# GUIDELINES FOR THE PAEDIATRIC ACUTE PAIN SERVICE (APS)

## GOALS:

- To provide safe and effective pain relief via specialized as well as basic analgesic methods for children of all ages and disease profiles.
- To ensure that our patients enjoy the continuity of a pain-free state right up to the day after discharge from the APS/ hospital.
- To provide a consultation services for Pain Control (e.g. Oncology, Trauma or Medical) with a view to admission to the Paediatric APS where indicated.
- To educate staff and parents to optimize the efficacy of pain control, cultivate good practices and promote "the right to analgesia".

## TRAINING OBJECTIVES:

1. Acquisition of practical working knowledge about Paediatric Pain
   - Appreciation of the difficulties of accurate pain assessment in children and the barriers to effective pain management.
   - Knowledge of the different pain assessment tools, their limitations and appropriate clinical application per child (eg with respect to age and cognitive ability).
   - Use of salient observations to corroborate accuracy of Pain Scores (viz behavior and functional limitations)
   - Concept of Pain as the 5$^{th}$ Vital Sign. Note that *regular* assessment is important) and 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.

2. The Basics of Analgesia (see chapter on Drug Doses)

a. Analgesic Pharmacology:

- Classes, Mode of Action, Pharmacokinetics, Indications and Contra-indications
- Side-effects and Treatment of Complications
- Dosing and Routes of administration
- their Treatment.

b. Good Prescription Practices for effective analgesia:

- individualized doses on a per kg body- weight basis with recommended safety limits (maximum dose x 24h)
- limit duration of therapy
- review CLMM daily to make adjustments for age, disease and risk profile)
- Match pain intensity with drug potency i.e. Provide analgesia round the clock with PRN analgesics to address breakthrough pain
- Recognise and treat Tolerance, Dependence and Withdrawal and Opiate Induced Hyperalgesia (OIH)
- Have a plan for weaning (eg Substitutions and interconversions of analgesics)

c. Analgesic Modalities

a) Simple Analgesia: oral and rectal analgesics, intra-venous morphine infusions,

b) Specialized Analgesia by the APS:
Patient Controlled Analgesia (PCA),
Continuous Epidural Infusions,
Caudal Additives (Morphine/ S+ketamine/ Clonidine)
Continuous Regional /Plexus Blocks
Continuous Wound Irrigation with LA

3. Fundamental workings of an Acute Pain Service

- APS Protocols (Admission, Prescription, Monitoring, Audit, Discharge & Follow-up)

- Appreciation of the Principles of Effective Analgesia:
- Appreciation of the Dynamic Nature of Pain and need for proactive management / provision for incident pain
- Multi-modal Approach to achieve the "Analgesic Corridor"
- Logical Prescription
    - By the Ladder (WHO Analgesic Ladder)
    - By the Clock (reserving PRN doses for rescue of Incident Pain),
    - By the Patient (constraints of age, disease, post-operative issues)
- Analgesic Plan (with a view to weaning & discharge)
    - Opiate inter-conversions e.g. from iv to oral (for APS discharge)
    - Conversion to take home prescriptions (for hospital discharge)

- Basic Trouble-shooting
- Ability to Manage Incident /Breakthrough /End of Dose Pain
- To Pre-emptively Treat Side-Effects( CLMM prescription)
- To Recognize "High Risk" patients who require implementation of additional Safety Measures (e.g. ICU care for close Monitoring, Reduction of Drug Dose, LFT ).

## THE PAEDIATRIC ACUTE PAIN SERVICE

### A. WORKFLOW

1. The Paediatric APS Team comprise of Specialist (C, AC or R), MO & Pain Nurse whenever possible.

2. Pain Rounds:

- Morning round (compulsory) usually commences at 0830h and is attended to by the designated APS team;

- Afternoon round will be done by PAIN NURSE before 1700h. Feedback of any problems will be directed to the On-Call Team / Dr Serene Lim or Dr Siow Yew Nam.
- Evening round (required for patients on Epidurals or other Continuous Regionals, as well as for any other patients on the APS who have problems controlling their Pain) is done between 1900 – 2100h by the On Call Team.

3. Hand-Over of Information and PCA pump keys

An official " hand-over" of the Pain Patients to the on-call team (by the post-call team), should be done before 1000h each day, especially if there are anticipated problems, poorly controlled pain, alterations to the analgesic management or a specific plan wrt analgesia. The PCA keys are together with the call room card key (gray pouch). *A fine as well as mandatory police report will be implemented if these are lost.*

4. Daily Duties

- Analgesic and dose adjustments (up or down as necessary)
- Management of side-effects
- Dilution (and Top up as needed) of Epidural Syringes
- Communication of Analgesic Plan to Nursing Staff & Primary Physician
- Daily Record of Patient's Progress (Both in Audit Form & Short Note in Case-Sheet Folder)
- Daily Review of Inpatient Medication Record (IMR)
- Weaning, Removal of Epidural Catheter & Signing Off patient from the APS
- Trouble-shooting

5. Blue-Letter Referrals (B/L Ref)

These should be faxed to Paediatric Reception (2227) after consultation with the Pain Consultants (Serene or Yew Nam) during office hours or the On Call Team. PAIN NURSE should also be notified. The letter as well as the reply should be photocopied and added to the PAIN FILE even if the patient is not admitted to the

APS. (Relevant Forms e.g. PCA orders) must be filled where applicable.

6. Admission to the APS:
a. Requires prior discussion/approval at Anaesthetic A/C or C level
b. Occurs either post-operatively or following Blue-Letter Referral
c. Appropriate Ward Accreditation and Monitoring is required
*Note that all continuous Epidurals/Caudal must be monitored in ICU or HD but PCAs can go out to the accredited wards (Paeds.Wards. 55,56,65,66,75,76,85 & 86)*
d. Pain education and consent should be obtained before admission.
e. Documentation
The appropriate paperwork must be done for all and the Pain File updated. Photocopy of the blue-letter with the reply should be made, stapled to the Audit form and filed. PCA Pumps are obtained from major OT (from the AU Nurse who will record the pump unit number).

7. Monitoring
All PCAs and Epidurals should be continuously monitored with respects to pulse oximetry, regularly assessed wrt Pain and Sedation Scores.Orders should be documented on the reverse of the Order Form (yellow). For PCAs, from the 2nd post-op day, pulse oximetry may be discontinued at discretion, only if and when no background infusion is used.

8. Discharge from the Service
This should be done by the Pain Team who should then notify the surgeon or physician in charge. Post-discharge interview (satisfaction/feedback) should be done on the spot, at the time of discharge and the requisite documentation (sign off) done (with date and time and signature).

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9. Miscellaneous:
Note that for 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.

## B. PAPERWORK AND PROTOCOLS

1. FORMS

a. The Acute Pain Service (APS) Audit Form *(white & purple A3)*
This form defines the location of the patient in the wards and should be kept in the ACUTE PAIN FILE (red) located in the Cupboard of the Reception Desk.
*All* relevant data must be filled in and filed in the appropriate section of the APS file. There is a section for patients *currently* being followed up by the APS as well as sections for those to be seen on *1st day post discharge* and a section for *completed* forms.

Any prescription changes (including PCA program and syringe top ups) should be recorded in both the CLMM, casenotes as well as the APS Audit Form *(white)*. This is for medico legal and billing purposes.

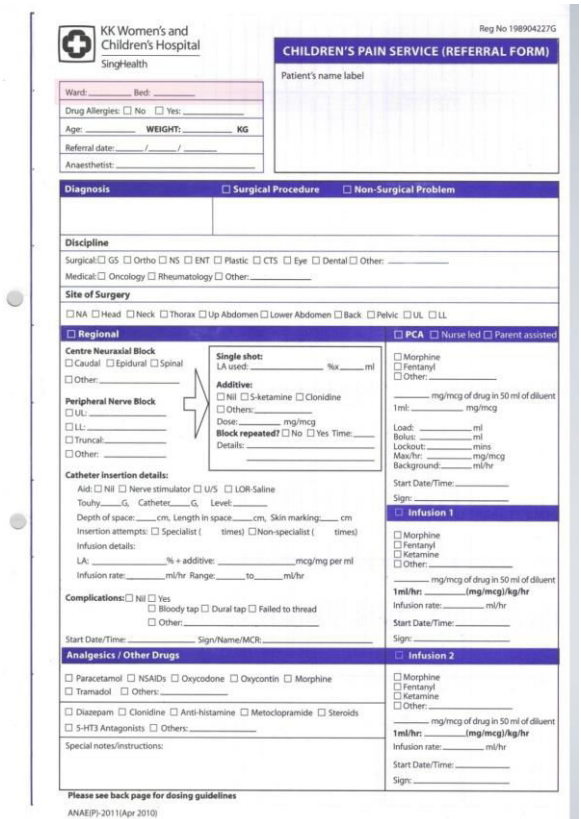
b. The Nursing Pain Flow Record *(yellow)*
Nurses are to fill this in. The prescribing Anaesthetist should check it. It must be started in the Recovery Room and continued in the ward until the patient is discharged from the APS.

c. Prescription recorded and signed in the CLMM system

The Audit & Pain File: divided into the following sections:

- Daily In-patient according to Ward (Follow-up)
- 1st Post-discharge day Follow-up
- Completed Forms
- Spare Forms
- Information and Contact Numbers

Forms



KK Women's and Children's Hospital
SingHealth

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**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
**1ml/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
**1ml/hr: _____(mg/mcg)/kg/hr**
Infusion rate: _____ ml/hr

Start Date/Time: _____

Sign: _____

**Please see back page for dosing guidelines**

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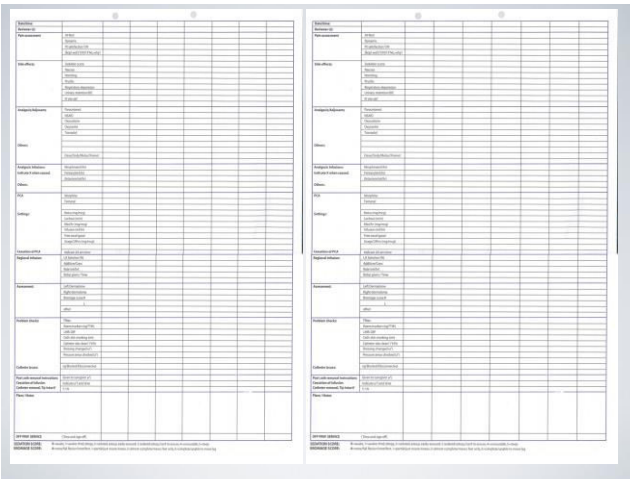

**Recommended Initial PCA and Analgesic Infusion Settings**

| 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<br>max: 1mg/ml | 0.3mcg/kg<br>max:15mcg/ml | 100mcg/kg<br>max:5mg/ml |
| **Infusion Range** | 0 - 4 ml/hr | 0 - 4 ml/hr | 0 - 4 ml/hr |
| **PCA settings** | Load: 2 mls (optional)<br>Bolus: 1 ml<br>Lock out: 5 min<br>Max/hr: 0.3 mg/kg<br>Background: 1 ml /hr (optional) | Load: 2 mls (optional)<br>Bolus: 1 ml<br>Lock out: 3 min<br>Max/hr: 5 mcg/kg<br>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<br>or<br>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 | | | | |
| | | | | **Antiemetics** | Metoclopra-mide | 0.2 mg/kg/dose (max 20mg) load 0.5mg/kg | 6 hrly (over 10 min) |
| | Tramadol | 1-2 mg/kg (max 400mg/day) | 6 hrly | | Dexametha-sone | 0.15 mg/kg (max 8mg) | Once daily (slowly) |
| | Oxycodone | 0.1-0.2 mg/kg<br>Oral oxycodone: oral morphine = 2:3 | 4 - 6 hrly | | Ondansetron | 0.1 mg/kg (max 4 mg) | 8 hrly over 10 min |
| | Oxycontin(SR)<br>*Do not Crush* | Calculate depending on opioid requirement | 12 hrly | | Promethazine | 0.5 mg/kg (max 25 mg) | 8 hrly |
| | Oral morphine | 0.2-0.5 mg/kg | 4 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<br>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

d. Equipment (PCA)

- Graseby 3300 , Omnifuse, CADD and Solis Pumps
- All opiate infusions must have an anti-reflux valve device in place

e. Changes

Daily changes and prescriptions are to be recorded in the CLMM as well as the APS data sheet. The IMR should be reviewed daily.

g. Monitoring

The Nursing Pain-flow Record mandates *hourly* assessment and monitoring of pain and sedation scores. The nurses do this. Monitoring of vital signs is done hourly for the 1st 24h and then q 4h if stable. Indicate on the chart if pulse oximetry and apnoea monitoring are required. Instruct the nurses to start this chart upon patient's arrival in the recovery room and to continue with it until the patient is discharged from the APS.

PCAs and epidural infusions must be started in the Recovery Room. Patients must be able to use the PCAs effectively before leaving the Recovery Room. Epidural patients must be comfortable and free of side effects. Changes to the initial regimen must be noted in the IMR and APS form and the attendant nursing staff informed of this. It is the responsibility of the Anaesthetist who puts the patient on the Service and the Anaesthetist in the Recovery Area to ensure that the patient is comfortable on transfer to the Ward / HD / ICU. Good communication (parent / nurse / anaesthetist / Pain Service) is essential to ensure safe and effective therapy. Problems should be made known to the anaesthetist /Pain Service and nurses in charge of the patient.

## C GENERAL GUIDELINES

### EPIDURALS

- provides excellent analgesia for young children when dermatomal coverage is appropriate

- in infants, risk-benefits must be carefully weighed, discussed and consent documented
- invariably done under GA
    - strict asepsis must be maintained (scrub, gown, adequate skin prep)
    - technique (see Regionals protocol)
    - indications: thoraco-abdominal ops, some laparotomies, major urological procedures, major orthopaedic ops involving hip or knee etc.
    - contraindications: parental objection, coagulopathy, sepsis, allergies to drugs used, inadequate monitoring facilities post op

a. Prerequisites :
- should have a working IV line
- total dose should not exceed toxic limits:
    Lignocaine: 4 - 5mg/kg
    Lig et adrenaline: 7mg/kg
    Bupivacaine: 2 - 3mg/kg

b. Dosing (consider dermatomal spread and toxic limits)
- Bolus: concentration - 0.1 - 0.25% bupivacaine
- Volume : load to achieve desired dermatomal coverage
  0.5 – 0.75 ml/kg (max. 1.0 ml/kg)
- Infusion limits :
    infusion rate : 0.1 - 0.4 ml/kg/h of 0.1% bupivacaine
    +/- an added opiate: fentanyl (usually) 1-2mcg/ml
    OR
    morphine (to improve spread) 5 mcg/ml

NB.
- For patients < 3/12 : AVOID adding ANY OPIOIDS in the epidural infusion

- Do NOT exceed infusion rate of 0.2 ml/kg/h of 0.1% solution
- For patients under 1 year : Do NOT exceed infusion rate of 0.3 ml/kg/h rate of 0.1% bupivacaine and 1 μg/ml fentanyl

## EPIURAL SOLUTIONS ARE DILUTED BY THE ACUTE PAIN SERVICE TEAM (AND NO ONE ELSE!!)

**CADD pumps with reservoir bags of 50, 100, 250 ml volume are available. YELLOW tubings & YELLOW covers are used for EPIDURAL infusions.**

NB: Ropivacaine or Levo-bupivacaine can also be used instead of Bupivacaine at the same concentration of 0.1%

**Epidural Opiates (not frequently employed)**

- Epidural Morphine bolus: 30 – 50 mcg/kg q 12h
- Do NOT use in infants < 6/12
- Do NOT exceed 30mcg/kg as a bolus in children <3yr
- REDUCE the dose if Epidural is sited in the thoracic area.
- Epidural Fentanyl bolus = 0.5 - 1.5 mcg/kg q 4h

**** Diluent for Epidurals must be normal saline.**
**All drugs must be preservative free.**

c. Prescription and labelling :
- both order form and APS form must be filled in
- infusions (syringes ) must be clearly labelled with the patient's name, drug, dosage, diluent, date and time syringe was prepared, and "FOR EPIDURAL USE ONLY" and signed.

d. Always use a filter. Make sure all connections are secure and cover connections with a plastic bag

e. Dressing : always use a “window” dressing to facilitate inspection of the insertion site and catheter marking at skin level. Double Tegaderm® application (small and big) reduces the incidence of catheter leak. Ensure catheter is taped so that the catheter marking at skin is clearly visible.

**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.

## CAUDALS

Same principles (as for epidurals) apply except that if no opiate has been added, patient does not require ICU or HD.

For single shot caudals with morphine, no narcotics should be given until at least 6h has elapsed.

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.

Dosing :

- Bupivacaine 0.1 - 0.25%

Do not exceed dose limit in terms of mg/kg. If calculated volume contains more drug than allowed, use the maximum allowed limit and dilute with normal saline to reach calculated volume.

LA Volumes – Dermatome to be anaesthetized:
*Armitage (modified):
0.5 ml/kg: perineal
0.75 ml/kg: inguinal
1 - 1.25 ml/kg: periumbilical

*Takasaki: 0.06 ml/segment/kg or 0.7 ml/kg

## COMMON PROBLEMS IN APS

1. Inadequate pain relief
This is usually from inadequate levels or malposition of catheter tip and occasionally from a failed block. It is good to pre-empt pain and bolus a sufficient volume of LA intra-op or post-op before starting the infusion. Adding some epidural fentanyl (either as a bolus or to the infusion) may be helpful. Unless the epidural is sited sufficiently close to the segment required for analgesia, it will be difficult to achieve excellent analgesia without giving huge volumes of LA.
If an epidural morphine (hydrophilic) bolus is used, this should be given at least 1 h before completion of surgery to give it adequate time to take effect.
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.
If rectal paracetamol is to be effective, it should be given early enough to have an effect (e.g. at the start of a short case).

*Solution :*
Check epidural site (for catheter kink / migration ) and then slowly bolus lignocaine 0.5 - 1% (about 0.5 – 1 ml/kg) to assess whether it is working. 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 and 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 (difficult 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 < 8 (see order forms).

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

This is 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®) 0.5 mg/kg over 15 minutes, q6h can be given. Warning: Diphenhydramine can give rise to significant somnolence! Alternatively very low dose naloxone can be given. Low dose Naloxone i/v infusion can also 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

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

9. Numbness

Document dermatomal level, extent, associated motor weakness and dysaesthesias. May reduce the epidural LA concentration. Remove if unresolved.

10. Urinary Retention

Urinary catheterisation may be necessary.

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

a) Epidural haematoma
b) Snapped/ retained catheter
c) Inadvertant Dural Tap
d) Spinal Headache

e) Cauda Equina Syndrome

**STANDARD DILUTION**
Bupivacaine 0.1% with Fentanyl 2 mcg/ml

| Total Volume in TPN Bag | Bupivacaine 0.5% | Fentanyl ** 50mcg/ml | Normal Saline 0.9% |
|---|---|---|---|
| 300ml | 60ml (6 vials) = 300mg | 12ml = 600mcg | 228ml |
| 400ml | 80ml (8 vials) = 400mg | 16ml = 800mcg | 304ml |
| 500ml | 100ml (10vials) = 500mg | 20ml = 1000mcg | 380ml |

** Big Ampoule = 500mcg/10ml
Small Ampoule = 2mcg/ 2ml

f)

**CLONIDINE as Additive**
Bupivacaine 0.1% with Clonidine 1 mcg/ml

| Total Volume in TPN Bag | Bupivacaine volume [0.5% or 5mg/ml] | Clonidine volume **150mcg/ml | Normal Saline volume (0.9%) |
|---|---|---|---|
| 300ml | 60ml (6 vials) = 300mg | 2.0ml = 300mcg | 238.0ml |
| 400ml | 80ml (8 vials) = 400mg | X.ml = 400mcg | 320 -Xml |
| 500ml | 100ml (10vials) = 500mg | 4.0ml = 500mcg | 400-Y ml |

NB: Be Very Careful & Triple-check Units
Dilute to X : clonidine 150mcg in 3 mls, discard 1 ml i.e. = 100mcg in 2ml + undiluted 2ml from vials gives total of 400mcg in 4ml i.e. X=4ml
Dilute to Y mls: clonidine 150mcg in 3 mls, discard 2 ml i.e. = 50 mcg in 1ml + undiluted 3 ml from vials gives total of 500 mcg in 4ml i.e. Y=4ml

g)

**SPECIAL DILUTION**
A Bupivacaine 0.1% with Morphine* 0 mcg/ml

| Total Volume in TPN Bag | Bupivacaine 0.5% | Morphine **1,000mcg/ml | Normal Saline 0.9% |
|---|---|---|---|
| 300ml | 60ml (6 vials) = 300mg | 1.5ml = 1,500mcg | 238.5ml |
| 400ml | 80ml (8 vials) = 400mg | 2.0ml = 2,000mcg | 318.0ml |
| 500ml | 100ml (10vials) = 500mg | 2.5ml = 2,500mcg | 397.5ml |

** Use 1ml syringe to draw from sterile PRE-DILUTED 10ml syringe of Morphine 1mg/ml (or 1,000mcg/ml)
NB: Be Very Careful & Triple-check Units

h)

## PATIENT CONTROLLED ANALGESIA (PCA)

PCAs - recommended for patients 6 yrs and older; maturity of the child needs to be assessed.

Prerequisites :

1. Understanding of PCA and its concept
2. Able to press the handset button

3. Not contra-indicated (e.g. medical condition / allergies / drug addiction )
4. Parents instructed not to press button for child.

Pump Settings :
CADD or Graseby pumps are used (Check availability)
Steps :

- note total opiate use in 24 h and good/total demands
- clear old patient data.
- check that appropriate syringe type / size is used.
- check that settings are appropriate for the drug used and child's weight

NB pump should be programmed to limit max. dose deliverable in 1 hour (NOT 4h)
Recommended limits are printed on the order form and should not be exceeded.

Dilution:
Note that there are 2 standard ways of diluting the narcotic infusion described in the order form; for those < 50kg and ≥ 50kg *(specify the actual dilution);* Anti-reflux valve is to be used at all times.
All orders must be clearly written and signed.

Continuous infusions are NOT recommended as a routine unless child is adequately monitored or expected pain is severe eg scoliosis patients. Remember to wean the background infusion after 24-48h
Because of accummulation of norpethidine and its tendency to cause tremors, pethidine infusions are not recommended.

The Lockout time range varies with the opiate profile 5 min given on the form is for Morphine and 3 min for fentanyl

**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 or pethidine.
Dose increments are usually associated with increased side-effects.
Adjuvant analgesics (PO / PR) may help.

2. Pruritus (Management as for Epidurals)

3. Nausea and vomiting (Management as for Epidurals)

PCAs are usually kept for 2 - 3 days, but may be continued for longer period if indicated.
Drips may need to be re-sited if inflammed.
Once the child is taking orally, start him / her on oral analgesics q 6 - 8h (whilst still on the PCA). This will help weaning off the PCA and will provide better analgesia.

Pumps are kept in the Paediatric OT reception cupboards.
PCA keys are kept in the following places: SR/R/MO-on-call pouch, with the Nurse in-charge of CD drugs in OT, ICU and Wards 65, 55 and 85.

## ASSESSING PAIN SCORES

This must be assessed daily and for 2 situations: at rest & on movement / deep breathing.

**FLACC Scale**: for age 3yrs and younger. (see table overleaf)
This is a Behavioural Pain Measure scored on a series of observations of known pain manifestations.
Maximum score = 10, Minimum score = 0

Need for active pain management and additional analgesics if score is 3 or more

**FLACC 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 |

**WONG-BAKER FACES Scale**: for age 3 - 5yrs.
Self-report score. Child needs to understand concepts of less, more, least and most.
Need for active pain management and additional analgesics if score is 3 or more


**NUMERIC RATING Scale**: for age > 5y and older.
Self-report Pain Score based on numeric rating of Pain Intensity

**0 1 2 3 4 5 6 7 8 9 10**

**No Pain** **Worst Pain**

## ALTERNATIVE ANALGESIA

**Paracetamol**

| | |
|---|---|
| Syrup | 120mg / 5 ml (KKH pharmacy stock) |
| Tablets | 500mg |
| Suppositories | 125mg, 250mg, 325mg 650mg |
| Intravenous | |

Dosing: (*daily maximum dose should not be exceeded!)*

| | |
|---|---|
| Oral (PO) | |
| Antipyretic dose | 10mg/kg q 4-6h |
| Analgesic dose | 15mg/kg q 4-6h |
| Max daily limit: | 60 – 90mg/kg/day |

NOT MORE THAN 1g6h

| | |
|---|---|
| Rectal (PR / Supp) | 20 – 30mg/kg q 4 – 8h |
| Max daily limit: | 100 – 200mg/kg/day |

NB:
Rectal absorption is slow and incomplete. The first dose PR should be 30 - 40 mg/kg and subsequent doses 25 - 30 mg q 6 - 8h. This should be reviewed after 2 days and converted to oral formulation as soon as possible. Always check that prescription falls within the maximum daily limit.

**Caution:**
1. Rectal routes should be avoided in neutropenic patients.
2. For neonates, use lower dose and lengthen the dosing interval. Prescription should be reviewed daily e.g. PO 10 mg/kg 8 -12 h PR 20mg/kg q 8h- 12h
3. Always check patient IMR for previous paracetamol dosing and adjust dose and timing accordingly to avoid accidental overdose.
4. If patient has evidence of sepsis, is hypotensive or on concurrent liver enzyme reducing drugs, reduce the dose or omit altogether.
5. Avoid in impaired liver function. Contra-indicated in liver failure.

## NSAIDS (Non-Steroidal Anti-inflammatory Drugs)

Caution:
1. Caution in children < 3 years of age.
2. Best avoided if child is atopic / asthmatic / has nasal polyps/ renal disease.
3. Contraindications: documented allergy, bleeding, peptic ulcer disease, platelet dysfunction.

i. Diclofenac (Voltaren®)
- Suppositories: 12.5 mg, 50mg
- Intramuscular: 75 mg//3 ml
- 1% Gel

Dosing:
- Suppository: 1 mg/ kg q 8 - 12h
- Intramuscular: same as suppository

ii. Ibuprofen (Brufen®)

- Syrup: 100mg/ 5ml
- Tablet: 400 mg tabs
- Dosing:
- Syrup/ Oral: 10 mg/ kg q 8h

iii. Ketorolac (Toradol®)

- Injection: 30 mg/ ml
- Dosing:
- Intravenous: 0.25 – 0.5 mg/ kg q 8h *(as an infusion over 30 minutes)* limit use to 48 -72h only

iv. Naproxen Sodium (Synflex®)

- Capsule: 275 mg caps
- Dosing:
- Oral: 5 mg/ kg q 12h

**Opioids**

1. Codeine Phosphate
   - Tablet : 30 mg
   - Injection: 50 mg/ml
   - Supp *(currently not available)*

2. Oxycodone
   - Normal OXYNORM tablets: 5 mg
   - Slow-release OXYCONTIN: 10 mg, 20 mg

3. Morphine
   - Injection: 10 mg /ml
   - *NB: oral dosing is 3x that of intravenous dose*
   - Mist Morphine (syrup): 5 mg/5 ml
   - Slow-release (MS-Contin): 10 mg, 30 mg

## PRESCRIPTION: MORPHINE

- *< 50kg*

  *Syringe preparation*
  Morphine = Body Weight (mg)
  in 50ml total volume
  1 ml = 20 mcg/kg
  1 ml/h = 20 mcg/kg/h

- *Recommended Settings:*
  Bolus = 1 - 2 ml
  Lockout = 5 min
  Max.1-h Limit = 200 - 300 mcg/kg/h
  Basal Infusion = 0 - 15 mcg/kg/h
  Loading Dose = 100 - 200 mcg/kg

- *50kg and above (like adults)*

  *Syringe preparation*
  Morphine = 50mg in
  50ml total volume
  1 ml = 1 mg
  1 ml/h = 1mg/h

- *Recommended Settings:*
  Bolus = 1 - 2 ml
  Lockout = 5 min
  Max. 1-h Limit = 15mg
  Basal Infusion = 0 - 1.5ml/h
  Loading Dose = 0.1 - 0.2 mg/kg

*NB: Background Infusion of 2ml /h on top of PCA boluses are associated with increased sedation & episodes of desaturation; as opposed to simple morphine infusions in children (Study by Berde et al) and need to be adequately monitored.*

4. Fentanyl
   - Injection: 100 mcg/2ml, 500 mcg/10ml
   - Transdermal Patch *(various strengths)* @ 25 mcg/h lasts 72h

## PRESCRIPTION: FENTANYL

- *< 50kg*

- *Syringe preparation*
  Wt. x 15 (mcg) Fentanyl
  in 50ml total volume
  [1 ml = 0.3 mcg/kg]

- *Recommended Settings:*
  Bolus = 1 - 3 ml
  Lockout = 3 - 4 min
  Max. 1-h Limit = 4 mcg/kg
  Basal Infusion = 0 - 1.5mcg/kg/h
  Loading Dose = 0.5 - 2 mcg/kg

NB: For the opioid tolerant ASA 1-2 patient with severe pain, syringe preparation can increase to 0.5mcg/kg in 1 ml i.e.
Wt x 25 (mcg) Fentanyl in 50 mls total volume

- *50kg and above*

- *Syringe preparation*
  Fentanyl 25 mcg /ml
  in 50ml total volume
  [1 ml = 25 mcg]

- *Recommended Settings:*
  Bolus = 1 - 2 ml
  Lockout = 3 - 4 min
  Max. 1-h Limit = 250 mcg
  Basal Infusion = 0.5 - 1.5 ml/h
  Loading Dose = 25 - 100 mcg

5. Pethidine
- Injection: 50mg/1 ml

6. Buprenorphine (Subutex®)
(mixed agonist/antagonist)
- Tablet: 0.2 mg

**Others**

7. COMBINATIONS
Panadiene®
- Tablet: 1 tablet consists of 500mg paracetamol + 8mg codeine

Dosing:
- Oral: limited by paracetamol dose

8. Ketamine
NMDA receptor antagonist, reduces morphine tolerance, improves analgesia.
- Injection: 50mg/ml

Dosing:
- Intravenous bolus: 0.1 – 0.2 mg/ kg
- Infusion: 0.16 – 0.32 mcg/kg/min
- *Body weight x 5 in 50 mls Normal Saline*
- *1 ml/h = 0.16 mcg/kg/min*
- Infusion range: 1 – 2 ml/h

9. Tramadol (Tramal®)
- Capsule: 50mg
- Injection: 50mg/ml

Dosing:
- 1 - 2 mg/kg 4 – 6 hourly