.5-5 (10-100 microgram/kg morphine & 20-200 microgram/kg ketamine)
NCA **PICU only**	0, 0.2, 0.5 or 1		5	

APPENDIX 2

MORPHINE and KETAMINE PCA/NCA PROTOCOL

Protocol for Children ≥ 50 kg

Protocol for Children ≥ 50 kg	**Morphine 100mg & Ketamine 100mg in 100mLs 0.9% NaCl** **Concentration: 1mL = 1mg morphine & 1mg ketamine (Maximum 4 hourly dose = 20mLs)** [4]			
Initial programming	**Continuous infusion (background) (mL/hour)**	**Bolus dose (mL) [via button]**	**Lockout (minutes)**	**Extra Clinician Bolus (mL)**
PCA standard	0, 0.2, 0.5 or 1	0.5 or 1 (0.5 or 1mg morphine & ketamine)	5 or 10	0.5-5 (0.5-5mg morphine & ketamine)
NCA standard	0, 0.2, 0.5 or 1	0.5 or 1 (0.5 or 1mg morphine & ketamine)	20 or 30	0.5-5 (0.5-5mg morphine & ketamine)
NCA **PICU only**	0, 0.2, 0.5 or 1	0.5 or 1 (0.5 or 1mg morphine & ketamine)	5	0.5-5 (0.5-5mg morphine & ketamine)

Protocol for Children ≥ 50 kg	**Morphine 100mg & Ketamine 200mg in 100mLs 0.9% NaCl** **Concentration: 1mL = 1mg morphine & 2mg ketamine (Maximum 4 hourly dose = 20mLs)** [4]			
Initial programming	**Continuous infusion (background) (mL/hour)**	**Bolus dose (mL) [via button]**	**Lockout (minutes)**	**Extra Clinician Bolus (mL)**
PCA standard	0, 0.2, 0.5 or 1	0.5 or 1 (0.5 mg morphine & 1mg ketamine **or** (1mg morphine & 2mg ketamine)	5 or 10	0.5-5 (0.5-5mg morphine & 1-10mg ketamine)

NCA standard	0, 0.2, 0.5 or 1	0.5 or 1 (0.5 mg morphine & 1mg ketamine **or** (1mg morphine & 2mg ketamine)	20 or 30	0.5-5 (0.5-5mg morphine & 1-10mg ketamine)
NCA **PICU only**	0, 0.2, 0.5 or 1	0.5 or 1 (0.5 mg morphine & 1mg ketamine **or** (1mg morphine & 2mg ketamine)	5	0.5-5 (0.5-5mg morphine & 1-10mg ketamine)

APPENDIX 2
MORPHINE AND KETAMINE PCA/NCA PROTOCOL

Suggested possible benefits
May reduce opioid consumption. There is some evidence that ketamine inhibits central sensitization and therefore prevention of postoperative chronic pain.

Precautions
Patients with Renal or Hepatic impairment: NO BACKGROUND infusion
Reduce loading dose and bolus to 75% if creatinine clearance 10 - 50 ml/minute/1.73m²
Reduce loading dose and bolus to 50% if creatinine clearance < 10 ml/minute/1.73m²
[Recommendations from the RBHSC Paediatric Renal team and Paediatric Gastroenterology]

Do not administer supplementary opioids.

Indications for use
- Spinal surgery
- Acute pain resistant to opioids e.g. mucositis (James, et al., 2010)
- Major surgery /orthopaedic surgery (Schrum & Bland)

Contraindications
- Allergy to morphine or Ketamine
- Hypertension
- Known psychiatric disturbance
- Raised intracranial pressure
- Lack of parental consent

Side effects
Side effects associated with morphine include; respiratory depression, nausea and vomiting, sedation, and pruritus.
Side effects associated with ketamine include; neuropsychiatric disturbances, hallucinations, psychotropic effects, central effects, dizziness, light headedness and nausea.

Less common side effects
Increased salivation, tachycardia, sweating, increased blood pressure, increased intracranial pressure and increased intraocular pressure.

Stability of ketamine and morphine mixture
Morphine and Ketamine are stable when mixed (Sveticic, et al., 2005).

Dosing
Studies have reported using low dose ketamine with morphine for postoperative analgesia (Schrum & Bland, n.d.) and mucositis pain (James, et al., 2010) (White, et al., 2011)

Prescription
The decision to commence a morphine and ketamine NCA/PCA **must be discussed with a Consultant Anaesthetist.** The infusion must be prescribed in the medicine kardex.

Equipment
The infusion must be administered via the standard PCA/NCA infusion pump

General instructions and observations
See observation chart and PCA/NCA guideline

APPENDIX 3

FENTANYL PCA/NCA PROTOCOL

Rationale Severe pain can be difficult to treat. Fentanyl may be used as an infusion for the relief of postoperative pain. This protocol is to be used along with EWS observation charts and PCA/NCA opioid guidelines. Please contact the pain team for further advice. ***Prescription of a Fentanyl NCA for neonates or a child <5kg must be discussed with a consultant anaesthetist.**

Protocol for Children < 50 kg

Protocol for Children <50 kg	**Fentanyl 50 micrograms /kg in 100mls 0.9% NaCl** Concentration: 1mL = 0.5 micrograms / kg (Maximum 4 hourly dose = 20mLs)			
Initial programming	**Continuous infusion (background)** **(mL/hour)**	**Bolus dose** **(mL)** **[via button]**	**Lockout** **(minutes)**	**Extra Clinician Bolus** **(mL)**
PCA standard	0 or 0.2	0.5 or 1 (0.25 or 0.5 microgram/kg)	5 or 10	0.5-2 (0.25-1microgram/kg)
NCA standard	0, 0.2, 0.5 or 1	0.5 or 1 (0.25 or 0.5 microgram/kg)	20 or 30	0.5-2 (0.25-1microgram/kg)
NCA **PICU only**	0, 0.2, 0.5 or 1	0.5 or 1 (0.25 or 0.5 microgram/kg)	5	0.5-2 (0.25-1microgram/kg)
Neonates & infants <5kg [this excludes preterm infants]	*Not applicable	*Not applicable	*Not applicable	*Not applicable

Protocol for Children ≥ 50 kg

Protocol for Children ≥ 50 kg	**Fentanyl 2500 micrograms in 100mls 0.9% NaCl** Concentration: 1mL = 25micrograms (Maximum 4 hourly dose = 20mLs)			
Initial programming	**Continuous infusion (background)** **(mL/hour)**	**Bolus dose** **(mL)** **[via button]**	**Lockout** **(minutes)**	**Extra Clinician Bolus** **(mL)**
PCA standard	0 or 0.2	0.5 or 1 (12.5 or 25 microgram)	5 or 10	**0.5-2** (12.5-50 microgram)
NCA standard	0, 0.2, 0.5 or 1	0.5 or 1 (12.5 or 25 microgram)	20 or 30	**0.5-2** (12.5-50 microgram)

NCA **PICU only**	0, 0.2, 0.5 or 1	0.5 or 1 (12.5 or 25 microgram)	5	**0.5-2** (12.5-50 microgram)

FENTANYL PCA/NCA PROTOCOL

Suggested possible benefits
Severe pain
Major surgery

Indications for use
Morphine allergy

Precautions
Patients with Renal or Hepatic impairment: NO BACKGROUND infusion
Reduce loading dose and bolus to 75% if creatinine clearance 10 - 20 ml/minute/1.73m²
Reduce loading dose and bolus to 50% if creatinine clearance < 10 ml/minute/1.73m²
[Recommendations from the RBHSC Paediatric Renal team and Paediatric Gastroenterology]

Do not administer supplementary opioids
Infuse slowly

Contraindications
Allergy to Fentanyl,
Lack of parental consent.

Side- effects
Side effects are those associated with morphine.

Prescription
The NCA/PCA infusion must be prescribed in the medicine kardex.

Equipment
The infusion must be administered via the standard PCA/NCA infusion pump

General instructions and observations
See observation chart and PCA/NCA guideline

FENTANYL and KETAMINE PCA/NCA PROTOCOL

Rationale Severe pain can be difficult to treat. Fentanyl may be used as an infusion for the relief of postoperative pain with the addition of Ketamine. This protocol is to be used along with EWS observation charts and PCA/NCA opioid guidelines. Please contact the pain team for further advice. ***Prescription of a Fentanyl/Ketamine NCA for a child 3 years old or younger must be discussed with a consultant anaesthetist.**

Protocol for Children < 50 kg

Protocol for Children < 50 kg	**Fentanyl 50 micrograms /kg & Ketamine 2 mg / kg in 100mLs 0.9% NaCl** **Concentration: 1mL= 0.5 micrograms/kg fentanyl & 20 micrograms/kg ketamine** **(Maximum 4 hourly dose = 20mLs)**			
Initial programming	**Continuous infusion (background)** **(mL/hour)**	**Bolus dose** **(mL)** **[via button]**	**Lockout** **(minutes)**	**Extra Clinician Bolus** **(mL)**
PCA standard	0 or 0.2	0.5 or 1 (0.25 microgram/kg fentanyl & 10 microgram/kg ketamine **or** (0.5 microgram/kg fentanyl & 20 microgram/kg ketamine)	5 or 10	0.5-2 (0.25-1microgram/kg fentanyl & 10-40 microgram/kg ketamine)
*NCA **Children >3 years old**	0, 0.2, 0.5 or 1	0.5 or 1 (0.25 microgram/kg fentanyl & 10 microgram/kg ketamine **or** (0.5 microgram/kg fentanyl & 20 microgram/kg ketamine)	20 or 30	0.5-2 (0.25-1microgram/kg fentanyl & 10-40 microgram/kg ketamine)
NCA **PICU only**	0, 0.2, 0.5 or 1	0.5 or 1 (0.25 microgram/kg fentanyl & 10 microgram/kg ketamine **or** (0.5 microgram/kg fentanyl & 20 microgram/kg ketamine)	5	0.5-2 (0.25-1microgram/kg fentanyl & 10-40 microgram/kg ketamine)

APPENDIX 4

Protocol for Children ≥ 50 kg

Protocol for Children ≥ 50 kg	**Fentanyl 2500 micrograms & Ketamine 100mg in 100mLs 0.9% NaCl** **Concentration: 1mL= 25 micrograms fentanyl & 1mg ketamine** **(Maximum 4 hourly dose = 20mLs)**			
Initial programming	**Continuous infusion (background)** **(mL/hour)**	**Bolus dose** **(mL)** **[via button]**	**Lockout** **(minutes)**	**Extra Clinician Bolus** **(mL)**
PCA standard	0 or 0.2	0.5 or 1 (12.5 microgram fentanyl & 0.5mg ketamine or 25 microgram fentanyl & 1mg ketamine	5 or 10	0.5-2 (12.5-50 microgram fentanyl & 0.5-2mg ketamine)
NCA standard	0, 0.2, 0.5 or 1		20 or 30	0.5-2 (12.5-50 microgram fentanyl & 0.5-2mg ketamine)
NCA **PICU only**	0, 0.2, 0.5 or 1		5	0.5-2 (12.5-50 microgram fentanyl & 0.5-2mg ketamine)

Protocol for Children ≥ 50 kg	**Fentanyl 2500 micrograms & Ketamine 200mg in 100mLs 0.9% NaCl** **Concentration: 1mL= 25 micrograms fentanyl & 2mg ketamine** **(Maximum 4 hourly dose = 20mLs)**			
Initial programming	**Continuous infusion (background)** **(mL/hour)**	**Bolus dose** **(mL)** **[via button]**	**Lockout** **(minutes)**	**Extra Clinician Bolus** **(mL)**
PCA standard	0 or 0.2	0.5 or 1 (12.5 microgram fentanyl & 1mg ketamine or 25 microgram fentanyl & 2mg ketamine	5 or 10	0.5-2 (12.5-50 microgram fentanyl & 1-4mg ketamine)
NCA standard	0, 0.2, 0.5 or 1		20 or 30	0.5-2 (12.5-50 microgram fentanyl & 1-4mg ketamine)
NCA **PICU only**	0, 0.2, 0.5 or 1		5	0.5-2 (12.5-50 microgram fentanyl & 1-4mg ketamine)

FENTANYL and KETAMINE PCA/NCA PROTOCOL

Possible benefits
May reduce opioid consumption
There is some evidence that Ketamine inhibits central sensitization and therefore prevention of postoperative chronic pain.

Precautions
Patients with Renal or Hepatic impairment: NO BACKGROUND infusion
Reduce loading dose and bolus to 75% if creatinine clearance 10 - 20 ml/minute/1.73m²
Reduce loading dose and bolus to 50% if creatinine clearance < 10 ml/minute/1.73m²
[Recommendations from the RBHSC Paediatric Renal team and Paediatric Gastroenterology]

Do not administer supplementary opioids.

Indications for use
- Spinal surgery
- Acute pain resistant to opioids e.g. mucositis (James, et al., 2010)
- Major surgery /orthopaedic surgery (Schrum & Bland)

Contraindications
- Allergy to fentanyl or ketamine
- Hypertension
- Known psychiatric disturbance
- Raised intracranial pressure
- Lack of parental consent

Side effects
Side effects associated with morphine include; respiratory depression, nausea and vomiting, sedation and pruritus.
Side effects associated with ketamine include; neuropsychiatric disturbances, hallucinations, psychotropic effects, central effects, dizziness, light headedness and nausea.

Prescription
The decision to commence Fentanyl and Ketamine PCA/NCA morphine **must be discussed with a Consultant Anaesthetist.** The infusion must be prescribed in the medicine kardex.

Equipment
The infusion must be administered via the standard PCA/NCA infusion pump.

General instructions and observations
See observation chart and PCA/NCA guideline

APPENDIX 5