GUIDELINES FOR THE PAEDIATRIC ACUTE PAIN SERVICE (APS)

APS GOALS :

- To provide safe & effective analgesia for children of all ages,
- disease & risk profiles irrespective of causality (eg Surgery/Procedures, Pathology, Burns, Trauma, Therapy etc).
- To optimise analgesic prescriptions & implement specialized pain control methods to suit the individual's needs & pain profile.
- To provide 24/7 consultation services for Paediatric Pain Control, to co-ordinate care & facilitate admission to our APS when indicated.
- To ensure that our patients continue to receive adequate pain control right up to the day after discharge from the APS & at times, hospital.
- To continually audit, review & improve our analgesic practice.
- To educate staff & parents on how to optimize pain control.
- To promote good pain culture & holistic care.
- To encourage & champion every patient's right to optimum pain relief.

TRAINING OBJECTIVES:

Practical knowledge about Paediatric Pain, its Assessment & Control

- How pain in children differs from adults (strong emotional & psycho-social component); Barriers to effective pain management; The approach (enlist the main care-giver).
- Pain in early childhood & sequelae of poorly managed pain

- Difficulties in accurate pain assessment & the need for different pain measurement tools (NIPS, PAT, FLACC, Wong-Baker & Numerical Rating Scales)~ application & limitations.
- Use other salient observations to corroborate accuracy of Pain Scores (viz mood, behaviour, limit of function/ activity)
- Concept of Pain as the 5th Vital Sign. Note that regular assessment is important & should involve staff, parents & child (e.g.keeping a Pain Diary).
- To be able to prescribe effective analgesia appropriate for the individual's pain intensity, pattern and clinical condition.
- To anticipate & manage side-effects & complications incurred
- To identify neuropathic/complex pain requiring specialist input
- To appreciate non-pharmacological methods (Music, Play)

ASSESSING PAIN

Pain scores must be assessed & charted daily for 2 situations:

- At Rest (i.e. Baseline Pain) &
- On Movement/Deep breathing (i.e. Incident or Dynamic Pain)

Pain Scales featured are those used in our insitution.
The FLACC Scale: *Observational Behavioural Pain Measure suitable for age 3yrs & below (to as young as 2 months)*
Scored on a series of observations of known pain behaviours.
Maximum score = 10, Minimum score = 0
Need active pain management/additional analgesics if scored > 3

Face Legs Activity Cry Consolability Scale

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

Other Observational-Behavioural Pain Scales used in our institution:

1. **NIPS (Neonatal Infant Pain Scale):** *for newborns & Neonates*
2. **WONG-BAKER FACES Scale**: *Self-report score for age 3 - 5yrs*.

Child needs to understand concepts of less, more, least & most.
Maximum score = 10, Minimum score = 0

Need active pain management/additional analgesics if score is > 3

NUMERIC RATING SCALE (NRS): *Self-report Score for age > 5yrs based on numeric rating of Pain Intensity*
Maximum score = 10, Minimum score = 0
Need active pain management/additional analgesics if score is > 3

0	1	2	3	4	5	6	7	8	9	10
No Pain										Worst Pain

THERAPEUTIC PRINCIPLES OF PAIN CONTROL:

a. **Basic Analgesic Pharmacology** (refer to section on drug doses)
- Drug Classes, Mode of Action, Pharmacokinetics
- Indications & Contra-indications
- Side-effects, Complications, Interactions & their management
- Dosing, Routes of administration, Onset/Latency & Duration

b. **Good Prescription Practices** :
- Individualize doses **on a per kg body-weight basis**
- Be aware of the **maximum** allowable **single** dose limit
- Stay within **recommended 24h daily dose limit**
- **Limit duration** of prescription to **3 - 7 days** & reassess
- **Frequent CLMM review** (daily) & make **adjustments** for age, disease, risk profile & response to therapy

c. Effective **analgesia** (through standardised logical prescription):
- **By the Ladder** (WHO Analgesic Ladder)
- **By the Clock** Strictly for baseline analgesia
- **By Patient's Request** (PRN rescue for unexpected pain)
- **By Risk Status** (constraints of age, disease, post-op status requiring dose reduction or route restrictions)

Select drug based on potency to match pain intensity. Include an opiate if moderate to severe pain exists (escalate as per the WHO Ladder, using Multi-modal Therapy & Analgesics round the clock (strictly served) to maintain within the "Analgesic Corridor"

Appreciate that Pain is dynamic, not static. Proactive treatment dictates provision of PRN analgesics for breakthrough/incident pain
Appreciate that pain is strongly influenced by anxiety

d. **Avoid or Rectify Analgesic Gaps**
- Address Incident /Breakthrough/End of Dose Pain

- Assess cause for increasing pain/analgesic requirements
    - disease progression
    - iatrogenic eg DXT & mucositis, physiotherapy
    - opioid dependence; tolerance; opioid induced hyperalgesia
    - Treat according to cause; use **lowest effective dose**

e. **Avoid or Manage Withdrawal** (Abstinence Syndrome)

- Gradual Weaning till Discontinuation (if opioid therapy > 5-7 days)
- Use Analgesic Substitutes / Analgesic adjuncts eg. Clonidine 1mcg/kg
- Monitor for withdrawal e.g. WAT-1 scores
- Wean single drug at a time

f. **Overall Plan** (analgesia, escalation, weaning, cessation, discharge)

Opiate Conversions (eg. from IV to PO based on 24h opioid use)

Opioid Rotations/ Substitutions +/- weaning; for sufficient duration

g. **Analgesic Modalities**

- **Simple Analgesia**: oral (PO) and rectal (PR) analgesics, intra-venous (IV) morphine infusions,
- **Specialized Analgesia** by the APS:
  Patient Controlled Analgesia (PCA) or authorised agent controlled analgesia (AACA)
  Continuous Epidural Infusions.
  Caudal Additives (Morphine/ S+ketamine/ Clonidine)
  Continuous Regional /Plexus Blocks
  Continuous Wound LA Irrigation with an infusor

THE PAEDIATRIC ACUTE PAIN SERVICE

(A) WORKFLOW

1. **The Paediatric Pain Team** consists of a Pain Consultant (PC), an Anaesthesia Resident/ Fellow/ Associate Consultant (AC) & Pain Nurse. The PC may be assigned to OT duties but should oversee daily rounds, be closely consulted & reported to. Rounds should be done by a minimum of 2 persons. After 5 pm, the On- Call team takes over but the PC remains available for consult.

2. **Requisite Pain & Hand-Over Rounds**:
   - **Morning Hand-over report** by previous night's On Call Team to the rostered Pain Team is compulsory & should highlight problems eg poorly controlled pain issues, update on therapy & progress, projected plans for escalation & weaning.
   - **Morning Pain Round** at 0830h
   - *An* **Afternoon Round** with the PAIN NURSE should be done at 3pm to review any problems & ensure all the logistics eg cartridge top-ups have been addressed.
   - **Afternoon Hand-over Communication** with prospective On-Call Team about the APS patients & outstanding issues
   - **Evening Pain Review** is required for patients on Epidurals / Continuous Regionals, as well as for any other patients on the APS who have problems controlling their Pain) ~ to be done preferably before 2200h) by the On Call Team.

3. **PCA pump keys**
   The On-Call team is responsible & accountable for PCA keys as well as Call Room card key. The hand-over of

these keys to the subsequent/next On-Call Team each day is mandatory. The day team will utilise either the Pain Nurse's or the Ward's PCA keys. ***A fine as well as police report are mandatory if the keys are lost.***

4. **Admission to the APS:**
   - Requires prior discussion/approval at Anaesthetic A/C or C level
   - Occurs post-operatively or for a referred "Blue-Letter(B/L)" patient
   - Must be cared for in an accredited Ward with proper monitoring
   - *NB All continuous Epidurals/Caudal/AACA must be monitored in ICU or HD; PCAs can go to accredited Paeds Wards (55,56,65,66,75,76,85 & 86)*
   - Pain education/consent issues should be settled before admission
   - Necessary documentation on admission to APS includes : APS Form & Photocopy of Blue Letter & Reply

5. **PCA Pumps** are obtained through AU Nurses in MOT. They will record the pump unit number & track its movement & only release pump after the requisite prescription on the APS Form has been filled.

6. **Monitoring**
   All PCAs & Epidurals require continuous pulse oximetry (SpO2), regular assessment wrt Pain + Sedation Scores, vital signs (especially Respiratory Rate) & a SHINE form to audit all opiate- containing infusions. SpO2 may be reduced to 3 - 4 hourly monitoring (only after 24h) at the discretion of the PC provided patient is not overly sedated & has no background basal opioid infusion.

7. **Documentation**
   Orders should be documented & checked. Pain & sedation scores, Side-effects, other observed cues & response to therapy noted daily. Patient's current location should also be updated on the APS form.

8. **Trouble-shooting & Other Duties**
   - Appropriate dose adjustments (maintain, escalate or wean).
   - Add analgesic adjunct if needed
   - Manage side-effects (nausea/vomiting/puritus/constipation) with pre-emptive PRN prescriptions in CLMM (refer to suggested dosing on the last page of purple APS form).
   - Dilute & Top up all Epidural infusions /CADD cassettes.
     - Epidural (dressing integrity/change, catheter adjustment/removal upon which please document that catheter tip is intact).
     - Communicate the analgesic plan & any changes to the Nursing Staff, Physician-in-charge, Parent & Patient.
     - Daily Record of Patient's Progress (in APS Form, Case-Sheets / ICIP notes & in CLMM).
     - Recognise & treat Abstinence Syndrome; monitor severity with WAT-1 scores every nursing shift.
     - Any complications should be relayed to the staff responsible.

9. **Flagging "High Risk" patients for extra-vigilant follow-up**
    - Identify “High Risk” groups eg Neonates/Infants up to 1 year, ASA >2, emergent surgery, Airway/Respiratory/CVS/CNS /NM disorders
    - Implement closer monitoring (e.g. ICU /HD care) & additional review
    - Consider drug dose reduction, additional labs eg LFT, ABG

10. **Blue-Letter Referrals** must be faxed to MOT Reception (2227)
    - *During office hours*, the rostered pain team will manage
    - After office hours, the On Call Team will manage with a helpline from the rostered Pain Consultant. The PAIN NURSE should also be notified. A photocopy of the referral letter AND its reply should be added to the PAIN FILE (even if patient is not admitted to the APS). Relevant Audit Form & the PCA order must be filed if PCA is started.

11. Discharge from the Service

This should be done by the Pain Team who should then notify the surgeon or physician in charge. A discharge note on adequacy of analgesia/other feedback should be done at the time of stopping APS, together with the requisite sign off from APS with date & time.

Post-discharge review/progress note is done the following day. Continued follow up is required until resolution of complications.

12. Charge codes

Remember to fill in the charge codes upon cessation of APS.

Patients may be charged for 1, 3, 7 or 14 days’ review.

B/L referrals are also billed on the patient's booklet.

13. **Miscellaneous issues & avoiding disruption of pain therapy**
    - *PCA Fentanyl in older children*: there may be insufficient stock in the Ward or Satellite Pharmacy to provide seamless analgesia. Temporary arrangements can be made with OT as a loan after office hours but please arrange for a prescription to be written for the projected duration of therapy (e.g. over the weekend) so that they can obtain adequate stock from the Main Pharmacy.
    - *Oxycodone* is not ward stock in some areas & only available after a **formal written prescription** (in addition to CLMM entry) is given to the satellite pharmacy
    - Procedures (eg MRI, chemotherapy, DXT) may interrupt opioid infusions & provisions must be made for alternative analgesia.

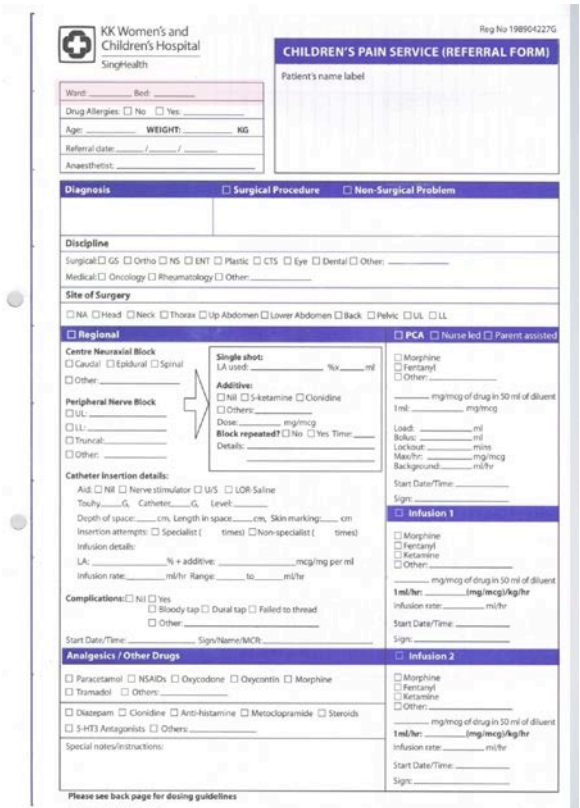
(B) PAPERWORK

1. **FORMS**
    - The APS Form (white & purple. A3 size) is essential
    - This form is kept in the red APS FILE (in Major OT Recovery Room). It tracks progress & patient's location & should not be misplaced. Check Citrix for update in patient's location.
    - All relevant sections/data must be recorded daily [eg 24h opiate totals (in mcg or mg; not mls)].
    - In event of a lost form, it must be filled in anew & filed in the red file
    - Prescriptions need to be recorded and signed in the CLMM

THE RED APS FILE

Please file forms in the appropriate section of the APS file - current follow-up, post discharge review, completed.

Any prescription changes (including PCA program and syringe top ups) should be recorded in the CLMM, casenotes and the APS Form *(white).* This is for medicolegal and billing purposes.
Important contact numbers, guidelines and information can be found in this file.



KK Women's and Children's Hospital
SingHealth

Reg No 198904227G

CHILDREN'S PAIN SERVICE (REFERRAL FORM)

Patient's name label

Ward: _____ Bed: _____

Drug Allergies: ☐ No ☐ Yes: _____

Age: _____ **WEIGHT:** _____ **KG**

Referral date: ____/____/____

Anaesthetist: _____

Diagnosis ☐ **Surgical Procedure** ☐ **Non-Surgical Problem**

Discipline

Surgical: ☐ GS ☐ Ortho ☐ NS ☐ ENT ☐ Plastic ☐ CTS ☐ Eye ☐ Dental ☐ Other: _____

Medical: ☐ Oncology ☐ Rheumatology ☐ Other: _____

Site of Surgery

☐ NA ☐ Head ☐ Neck ☐ Thorax ☐ Up Abdomen ☐ Lower Abdomen ☐ Back ☐ Pelvic ☐ UL ☐ LL

☐ Regional

Centre Neuraxial Block
☐ Caudal ☐ Epidural ☐ Spinal
☐ Other: _____

Peripheral Nerve Block
☐ UL: _____
☐ LL: _____
☐ Truncal: _____
☐ Other: _____

Single shot:
LA used: _____ %x_____ ml

Additive:
☐ Nil ☐ S-ketamine ☐ Clonidine
☐ Others: _____
Dose: _____ mg/mcg
Block repeated? ☐ No ☐ Yes Time: _____
Details: _____

Catheter insertion details:
Aid: ☐ Nil ☐ Nerve stimulator ☐ U/S ☐ LOR-Saline
Touhy_____G, Catheter_____G, Level: _____
Depth of space: _____cm, Length in space_____cm, Skin marking: _____ cm
Insertion attempts: ☐ Specialist (times) ☐ Non-specialist (times)
Infusion details:
LA: _____ % + additive: _____ mcg/mg per ml
Infusion rate: _____ ml/hr Range: _____ to _____ ml/hr

Complications: ☐ Nil ☐ Yes
☐ Bloody tap ☐ Dural tap ☐ Failed to thread
☐ Other: _____

Start Date/Time: _____ Sign/Name/MCR: _____

☐ PCA ☐ Nurse led ☐ Parent assisted

☐ Morphine
☐ Fentanyl
☐ Other: _____

_____ mg/mcg of drug in 50 ml of diluent
1 ml: _____ mg/mcg

Load: _____ ml
Bolus: _____ ml
Lockout: _____ mins
Max/hr: _____ mg/mcg
Background: _____ ml/hr

Start Date/Time: _____
Sign: _____

☐ Infusion 1

☐ Morphine
☐ Fentanyl
☐ Ketamine
☐ Other: _____

_____ mg/mcg of drug in 50 ml of diluent
1 ml/hr: _____ **(mg/mcg)/kg/hr**
Infusion rate: _____ ml/hr

Start Date/Time: _____
Sign: _____

Analgesics / Other Drugs

☐ Paracetamol ☐ NSAIDs ☐ Oxycodone ☐ Oxycontin ☐ Morphine
☐ Tramadol ☐ Others: _____

☐ Diazepam ☐ Clonidine ☐ Anti-histamine ☐ Metoclopramide ☐ Steroids
☐ 5-HT3 Antagonists ☐ Others: _____

Special notes/instructions:

☐ Infusion 2

☐ Morphine
☐ Fentanyl
☐ Ketamine
☐ Other: _____

_____ mg/mcg of drug in 50 ml of diluent
1 ml/hr: _____ **(mg/mcg)/kg/hr**
Infusion rate: _____ ml/hr

Start Date/Time: _____
Sign: _____

Please see back page for dosing guidelines

ANAE(P)-2011(Apr 2010)

Date/time:								
Reviewer (s):								
Pain assessment	At Rest							
	Dynamic							
	Pt satisfaction Y/N							
	Slept well (Y/N)? if No, why?							
Side effects:	Sedation score							
	Nausea							
	Vomiting							
	Pruritis							
	Respiratory degression							
	Urinary retention/IDC							
	IV site ok?							
Analgesic/Adjuvants	Paracetamol							
	NSAID							
	Oxycodone							
	Oxycontin							
	Tramadol							
Others:								
	Dexa/Ondy/Metoc/Promet							
Analgesic Infusions:	Morphine(ml/hr)							
Indicate X when ceased.	Fentanyl(ml/hr)							
	Ketamine(ml/hr)							
Others:								
PCA	Morphine							
	Fentanyl							
Settings:	Bolus (mg/mcg)							
	Lockout (min)							
	Max/hr (mg/mcg)							
	Infusion (ml/hr)							
	Tries total/good							
	Usage/24hrs (mg/mcg)							
Cessation of PCA	Indicate DO ans time							
Regional Infusion:	LA Solution (%)							
	Additive/Conc							
	Rate (ml/hr)							
	Bolus given / Time							
Assessment:	Left Dermatome							
	Right dermatome							
	Bromage score R							
	L							
	other							
Problem checks:	TMax							
	Haem.markers (eg FTW)							
	4HR/UBP							
	Cath. skin marking (cm)							
	Catheter site clean? (Y/N)							
	Dressing changed (✓)							
	Pressure areas checked (✓)							
Catheter issues:	eg Blocked/Disconnected							
Post cath removal instructions	Given to carrgiver (✓)							
Cessation of infusion	Indicate (✓) and time							
Catheter removal. Tip intact?	Y / N							
Plans / Notes								
OFF PAIN SERVICE	(Time and sign off)							

SEDATION SCORE: 0=awake, 1=awake, tired, sleepy, 2=sedated, asleep, easily aroused, 3 sedated/asleep, hard to arouse, 4=unrousable, 5=sleep

BROMAGE SCORE: 0=none/full flexion knee/feet, 1=partial/just moves knees, 2=almost complete/moves feet only, 3=complete/unable to move leg

Recommended Initial PCA and Analgesic Infusion Settings

Drug	Morphine	Fentanyl	Ketamine
Dilution instruction	1mg/kg (Max 50mg) in 50 mls diluent	15 mcg/kg (Max 750mcg) in 50 mls diluent	5mg/kg (Max 250mcg) in 50 mls diluent
Concentration 1ml =	20mcg/kg max: 1mg/ml	0.3mcg/kg max: 15mcg/ml	100mcg/kg max: 5mg/ml
Infusion Range	0 - 4 ml/hr	0 - 4 ml/hr	0 - 4 ml/hr
PCA settings	Load: 2 mls (optional) Bolus: 1 ml Lock out: 5 min Max/hr: 0.3 mg/kg Background: 1 ml /hr (optional)	Load: 2 mls (optional) Bolus: 1 ml Lock out: 3 min Max/hr: 3 mcg/kg Background: 1 ml /hr (optional)	NA

Recommended Initial Epidural Infusion Settings

Age	LA Concentration(%)	Additive concentration	Rate Range
Standard (>1 year)	0.10% Bupivacaine	Fentanyl 2 mcg/ml or Clonidine 1 mcg/ml	0.1 - 0.4ml/kg/hr
6mths - 1 year	0.10% Bupivacaine	Fentanyl 1 mcg/ml	0.1 - 0.3 ml/kg/hr
< 6 mths	0.10% Bupivacaine	Nil	0.1 - 0.2 ml/kg/hr
< 2 mths	0.05% Bupivacaine	Nil	0.1 - 0.2 ml/kg/hr

Oral analgesics	Paracetamol	15-20 mg/kg (max 90mg/kg/day for up to 48hr, thereafter reduce to 60mg/kg/day)Term neonates = (max 40mg/kg/day)	4 - 6 hrly	**IV analgesics**	Paracetamol	Term neonates = 7.5mg/kg (max 40mg/kg/day) All other children:15mg/kg (max 60mg/kg/day)	6 hrly (max 4 doses)
	Diclofenac	0.5-1 mg/kg (max 60mg/dose)	8 -12 hrly		Tramadol	1 - 2 mg/kg (Load 2-3mg/kg)	6 hrly over 10 min
	Ibuprofen	10 mg/kg/dose (max 400mg/dose)	6 hrly		Ketorolac	0.2mg/kg/dose (max 10mg)	6 hrly
	Indomethacin	0.5 - 1 mg/kg	8 - 12 hrly		Clonidine (analgesia/ sedation/ anxiolysis)	1 - 2 mcg/kg	give slowly and 8 hrly
	Naproxen	7 mg/kg (max 500mg/dose)	12 hrly				
	Tramadol	1-2 mg/kg (max 400mg/day)	6 hrly	**Antiemetics**	Metoclopramide	0.2 mg/kg/dose (max 20mg) load 0.5mg/kg	6 hrly (over 10 min)
	Oxycodone	0.1-0.2 mg/kg Oral oxycodone: oral morphine = 2:3	4 - 6 hrly		Dexamethasone	0.15 mg/kg (max 8mg)	Once daily (slowly)
	Oxycontin(SR) *Do not Crush*	Calculate depending on opioid requirement	12 hrly		Ondansetron	0.1 mg/kg (max 4 mg)	8 hrly over 10 min
	Oral morphine	0.2-0.5 mg/kg	4 hrly		Promethazine	0.5 mg/kg (max 25 mg)	8 hrly
	Diazepam	0.1mg/kg (for muscle spasms)	4 hrly				
	Amitriptyline	1-2 mg/kg	ON	**Opioid antogonist Naloxone**	Pruritus	1mcg/kg. If returns consider infusion	PRN x 1-2
	Gabapentin	5-10 mg/kg Start incremental doses over 3 days	8 hrly		Urinary retention	1-2mcg/kg	PRN x 1-2
					Sedation	2 mcg/kg over 2 minutes	
					Resus	10mcg/kg over 2 minutes	

Incident reporting: *Please report any management related issues that impacted or could have impacted patient care. Please indicate date/ time. Anonymous. Can be more than 1 report.*

What happened?/Learning points?/Need further discussion?/Ideas?

Classification:

- ☐ CNS
- ☐ RESP
- ☐ CVS
- ☐ Monitoring
- ☐ Education
- ☐ Communication
- ☐ Equipment
- ☐ Drug related
- ☐ Documentation
- ☐ Other

(C) PROTOCOLS

Adherence to workflow, monitoring & dosing/ prescription guidelines are important for safety. Additional information and details on protocols & policies can be found on the KKH intranet. All trainees should be fluent in setting up safe & effective prescriptions for PCA, Epidural as well as IV Morphine infusions for children of all weights.

(D) EQUIPMENT

PCA Pumps

- Graseby Omnifuse & CADD Solis Pumps
- All opiate & ketamine containing infusions must have an anti-reflux valve device in place
- Practical orientation session on equipment is compulsory

(E) SERVICE QUALITY STANDARDS

PCAs & epidural infusions should be started in the Recovery Room. Patients should be able to use the PCAs effectively before leaving Recovery (PACU). Epidural patients must be comfortable & free of side-effects. If excessive sedation prevents this then an expedited review in the ward is needed to rectify this.

Severe pain & analgesic gaps need to be reported & addressed with input by PC. Loading or additional boluses are recommended instead of increasing infusion rates to expedite pain control. Strict multimodal analgesia with paracetamol ± NSAIDs is recommended.

It is the responsibility of all anaesthetists (admitting patient to the APS, discharging from Recovery Area & on call) to ensure that the patient is comfortable upon transfer to the Ward / HD / ICU.

Good communication (parent / nurse / anaesthetist / Pain Service) is essential to ensure safe & effective therapy. All changes to the initial regimen & additional bonuses must be noted in the CLMM & APS forms plus Progress Notes, noted by attendant nurse with a two-way read back clarification of prescription, likely problems & plan.

High risk patients need parameter guidelines as to when to alert APS.

Anti-emetics PRN need to be prescribed when opiates are on board.

PATIENT CONTROLLED ANALGESIA (PCA)

Recommended for patients 6 yrs & older; Assess the individual child's cognitive maturity ~ we have successfully used PCA in a 5 yr old.

Prerequisites :

- Understands the concept of analgesia upon demand (press for it)
- Able to cope with latency of onset & mandatory lockout for safety.
- Physically able to press the handset button
- No contra-indications (wrt medical condition /allergies/ cognitive
- limitations)
- Parents should be instructed **NOT** to press PCA for the child (especially if he/she is sleeping)

CADD or Graseby syringe pumps are used (Check availability)

- clear old patient data & select appropriate Programme
- check that appropriate syringe type / size or cartridge is used (this should last at least 24-48h)

- check that settings are appropriate for the drug used & child's weight

Compulsory Pump Settings :
Please programme

- Bolus
- Lockout
- Max. Dose Limit in 1 hour (check that this is NOT for a 4h interval)

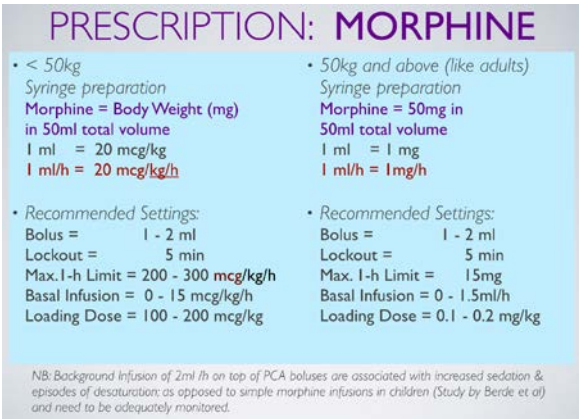
Optional Pump Settings : Loading dose
Background Basal Infusion

Recommended limits are printed on the order form & should not be exceeded
Note that the Lockout time range varies with the opiate profile
with a minimum interval of 5 min for Morphine & 3 min for Fentanyl
Continuous basal infusions are NOT recommended as a routine unless child is adequately monitored /pain is expected to be severe eg scoliosis. Start with 0.5-1.0 ml/h; try not to exceed 1.5 ml/h. Wean the background infusion by 25-50% after 24-48h.

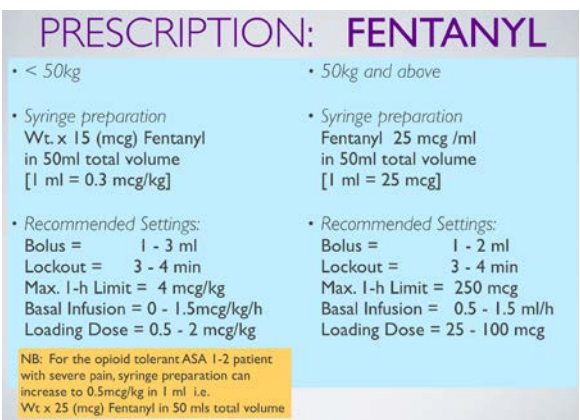
Steps to adhere to at daily morning round:

1. note total opiate use in 24h (in mg or mcg)
2. note successful vs total demands
3. clear old data & adjust bolus or background as needed
4. check that contents should last at least 24-48h

Dilution:
There are 2 standard ways of diluting the narcotic infusions according to weight: for patients weighing < 50kg *or* ≥ 50kg
(specific dilution order set is available in the CLMM);
All orders must be clearly written, dated & signed
The syringe/cartridges should also be similarly labelled



CADD cartridges of various volume capacities (50 ml - 10 ml) require corresponding dilutions to achieve the same final concentration. Please have a 2nd person verify dilution & the math.



Monitoring & trouble-shooting

1. Inadequate analgesia

Check patient history from the pump.

If there are multiple unsuccessful attempts, increase the bolus and 1 h max *and* re-educate the child on PCA usage.

If child has problems pressing handset, nurse or parent can help her with this. Perils of over administering should be indoctrinated appropriately.

The lockout interval may vary from 5 – 8 min but to NOT < 4min for morphine.

Dose increments are usually associated with increased side-effects.

NCA (NURSE CONTROLLED ANALGESIA) or AACA (Authorised Agent Controlled Analgesia)

At present, only CICU, NICU and HD are capable of supporting this..

The principles & charting are the same as for PCA. Programming is more conservative with strict instructions to press only if pain scores exceed 3-4.

- The lockout period is 10-15 min for morphine & 5-10min for fentanyl
- The maximum 1 h limit is set 20-25% lower
- Typically we limit boluses to no more than 4 per h at the start

OPIATE INFUSIONS

These follow the dichotomous weight-based PCA prescription; limits should not be exceeded; syringe boluses should not exceed 2 mls & require sufficient interval (15 min) for assessment of response.

LOW-DOSE KETAMINE INFUSIONS

Indicated if :

- The pain is hard to control despite adequate opioids.
- Used to curb opiate tolerance
- Used improve quality of analgesia
- Reduces opiate requirements & thereby ameliorating opioid induced hyperalgesia (OIH) & opiate side- effects

Dilution:
It is recommended to use lockable PCA pump to prevent tampering)
This is diluted as per morphine to create a **1ml/h = 20 mcg/kg/h**
Generally patients are rational & not over sedated with infusions of 1 ml/h but some will complain of dizziness, excessive salivation, hallucinations & a dis-embodied feeling

PCA KETAMINE

Indicated if : frequent intense pain or procedural intervention render PCA opiate or opiate infusion ineffective.
Dilution: Body Weight (mg) in 50 ml N/S
Low dose 1 ml /h = 20 mcg/kg/h
Lockout 10-15 min
Background not to exceed 1ml/h
Higher concentration or higher dose dilution:
Body Weight x 5 (mg) in 50 ml ; 1ml/h = 100 mcg/kg/h
if require more intense sedation/ analgesia eg for dressing changes provide more drug per bolus; keep infusion to < 1ml/ h

PCA KETAMINE-MORPHINE COMBINATION

Indicated if: pain is hard to control despiteadequate opioids.
Dilution: Both ketamine & morphine combined (1:1) into one PCA
Allow 4-5 presses per hour & increase lockout interval to 10-15min.
Difficult to adjust dose if patient is intolerant to adverse effects of ketamine so a trial of a separate Low-dose Ketamine infusion allows more flexibility in dose adjustment

Other adjuncts: Dexmedetomedine infusion
Clonidine (1mcg/kg q6-8h IV / PO)
Gabapentin, Pregabalin

Optimising good use of PCA modality

Load opiate or dispense 2 -3 boluses if pain not well controlled
Educate on proper use: encourage pre-emptive 2 boluses before movement & Physiotherapy
Treat side-effects which may deter optimum use
Escalate analgesia by increasing bolus as well as being quick to add an analgesic adjunct

Weaning & discontinuation

PCAs are usually required for 2 - 3 days, but may be continued for much longer period if indicated eg in Oncology, Trauma & Burns, Scoliosis

Once the child is taking orally, start him / her on oral non-opiate analgesics q 6 - 8h (whilst still on the PCA). This will help with weaning the PCA & will provide better analgesia.

Convert the 24h opiate requirement to an oral opiate round the clock with PRN prescription of 10-20% of this amount. Either Mist morphine or Oxycodone (Oxynorm) make good conversions; sustained-release formulations & trans-dermal applications are neither suited to nor recommended for Acute Pain management.

Discontinue PCA when:
minimal use of bolus demands (Eg < 4-8 presses per 24h)
minimal 24h opiate requirement (Eg < 0.1-0.3 mg/kg morphine in 24h)
patient or surgeon request (providing pain is well controlled)

Drips may need to be re-sited if painful or inflammed.
Additional adjuncts are required if pain is really severe

EPIDURALS : GENERAL GUIDELINES (see RA section)

- EPIDURALS provides excellent analgesia for young children only if dermatomal coverage is adequate
- proper efforts should be made in planning & execution to achieve the ideal dermatomal cover so as to avoid the need for rescue or concommitant IV opioids/PCA;
- in case of inadequate dermatomal cover, the PC is responsible for deciding how to best optimise analgesia which may include removing the catheter & alternative pain control; if IV opiates are used please remove any opiate additive in the epidural solution that is infused
- in infants, risk-benefits must be carefully weighed, discussed with parents & consent documented; risk of post-op coagulopathy (eg anticipated major blood loss) & catheter complications should be considered
- strict asepsis to be maintained with vigilance not to contaminate with potential neurotoxic agents eg alcohol/cleaning solutions when diluting or topping up epidural
- prerequisites:
    - should be nursed in ICU or HD setting with monitoring
    - should have a working IV line
    - total doses/infusion rates should not to exceeds the recommended limits for age.

EPIDURALS: DUTIES

- Twice daily review all the necessary documentation until discharge
- Assessment management of analgesic quality dermatomal level as well as complications including dressing issues catheter migration pruritus
- Somnolence numbness neurological complications as well as pressure sores
- Adjust refill prescription as needed trouble-shoot equipment problems
- Removal of catheter

EPIDURAL DRESSINGS

- Dressing: always use a "window" dressing to facilitate inspection of the insertion site and catheter marking at skin level.
- The integrity of the dressing should be intact: clean, dry & adherent
  Double Tegaderm→ application (small and big) reduces the incidence of catheter leak as does using Dermabond to seal the puncture site.
- Ensure catheter is taped such that the catheter marking at skin is clearly visible & easy to inspect
- Continuous caudal catheters should be securely fixed with Steristrips→ and dressed with a waterproof dressing such as Tegaderm→, covered with Hypafix→ to avoid fecal contamination

EPIDURAL SOLUTION PREPARATION:

- Diluted ASEPTICALLY by the Paeds Anaesth or APS TEAM
- CADD pumps & reservoir bags of 100 & 250 ml volume available with specific YELLOW lined tubings & YELLOW covers
- Please predict/ precalculate at least 48h-72h amount to be used to determine bag volume (using average infusion rate at 0.3 ml/kg/h)
- Diluent for Epidurals must be normal saline and NOT water
- All drugs must be preservative free eg S+ketamine & sterile
- Prescription: orders must be filled in both APS form & CLMM
- Labelling : Use special coloured Epidural stickers & labels
  "FOR EPIDURAL USE ONLY"
  with Clearly written prescription: ***LA (%) & additive (mcg/ml)***

LA amount (in mg), total volume (ml), diluent (N/S) & additive used amount (mcg) labelled patient's name, with date & time & signed

- Always use a filter.
  Make sure all connections are secure and cover connections with a plastic bag to avoid contamination

TROUBLE-SHOOTING EPIDURALS: common problems

1. Inadequate pain relief

Usually due to inadequate dermatomal level/ malposition of catheter tip & occasionally from a failed block.

Solutions :

1. achieve target by correct insertion level & position of catheter tip; pre-empt & bolus with a sufficient volume of LA intra-op or post-op before starting the infusion; *NB : Unless the epidural is sited sufficiently close to the segment required for analgesia, it will be difficult to achieve excellent analgesia without giving huge & potentially toxic volumes of LA.*

2. additives eg epidural fentanyl (either as bolus or added to the infusion) may be helpful; if using epidural morphine (hydrophilic) bolus, this should be given at least 1 h before completion of surgery to give it adequate time to take effect & only if confident epidural is sited correctly in the epidural space

In instances when a lumbar epidural may be preferable to a thoracic epidural because of the risks inherent (i.e. small child < 20 kg), morphine can be used instead of fentanyl in the epidural solution to improve dermatomal spread of analgesia.

3. check epidural site (for catheter kink / migration) ascertain dermatomal levels
4. attempt rescue slowly bolus lignocaine 0.5-1% (about 0.5- 1 ml/kg).

If pain is relieved with the bolus, either increase the infusion rate OR change epidural solution to morphine instead of fentanyl.
If there is no pain relief at all, either re-site the epidural or remove it & prescribe appropriate analgesia.

2. Excessive Sedation :

Sedation score must be closely monitored as a score exceeding 2 may be the only indication of impending respiratory arrest.

0	no sedation
1	mild sedation (occ. drowsy, but easily aroused)
2	mod sedation (freq. drowsy, but easily aroused)
3	severe sedation (diff to arouse)
S	normal sleep, fairly easy to arouse

NB **Score of 3 needs URGENT & PROMPT intervention**: stop infusion, call for help, stimulate the child, apply oxygen if needed.

3. Respiratory Depression

This is potentially life threatening. Patient will require O2 via bag and mask if RR < 20 -22 /min in infants & <8 -12 /min in older children

IV naloxone may be titrated as necessary. As the administration of naloxone is associated with its own side effects, give in small increments and at intervals of 2 – 5 min.

4. Pruritus

A common side effect with epidural opiates. Reduce the dose (if pain free) or treat symptomatically with calamine lotion, talcum

powder. If unrelieved, IV diphenhydramine (Benadryl→) 0.2 - 0.5 mg/kg over 15 minutes, q6h can be given. Warning: Diphenhydramine can give rise to significant somnolence! Alternatively very low dose naloxone bolus or infusion at 0.25 mcg/kg/h can be utilized.

5. Nausea & Vomiting

- IV metoclopramide (1st line) 0.10 – 0.15mg/kg q 6-8h slow bolus. Watch out for side effects e.g. oculogyric crisis.
- IV ondansetron (2nd line) 0. 1 – 0.2 mg/kg q 8 h
- If child is on N/G tube, check if it is draining freely - the cause may be a blocked tube and distended bowel.

*Amount of opiates used may have to be reduced.

6. Leak around the catheter

This is commonly seen in young children, particularly with small catheters. Tegaderm→ dressing will need to be changed if there is any suspicion of compromise of sterility e.g. lifting up of the dressing due to the fluid. Use sterile technique, Opsite→ spray and clean gauze to staunch where necessary to ensure that the new dressing is as dry and secure as possible.

7. Catheter Disconnection

Do *not* reconnect if it is at catheter end unless it is an observed disconnection and the proximal catheter end is still sterile.

Epidural will have to be removed and discontinued, alternative methods of analgesia started.

8. Motor Blockade - daily Bromage score to be assessed & charted

I	complete (no movement)
II	almost complete (moves feet only)
III	partial (only knee movement)
IV	none

Alert PC if Bromage is abnormal.

9. Numbness

Document dermatomal level, extent, associated motor weakness and dysaesthesias. Try to reduce the epidural LA concentration, or withdraw catheter a little whilst positioning the numb side up.

Please remove it if unimproved /unresolved in 24h. Will require follow-up & a consultant to oversee until resolution

10. Urinary Retention

Urinary catheterisation may be necessary. Ultra-Low dose naloxone 0.25 mcg per kg may also be used

11. Hypotension

This is not very common in children but it is nevertheless advisable to ensure patient is well hydrated before an epidural is commenced.

A bolus of IV 5 - 10 ml/kg of crystalloid is enough to correct this. If BP does not respond to this fluid challenge always suspect another cause e.g. ongoing blood loss / sepsis.

12. Infection

The epidural site should be inspected daily for evidence of inflammation. Check the temperature chart and document maximum recorded temperature (Tmax) as well as total white trend.

The epidural catheter should be removed if you suspect infection (e.g. pustule) or sepsis; culture the tip of the catheter if necessary.

13. Coagulopathy or anti-coagulation

Ensure that coagulation profile is normal or that an appropriate period has elapsed since the last dose of heparin before removing the epidural catheter.

14. **Other problems** are rare and require discussion with the primary physicians / surgeons wrt imaging and intervention as well as with the patient/parents
    1. Epidural haematoma
    2. Snapped/ retained catheter
    3. Inadvertant Dural Tap
    4. Spinal Headache
    5. Cauda Equina Syndrome

Discontinuing Epidurals:

When discontinuing epidurals, it is important to:

1. Ensure adequate alternative analgesia (PO), if the patient is still NPO, consider switching to PCA if HD/ICU bed is no longer available. Start paracetamol orally / rectal whilst still on epidural.
2. Position the patient properly (lateral and flexed) for catheter removal; (do not do this unassisted)
3. Withdraw catheter carefully and check that tip of catheter is intact after removal.
4. Do not tug forcibly on catheter. It may snap.
5. Place a dry dressing over the site.
6. Patient should be monitored in HD and no opiates be given for 6h after the last dose of epidural morphine.

ALTERNATIVE ANALGESIA

Paracetamol*	PO 10-15mg/kg/dose Q4-6h; max 90mg/kg/day IV 10-15mg/kg/dose Q6h; max 75mg/kg/day PR 25-30mg/kg/dose Q6h; max 100-200mg/kg/day
NSAIDs**	PO Ibuprofen 5-10mg/kg/dose Q6-8h; max 40mg/kg/day PR Diclofenac 1mg/kg/dose Q12h IV Ketorolac 0.25-0.5mg/kg/dose Q6-8h; max 3 days
Tramadol***	PO/ IV Tramadol 1mg/kg/dose Q8h
Strong Opioids	PO morphine syrup 0.2-0.4mg/kg/dose Q4-6h IV morphine infusion 20mcg/kg/hr PO Oxycodone 0.1-0.2mg/kg/dose Q4-8h

* Avoid PR administration of any drug in neutropenic patients
** Avoid in <6mo. Caution in <3yo.
*** Avoid in chidlren with seizure history

Neonatal drug administration :
Use lower doses, lengthen dosing intervals, review daily