

Paediatric Anaesthesia Rotation  
Orientation Booklet

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University of KwaZulu-Natal



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Welcome to your paediatric anaesthesia block. This booklet is intended to assist you in the basics of paediatric anaesthesia. The information ranges from orientation from a practical point of view and also covers academic areas of paediatric anaesthesia. The head of the clinical division of paediatric anaesthesia is Dr Kampik.

I welcome any suggestions or alterations for this booklet. All references are available on request. I hope you find your rotation to be enjoyable and beneficial.

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## IMPORTANT CONTACT NUMBERS

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Anaesthetic Tea Room			2450
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B3W – Call Room			1597
C4W (Paeds High Care)			2073/4
ICU 4 (Paeds ICU)			2038/40
NICU			2485
Neonatal Isolation			2489
Blood Bank			1502
Clinical Technologists			2076
Chemistry			2574/5
Haematology			2689/90
Virology			2589/90

## **CORE KNOWLEDGE – DOMAIN 7 (CMSA FCA PART II CURRICULUM)**

### **Trainee's Aims**

In Domain 7 clinical experience is gained from participating in anaesthesia for paediatric patients. The aim of Domain 7 is for Trainees to acquire knowledge and a series of clinical abilities and skills in the perioperative and peri-anaesthetic care of paediatric patients. These include:

- Conducting or assisting in anaesthesia and peri-operative / peri-anaesthetic care for emergency and elective anaesthesia for patients in all paediatric age groups, including adolescents
- Recognising the skills and facilities required for various procedures in children of various ages and with various medical conditions
- Demonstrating paediatric and neonatal resuscitation skills

### **Knowledge**

#### **Basic Sciences**

Trainees are required to revise the relevant subjects in the Basic Sciences. Trainees are expected to apply Basic Science principles in clinical practice.

Basic Science subjects relevant to neonates, infants and older children include the following:

- Risk factors relevant to Morbidity and Mortality in paediatric anaesthesia
- Anatomy relevant to airway management and breathing, circulation and regional anaesthesia
- The physiology of respiration, circulation, fluid balance and thermoregulation
- The relevance of surface area of children of various ages
- Stages of physical and psychological development of the normal child
- The pharmacology of anaesthetic agents, analgesics and common paediatric medications, especially the relationship of dose to the size/maturity of child

#### **Considerations for Paediatric Anaesthesia**

- Stages of development of the normal child and their relevance to hospitalisation
- General principles of perioperative management relevant to children, emphasising:
  - o common childhood illnesses and their influence on anaesthesia and surgery
  - o fasting guidelines
  - o fluid and electrolyte replacement
  - o temperature control
  - o specialised equipment for children of different sizes
  - o perioperative monitoring
  - o laboratory issues (haemoglobin, BGA, Blood glucose, coagulation testing)
  - o dosage and administration of emergency drugs
  - o drug dosing and relevant pharmacology
  - o postoperative apnoea detection, causes, monitoring, risk factors, management
  - o Recognition of postoperative problems (PONV, Emergence delirium, post-extubation stridor, hypothermia)
  - o acute and persistent pain management
  - o paediatric day case surgery

#### **Relevant features of important childhood conditions, particularly:**

- respiratory infections including PTB, bronchiolitis
- asthma
- prematurity and its complications
- facial anomalies affecting the airway including cleft lip and palate
- neonatal emergencies; especially respiratory distress, tracheo-oesophageal fistula, congenital diaphragmatic hernia, necrotising enterocolitis, abdominal wall defects, ROP, IVH, PDA, NEC
- other childhood emergencies; especially inhaled/ingested foreign bodies, fractures, head injuries and burns

- congenital cardiac disease; especially ASD, VSD, Tetralogy of Fallot
- cerebral palsy and seizures
- Muscular and neuromuscular diseases incl. malignant hyperthermia
- chronic diseases of childhood; especially cystic fibrosis
- congenital syndromes; especially Down's, Pierre-Robin, Mucopolysaccharidoses
- congenital and acquired bleeding disorders
- the child at risk
- malignancy and the treatment of malignancy
- renal failure

General principles of paediatric intensive care and paediatric emergency medicine, including resuscitation of the neonate, infant and child and general principles of the management of the neonate and the premature baby.

### **Clinical Management**

Trainees are expected to understand relevant principles, apply knowledge in practice and to demonstrate abilities in paediatric anaesthesia care. These include the following.

- Applying principles of paediatric anaesthesia for the following surgical sub-specialties:
  - o Neurosurgery
  - o Ophthalmology
  - o Dental surgery
  - o Plastics and reconstructive surgery
  - o Thoraco-abdominal surgery including laparoscopic/ thoracoscopic techniques
  - o Cardiac surgery and procedures, including cardiac catheterisation
  - o Urology surgery and procedures/investigations
  - o Orthopaedic Surgery
  - o Otorhynolaryngology
  - o General surgery
  - o Interventional radiology
  - o Trauma and Burns
- Preoperative evaluation and premedication
- Postoperative recovery room management and the initial stabilization of vital parameters of children who require intensive care management
- Management of airway and breathing problems such as: cannot ventilate, cannot intubate, hypoxia, hypercarbia, bronchospasm; apnoea; upper airway obstruction; upper airway infections; inhaled foreign body; laryngospasm; stridor; aspiration of gastric contents; seizures
- Principles and management of the child at risk for regurgitation
- Management of difficult venous access
- Applying principles of paediatric anaesthesia for diagnostic procedures
- Recognising and managing the sick child
- Recognising and managing reversal to transitional foetal circulation
- Managing fluid and blood therapy in paediatric patients
- Post-operative anaesthetic complications eg laryngospasm, emergence delirium
- Managing specific childhood syndromes and disorders
- Applying principles of paediatric anaesthesia for procedures outside the operating theatre, including patient transport
- Caring for paediatric patients undergoing imaging investigations, which may require sedation or anaesthesia
- Recognising and managing paediatric emergencies including basic and advanced life support
- Understanding the organisation of a paediatric anaesthesia and analgesic service
- Recognising psychological issues relevant to hospitalised children

## **Skills**

### **Clinical Skills**

In this Domain, Trainees will provide safe anaesthesia for paediatric patients and the support of the critically ill child.

Trainees will revise pre-assessment skills, including taking an appropriate history and performing an appropriate physical examination (including airway assessment, cardiovascular, respiratory and neurological examinations) to assess the patient's status.

Trainees will demonstrate decision-making and clinical skills, and perform drills such as paediatric advanced life support, to manage emergencies and conditions including the following.

- Hypoxia
- Bronchospasm
- Apnoea
- Upper airway obstruction including upper airway infection
- Bradycardia (and other arrhythmias)
- Cardiac arrest
- Hypovolaemia
- Neurological compromise
- Epiglottitis and croup
- Inhaled foreign body
- Infantile airway obstruction
- Laryngospasm
- Masseter spasm
- Postoperative stridor
- Aspiration of gastric contents
- Skills learned in Domains 1 and 2 should be reviewed
- Technical skills, such as airway management (including ventilation, laryngeal mask and intubation, fiberoptic intubation through the LMA and use of other special equipment, nasal-pharyngeal tube CPAP/assisted ventilation), vascular cannulation, including intraosseous access and regional anaesthesia should be demonstrated for paediatric patients
- Interpersonal skills in dealing with paediatric patients and their carers should be demonstrated

## **Attitudes and behaviours**

### **Paediatric Considerations**

The following attitudinal considerations are important in caring for children:

- Varied individual needs of hospitalised children
- Communication with children and their carers
- Interaction with children that is appropriate to their developmental age
- Psychosocial aspects, especially the stress of separation experienced by children and their carers alike
- Strategies to provide informed consent for procedures or research and disclosure of risk when consulting with children and carers
- Planning of post-operative management, particularly of pain, stress and post-operative nausea and vomiting
- Follow-up after anaesthesia complications

## **CORE READING MATERIAL**

- Any anaesthesia text book
- Additional material is available on the IALCH system:
  - o My Computer\Z:\Anaesthetics\Public\Paediatric Surgery\Core Material
- You shall be sent a link to the Paeds Dropbox Folder

## **BLOCK STRUCTURE:**

The Paediatric Surgeons have elective slates in Theatre 9 on Tuesdays, Wednesdays, Thursdays and Fridays. Mondays are just emergencies.

The surgeons have a meeting on Wednesdays at 8am in the seminar room in A-Block. You are expected to attend this meeting in your "on call" week.

Other paediatric slates that you shall be assigned to include:

- Mondays:
  - o Ophthalmology
  - o Plastics
  - o Cardiac cath
- Tuesdays
  - o Burns
- Wednesdays
  - o Craniofacial
- Thursdays
  - o Orthopaedics
  - o Burns
- Fridays
  - o ENT
  - o Burns

Paeds database – All OT 09 cases are to be recorded in the paediatric database on the system. This can be found at: My Computer\Z:\Anaesthetics\Public\Paediatric Surgery\Paediatric Surgery database collection.

## **PREOPERATIVE VISIT**

### **Elective Slates**

- See all patients on the afternoon / evening before the slate
- Discuss all cases with the consultant. Photographs of the yellow forms via whatsapp is appreciated by some consultants
- Please counsel the parents fully with regards to blood transfusion, neuraxial anaesthesia & peripheral nerve blocks. Explain any planned invasive monitoring to the parents. Document the consent on the theatre consent form & the yellow chart.

### **Fasting Guidelines – as per PACSA Consensus Guideline 2019**

Age	Liquids	Fasting Time
All ages	Clear fluids	1 hour
All ages	Breastmilk	4 hours
All ages	Formula	6 hours
All ages	Solids	6 hours

Clear fluids are defined as water, clear (non-opaque) fruit juice or squash / cordial, ready diluted drinks and non-fizzy sports drinks. Non thickened, non-carbonated.

Volume: 3ml/kg

Please be clear with your orders on the yellow form, e.g.: "last breastfeed at 4am. Clear fluid 30ml orally at 7am".

### **Premedication:**

Contra-indications:

- < 1 year old (relative – discuss with consultant)
- Airway problems:
  - o Sleep apnoea
  - o Snoring
  - o Syndromes
- Other problems e.g. bowel obstruction

Drug	Route	Formulation	Dose	Comments
Paracetamol	Oral	24mg/ml	30mg/kg	Load if Paracetamol naive
			15mg/kg	Following loading dose
				(IV does not need loading dose)
Trimeprazine (Vallergan forte)	Oral	6mg/ml	2mg/kg	Long duration of action
Midazolam & Paracetamol	Oral	Use IV prep of midazolam (bitter) & mix with paracetamol	0.5mg/kg (M) 20mg/kg (P)	Only for use in OT Supervision by senior
Ketamine	Oral	10 or 100mg/ml	5 – 10mg	Mix with paracetamol to improve taste
Dexmedetomidine	Intranasal	4mcg/ml	2mcg/kg	Takes 45 min to work



## **NORMAL PHYSIOLOGICAL VARIABLES**

<b>Age</b>	<b>Pulse*</b>	<b>Resp Rate</b>	<b>SBP</b>	<b>DBP</b>
Prem	120 – 170	40 -70	55 – 75	35 - 45
0 – 3 months	100 - 150	35 – 55	65 – 85	45 - 55
3 – 6 months	90 – 120	30 – 45	70 – 90	50 - 65
6 – 12 months	80 - 120	25 – 40	80 – 100	55 - 65
1- 3 years	70 – 110	20 – 30	90 – 105	55 - 70
3 – 6 years	65 - 110	20 – 25	95 – 110	60 - 75
6 - 12 years	60 - 95	14 – 22	100 – 120	60 - 75
> 12 years	55 - 85	12 – 18	110 – 135	65 - 85

Note:

- \* Heart rate changes in sleep and awake states
- This is a guide only – always refer to the normal value in your patient
- Blood pressure is dependent on weight & height

Other useful tricks:

- Neonate & young infant – MAP equivalent to gestational age (i.e. 45 weeks = 45 mmHg)
- SBP in 1 – 10-year-old = (age x 2) + 70mmHg

### **Normal Oxygen Saturation Values**

Productal values in neonates:

<b>Age (minutes)</b>	<b>Value</b>
1	60 – 65%
2	65 – 70%
3	70 – 75%
4	75 – 80%
5	80 – 85%
10	85 – 95%

No baby less than 2kg should have sats > 92% (range 88 – 92%)

### **Normal ABG values**

<b>Parameter</b>	<b>Neonate</b>	<b>1 – 24 Months</b>	<b>&gt; 24 Months</b>
pH	7.30 – 7.40	7.30 – 7.40	7.35 – 7.45
PaCO <sub>2</sub>	30 – 35mmHg	30 – 35mmHg	35 – 45mmHg
HCO <sub>3</sub> <sup>-</sup>	20 - 22mEq/L	20 – 22mEq/L	22 – 24mEq/L
PaO <sub>2</sub>	60 – 90mmHg	80 – 100mmHg	80 – 100mmHg

### **Coagulation Indices**

<b>Parameter</b>	<b>24 - 29 wk</b>	<b>30 – 38 wk</b>	<b>Term</b>	<b>Adult</b>
PT	19 - 44	16 - 30	12 - 23	11.4 - 14
INR	6.2	3.0	1.7	1.1
aPTT	87 – 210 (154)	76 – 128 (104.8)	35 – 52 (44.3)	25 – 29 (33)

Note: standard coagulation tests are unreliable in neonates. Please perform a TEG

## **EMERGENCY DRUGS**

### Adrenalin

- Cardiac arrest 10mcg/kg
- Anaphylaxis 5 – 10 mcg/kg

### Adenosine

- Initial dose: 0.1mg/kg rapid IV push (max 6mg)
- 2nd dose: 0.2mg/kg rapid IV push (max 12mg)

### Amiodarone

- Load: 5mg/kg load over 20 – 60min (dilute in 5% dextrose water)
- 5-15 mcg/kg/min (max 1.2g / 24 hours)

Atropine - 20mcg/kg (can repeat once)

Dantrolene - 1mg/kg (quoted maximum 10mg/kg)

Hydrocortisone - 2mg/kg

Insulin - 0.14 IU/kg/hour

Intralipid 20% (local anaesthesia toxicity)

- Bolus:
  - o 1.5ml/kg over 1 minute
  - o Repeat every 5 minutes until ROSC or a max of 5ml/kg
- Infusion:
  - o 0.25ml/kg/minute
  - o Persistent hypotension – increase infusion to 0.5ml/kg/min
  - o Maximum dose 8ml/kg

### MgSO<sub>4</sub>

- Load 30 - 50mg/kg over 20min; Maintenance 30mg/kg/hour

Naloxone - 10mcg/kg

### Phenylephrine

- Bolus: 1mcg/kg (max 10mcg/kg)
- Infusion: 1 – 5 mcg/kg/min

### Sodium Bicarbonate 8.4%

- Dose in ml = 0.3ml x Base Deficit x weight (kg)
- Administer over 30 min, recheck and can repeat the dose

### Hyperkalaemia (K<sup>+</sup> shift)

- Calcium gluconate 0.5ml/kg OR Calcium chloride 0.2ml/kg
- Glucose 200mg/kg
- Insulin 0.1 units/kg

Hypokalaemia - 0.3 – 0.4 mmol/kg/hour over 4-6 hours (max 4mmol/kg/day)

### Defibrillation

- Monophasic 2J/kg; 4J/kg; 4J/kg (max 10J/kg)
- Biphasic 1J/kg; 1J/kg; 2 J/kg

Synchronised Cardioversion - 0.5 J/Kg; 1 J/kg; 2J/kg

## **ANTIBIOTICS**

<b>Drug</b>	<b>Dose (mg/kg)</b>
Cefoxitin	25 – 60 (30)
Cefazolin	20 - 30
Cefuroxime	50
Ampicillin	30
Metronidazole	7.5
Amoxicillin Clavulanate (Augmentin)	30
Fluconazole	5
Ceftriaxone (Rocephin)	30
Gentamicin	3 - 6
Amikacin	15
Clindamycin	3 - 6
Vancomycin	15 (over 60 minutes)
Ciprofloxacin	4-7
Piperacillin Tazobactam (Tazocin)	50 – 100 (90)

### **Prophylaxis Against Infective Endocarditis:**

Indications:

- Prosthetic cardiac valve
- Previous infective endocarditis
- Congenital heart disease
  - o Unrepaired cyanotic (including shunts & conduits)
  - o Repaired congenital heart defects with prosthetic material
  - o Repaired congenital heart disease with residual defects
- Cardiac transplant

Relevant Procedures:

- Dental procedures:
  - o manipulation of gingival tissue / periapical region of teeth / perforation of mucosa
- Respiratory Procedures
  - o Invasive procedure with incision / biopsy of tract (not purely diagnostic)
- Genitourinary / GI
  - o Not for purely diagnostic procedures
- 

Drug Regimes:

- Single dose 30 – 60 minutes prior to procedure
  - o 1<sup>st</sup> line:
    - Ampicillin 50mg/kg
  - o Ampicillin allergy:
    - Cefazolin 50mg/kg
    - Ceftriaxone 50mg/kg
    - Clindamycin 20mg/kg
- If enterococci may be encountered:
  - o Ampicillin OR Vancomycin 15mg/kg

## CVS DRUGS

### DOSAGES OF VASOACTIVE DRUGS GIVEN AS INFUSIONS

Adrenalin:	0.05 – 1 mcg/kg/min
Dopamine:	2 – 20 mcg/kg/min
Dobutamine:	2 – 20 mcg/kg/min
Noradrenalin:	0.1 – 1 mcg/kg/min
Phenylephrine:	1 – 5 mcg/kg/min
Milrinone:	0.375 – 0.75 mcg/kg/min (load 50 mcg/kg over 10 min)
Labetalol:	0.25 – 3 mg/kg/hr, bolus 0.2 – 1.0 mg
Prostin:	0.01 – 0.1 mcg/kg/hr

Calculations as per 50ml syringe

- 1) This can be used for any drug used as an infusion
- 2) Select drug dosage to be delivered (mcg/kg/min)
- 3) Calculate infusion rate (from centre of table)
- 4) Calculate mg to be mixed in a 50ml syringe

	0.15mg/kg in 50ml	0.3mg/kg in 50ml	0.6mg/kg in 50ml	1.5mg/kg in 50ml	3mg/kg in 50ml	6mg/kg in 50ml	15mg/kg in 50ml	30mg/kg in 50ml	60mg/kg in 50ml
mcg/kg/min	ml/hour	ml/hour	ml/hour	ml/hour	ml/hour	ml/hour	ml/hour	ml/hour	ml/hour
0.05	1								
0.1	2	1							
0.2	4	2	1						
0.3	6	3	1.5						
0.4	8	4	2	1					
0.5	10	5							
0.6	12	6	3						
0.7	14	7							
0.8	16	8	4						
0.9	18	9			1				
1.0	20	10	5	2	1				
1.5		15		3	1.5	1			
2.0		20	10	4	2	1			
3.0				6	3	1.5			
4.0			20	8	4	2	1		
5.0				10	5		1		
6.0				12	6	3			
7.0				14	7				
8.0				16	8	4			
9.0				18	9			1	
10.0				20	10	5	2	1	
12.0					12	6			
14.0					14	7			
15.0					15		3	1.5	
20.0					20	10	4	2	1
25.0							5		
30.0						15	6	3	1.5
40.0						20	8	4	2
50.0							10	5	
100.0							20	10	5
150.0								15	
200.0								20	10

Note – Easiest is to mix 3mg/kg then 1ml/hour = 1mcg/kg/min

## **ANAESTHETIC AGENTS**

### **INDUCTION AGENTS**

Etomidate:	0.3mg/kg
Ketamine:	2mg/kg (IV)
Propofol:	2-3mg/kg
Neonates:	3-6mg/kg
Thiopentone:	4-6mg/kg
Neonates :	2-4mg/kg

### **MUSCLE RELAXANTS**

Atracurium:	0.5mg/kg
Cisatracurium:	0.15 – 0.2mg/kg
Mivacurium :	0.1- 0.2 mg/kg
Pancuronium:	0.1mg/kg. Top up:10 – 20mc/kg
Rocuronium :	0.6mg/kg; RSI – 1mg/kg. Top up: 0.15mg/kg
Suxamethonium:	1-2 mg/kg
Vecuronium :	0.1mg/kg

Cisatracurium – adult data

Dose (mg/kg)	Time to 90% suppression (min)	Time to 25% recovery (min)
0.1	3.4	45
0.15	2.6	55
0.2	2.4	65
0.4	1.5	91

Rocuronium

Dose (mg/kg)	Time to intubation (seconds)
0.6	90
1.0	60

### **REVERSAL**

Atropine – 20mcg/kg

Glycopyrrolate – 10 mcg/kg

Neostigmine – 50 mcg/kg

Easy dosing guide

- > 10kg: place Neostigmine 2.5mg & Glycopyrrolate 0.6mg in a 10ml syringe, dilute to 6ml then give 1 ml per 10kg. (based on dose for 60kg adult)
- < 10kg: Neostigmine 0.5mg plus Glyco 0.2mg. Dilute to 10ml. Give 1ml/kg body weight

### **POSTOPERATIVE APNOEA**

Naloxone: 10 mcg/kg

Flumazenil: 10 mcg/kg

Theophylline: 5mg /kg loading dose over 20 minutes

Caffeine Load 20mg/kg IV, then 5mg/kg/day (IV or via NGT) (All babies under 34 weeks should already be prescribed caffeine in NICU)

### **PONV**

Dexamethasone: 200 mcg/kg (maximum 8mg)

Droperidol: 20 mcg/kg

Ondansetron: 100 - 150 mcg/kg

## **ANALGESIA**

### **FLACC Score:**

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

### **Analgesics**

Drug	IV Boluses	IV Infusion	Oral
Morphine	50 – 200 mcg/kg	2 – 5mcg/kg/hour	< 1 month: 0.05mg/kg/dose 6 hourly 1-12 months: 0.1mg/kg/dose 4 hourly > 12 months: 0.3mg/kg 4 hourly NB: Prescribe as mg & ml (morphine syrup = 10mg/ml)
Fentanyl	1 – 4 mcg/kg	0.015 – 0.025 mcg/kg/min 0.9 – 1.5 mcg/kg/hr	
Sufentanil	0.5 – 1.0mcg/kg	0.005 – 0.008 mcg/kg/min (0.3 – 0.48 mcg/kg/hr)	
Pethidine	0.5 – 1mg/kg	100 - 400mcg/kg /hour	
Alfentanil	10 – 30mcg/kg	0.5-1.0 mcg/kg/min	
Ketamine	0.25 – 0.5 mg/kg IVI	TIVA: 1-3 mg/kg/hour Analgesia: 0.25mg/kg/hr	4mg /kg 6 hourly po
Clonidine	1 – 2 mcg/kg	/	/
Tilidine (Valaron)			0.5 – 1mg/kg (1 drop = 2.5mg)
Gabapentin			2mg/kg tds OR 10mg/kg nocte (maximum 70mg/kg/day)

NB – all infusions require a loading dose before commencing infusion. Patients on postoperative infusions should be monitored in a High Care setting

### **Anti-hyperalgesics:**

- Diclofenac 1mg/kg PR bd (over 1 year)
- Ibuprofen 5-6mg/kg PO 6 – 8 hrly
- Paracetamol:
  - o Oral:
    - 15mg/kg/dose 6 hrly
  - o Rectal:
    - 30 – 40mg/kg stat (if > 44 wk post conceptual age)
  - o IV (Perfalgan):
    - dosing interval always 4 – 6 hourly
    - Children 33 – 50kg
      - 15mg/kg
      - Not to exceed 3g/day
    - > 1 year / 10kg
      - 15mg/kg
      - not to exceed 60mg/kg/day (or 2 g/day)
    - < 1 year / 10kg (including term neonates):
      - 7.5mg/kg
      - Not to exceed 30mg/kg/day
      - Prens - No data

## **REGIONAL ANAESTHESIA**

### **Epidurals**

- All epidurals to be managed in high care or ICU
- No epidural opioids in children under 1 year of age
- It is the responsibility of the paediatric anaesthetic registrar on call to follow up all paediatric patients on epidural analgesia (NOT the obstetric & pain registrar)
  - o Write notes on the system every time you assess the child (minimum once daily including weekends)
  - o Ensure that the child's bed has an epidural notice on it
  - o Don't forget to hand over to the registrar on call
  - o Enter patient on the pain spreadsheet on the system

### **Practical Points on Paediatric Epidural Insertion:**

- Estimated skin epidural distance
  - o 1mm/kg (+2)
  - o (2 x age) + 10mm
- Aim to place catheter tip opposite level of surgical incision dermatome
- Loading dose:
  - o Bupivacaine 0.25%
    - 0.5 – 0.6ml/kg
    - OR if > 100cm: 1ml/10cm height
- Top up
  - o After approx. 2 hours with half the initial loading dose (neonates: after 60 – 75 minutes)
- Infusion – start ASAP after placement
  - o Mix:
    - Neonates
      - Bupivacaine 0.1% for under 2kg babies
      - Bupivacaine 0.2% for over 2kg
    - > 1 year or > 10kg
      - Bupivacaine 0.2% plain
      - 0.1ml- 0.2ml/kg/hour
    - > 20kg or > 100cm
      - Bupivacaine 0.1% + Fentanyl 2mcg/ml
      - 0.1ml – 0.2ml/kg/hour
- Maximum safe doses of Bupivacaine:
  - o ≥ 6 months: 0.2 – 0.4 mg/kg/hour - stop after 48-72 hours
  - o Neonates: 0.2mg/kg/hour, stop after 48-72 hours

### **Paravertebral Blocks**

- Dosing & guidelines as for epidurals

Surgery	Suggested insertion level
Thoracotomy	T5
Renal	T9
Orchidopexy	T11/12 or L1

**Caudal:**

- Sterile procedure – use a face mask, sterile gloves and catheter pack
- Inguinal region:
  - o Bupivacaine 0.25% with adrenalin 1:400 000
  - o 1ml/kg (up to 20kg, then 0.25ml/kg thereafter)
- Abdominal procedures (T8 – T10 block height)
  - o Bupivacaine 0.2% with adrenalin 1:400 000
  - o 1.25ml/kg [up to 20kg, then 0.25ml/kg thereafter]

Volume (ml/kg)	Dermatome level	Indication
0.5	Sacral	Circumcision
0.75	Inguinal	Inguinal herniotomy
1	Lower thoracic (T10)	Umbilical hernia
1.25	Mid thoracic	

Maximum volume 25ml

Epidural/caudal test dose (given prior to local anaesthetic)

- Dose:
  - o <6 months: adrenaline 1/400 000 = 2.5mcg/ml 0.25mcg/kg
  - o >6 months: adrenaline 1/200 000 = 5mcg/ml 0.25 – 0.5 mcg/kg 0.1- 0.2ml/kg (max 15 mcg)
- Look for: elevated T wave (earliest sign); increased HR >10 bpm; ECG changes; increased SBP >15mmHg
- Can occur 60 -90 seconds later
- Sevoflurane blunts the haemodynamic response

## Adrenaline:

- Studies show insignificant prolongation of LA effect
- Vasoconstrictor properties could theoretically compromise perfusion of spinal cord (not proven). Maintenance of adequate systemic BP relevant for spinal perfusion
- Still give fractionated doses even if test dose negative

**Peripheral Nerve Blocks:**

- Drug: Bupivacaine 0.2 – 0.5% with or without Adrenalin 1:200 000
- NO adrenaline in penile & digital blocks
- Max dose: 2mg/kg (up to 3mg/kg)
- 0.2 – 0.5ml/kg
  - o 1 nerve: 0,3ml/kg
  - o 2 nerves: 0,2ml/kg per nerve
  - o Sciatic – 0.5ml/kg (may need 0.25% bupivacaine)

**Plane Blocks**

- 0.2% solution, maximum dose of local divided by number of injection points



## **SAFE PATIENT TRANSFER**

- Incubators:
  - o Ensure that these are plugged in AND switched on during a case
  - o Do not cover the baby with blankets if incubated
  - o The appropriate temperature is dependent on the weight & age of the baby:

Weight	Days after delivery						
	0	5	10	15	20	25	30
< 1500g	35.0	35.0	35.0	34.5	34	33.5	33.0
1500 – 2000g	35.0	34.0	33.5	33.5	33.0	32.5	32.5
2000 – 2500g	34.0	33.0	32.5	32.0	32.0	32.0	32.0
2500 – 3000g	33.5	32.5	32.0	31.0	31.0	31.0	31.0
> 3000g	33.0	32.0	31.0	30.0	30.0	30.0	30.0

- During a case, place blankets and gowns into the fluid warmer to maintain body temperature in recovery

### **Proper Documentation**

- When transferring a child to NICU or ICU4 always hand over properly to the receiving doctor:
  - o Document the child's physiological status at handover
  - o Write the name of the doctor to whom you have handed over
- A note written on the system in the patient's file is essential in certain scenarios. These include:
  - o ALL ICU admissions
  - o Major surgery
  - o Complications or unexpected events occur intra-operatively

Although these details of the anaesthetic are recorded in the yellow form which is scanned, a separate note on the system is essential as the yellow forms are not scanned immediately following the case. It greatly assists the surgical & paediatric team to have a summary of the patient's intra-operative course.

## **PRACTICAL EQUIPMENT GUIDE**

### **LMA Sizing Guide:**

Weight	Size
Up to 5kg	1.0
5 – 10kg	1.5
10 – 20kg	2.0
20 – 35kg	2.5
> 35kg	3.0

### **I-Gel Sizing Guide:**

Weight	Size
2 – 5kg	1
5 – 12kg	1.5
10 – 25kg	2
25 – 35kg	2.5
30 – 60kg	3.0
50 – 90kg	4.0
> 90kg	5.0

### **ETT Sizing Guide:**

Uncuffed:

- Age/4 + 4
- Use in kids < 8 yrs

Cuffed

- Age/4 + 3.5
- Always check cuff pressure

### **PAEDIATRIC CENTRAL VENOUS CATHETER SIZING GUIDE**

Child Size	Approach / Scenario	Size	Length (cm)
< 5 kg	IJV / Subclavian	4 Fr	5
< 5 kg	Femoral *	4 Fr	8
5 – 10 kg	IJV / Subclavian	4 Fr	8
5 – 10 kg (chubby)	Femoral	4 Fr	13
10 – 30kg <sup>#</sup>	IJV / Subclavian	4 Fr or 5.5 Fr	8 or 13
10 – 30 kg	Femoral	4 Fr or 5.5 Fr	13
> 30 kg	IJV / Subclavian	5.5 Fr	13
> 12 years		8 Fr	15

\* Do not use the femoral approach in a baby < 2kg unless no other option

<sup>#</sup> In this group, estimate on the skin from the site of insertion to just distal to the jugular notch

## **PERIOPERATIVE FLUIDS & TRANSFUSION**

### **Fluid categories:**

- Maintenance, replacement & ongoing losses

Maintenance – 4:2:1

- 4ml/kg/hr for 1<sup>st</sup> 10kg
- 2ml/kg/hr for the second 10kg
- 1ml/kg/hr for each subsequent kg
- Use MRL, plasmalyte or equivalent isotonic fluid

Ongoing Losses

- Depending on surgical situation – MRL, Voluven, blood, plasma
- 1:1 RBC & colloid, 3:1 crystalloid

Colloids: Voluven/Volulyte – registration information for paediatrics:

- Dose limit: 15ml/kg/24hrs for patients <12 years of age
- Registration excludes neonates
- Infusion rate and starting dose is patient-dependent

### **Glucose Management:**

All children should have a finger prick glucose performed following induction

Certain children are at higher risk of hypoglycaemia

- Prems
- Neonates (1<sup>st</sup> 48 hours of life)
- Neonates / infants already receiving glucose containing fluid
- Low birth weight (< 3<sup>rd</sup> centile)
- Patients receiving TPN
- Liver disease
- Prolonged surgery
- Extensive regional blockade with attenuated surgical stress response

High risk patients should either have frequent glucose monitoring or intraoperative maintenance with 1-2.5% dextrose containing fluid

Repeat the glucose test at the end of the case in high risk patients

Intra-operative fluids: Dextrose free / 1% dextrose / 2% dextrose (depending on the patient)

Management of hypoglycaemia (GM < 3.6 mmol/L)

- 5% dextrose solution (dextrose water or saline, NOT maintenance fluid due to K<sup>+</sup> load)
  - o 4 – 10ml/kg (i.e. 200 – 500mg dextrose / kg)

To make a glucose containing fluid:

- 1% solution – 4ml 50% dextrose to 200ml

*TPN must not be interrupted for surgery.* The reason is two-fold

- Patients develop rebound hypoglycaemia
- For sepsis reasons, the TPN cannot be disconnected & reconnected. A disconnected TPN line needs to be discarded

## **BLOOD MANAGEMENT & TRANSFUSION**

### **Blood Volumes:**

<b>Age</b>		<b>Blood Volume</b>
Neonates	Premature	95mL/kg
	Term	85mL/kg
Infants		80mL/kg
Adults	Men	75mL/kg
	Women	65mL/kg

### **RBC transfusion:**

- 4ml/kg will increase Hb by 1g/dL
- Use leucodepleted blood in cancer patients and neonates
- Blood should be less than 5 days old if at all possible
- Whole blood – approx half the haematocrit of RCC therefore 8ml/kg will increase the Hb by 1g/dL

### **Allowable blood loss:**

$$ABL = \frac{EBV \times (Hi - Hf)}{Hav}$$

ABL – allowable blood loss; EBV – estimated blood volume  
Hi – initial; Hf – lowest final; Hav – average

### **Plasma:**

- 10 - 15ml/kg

### **Platelets:**

- 5ml/kg will raise by 30 – 40 000 (1 unit/ 10kg will raise platelets by 50 000)

### **Vitamin K –**

- Neonates 1mg IMI (routine prophylaxis)
- Haemorrhage: Slow IV injection 0.5 – 5mg, depending on severity of coagulopathy

### **Cryoprecipitate**

- 5ml/kg (1 bag is approximately 30ml)

## **GUIDELINES FOR BURNS ANAESTHESIA**

### **PREOPERATIVE**

Important things to assess and document are:

- Site of burns & percentage
- Presence of inhalational burns
- Nutritional status
- SIRS response
- Signs of sepsis
- Analgesic requirements
- Predicted difficulty with IV access

Almost all children will require blood. To determine the estimated blood loss, use the following formula:

#### **Estimated Blood loss (Burns):**

Average - 1ml / kg/ % burn (donor + graft area)

(Children: 1.2; adults 0.8)

Unless you are concerned about the airway, give a premed at the appropriate time. It is ideal to perform steal inductions in burns patients. These children are in pain and present to theatre for multiple surgeries. Do not give them a traumatic induction so that they fear returning to theatre.

### **INTRAOPERATIVE**

- Warm the theatre! Maintaining normothermia is a huge challenge due to the large surface area of the burn – evaporative heat loss is substantial coupled with difficulty in covering the child adequately
- Airway – there is no contra-indication to using a supraglottic airway device. Keep in mind, however, that during the dressing process, considerable patient movement may be required.
- Maintenance including nitrous oxide is recommended
- Be willing to be flexible with regards to monitoring. In extensive burns, you may need to reposition the BP cuff or sats probe as the surgeons work.
- These patients bleed! Do not underestimate blood loss. Maintain euvolaemia with crystalloids or colloids but commence the transfusion of warmed blood early
- These children have very high analgesic requirements. Burns are painful and these patients are usually resistant to opioids. Please try the following:
  - o Use regional anaesthesia whenever possible, even if it just covers a portion of the surgical site (e.g. femoral nerve block for the donor site)
  - o Multimodal analgesia is vital
  - o NSAIDs are not contraindicated in burns per se but exercise caution in the acute phase
  - o Be generous with opioids and do not be afraid! In my experience ventilating the patient on PSV and titrating the opioids to respiratory rate achieves a good state of analgesia.
  - o Use ketamine
- A ketamine & midazolam infusion is a good option for dressing changes. It can also be used as a background infusion for more extensive surgery, in combination with a volatile and opioids. Mix it in a 50ml syringe as follows:
  - o Ketamine 200mg (4mg/ml)
  - o Midazolam 5mg (0.1mg/ml)
  - o Loading dose – 0.1ml/kg
  - o Maintenance - 1ml/kg/hour
- Communicate with the surgeons. Do not allow them to proceed if the child is tending towards hypovolaemia or hypothermia.

### **POSTOPERATIVE**

- No child should leave the recovery room in pain – ensure that they are comfortable
- Consider as pethidine, fentanyl or morphine infusion for extensive burns. Please discuss with the burns doctors – they do have facilities to monitor these children.

## **THE KETAMINE OPHTHALMOLOGY EUA**

- Children with glaucoma require an EUA to measure intra-ocular pressure (IOP)
- Sevoflurane, propofol and other agents reduce IOP and result in falsely low readings
- Intramuscular ketamine provides excellent conditions for this procedure, however injections are unpleasant
- Please ensure the following:
  - o Premedicate these children PROPERLY
  - o Apply an EMLA patch on the site (arm, anterior thigh). This can be done in one of two ways:
    - Mark the site & prescribe this on the yellow form
    - Send for the child early and apply it yourself in the holding area
  - o Counsel the mother – she will most likely be expecting a gas induction and may be upset by an intramuscular injection
- Dosing:
  - o 5 – 10mg/kg (7.5mg/kg usually suffices)
  - o Onset 2 – 8 minutes
  - o Duration of action 10 – 20 minutes
- Alternatively:
  - o Standard volatile induction
  - o IV access
  - o LMA / intubate following applying lignocaine to the cords (no Propofol)
  - o Ketamine 2mg/kg IVI
  - o Switch off volatile & N<sub>2</sub>O – flush out for at least 5 minutes (watch end tidal concentrations)
  - o Additional bolus of IV ketamine 0.5 – 1 mg/kg prn
  - o IOP monitoring can proceed
  - o Recommence the volatile and add opioids if definitive surgery proceeds

## **PREPARATION FOR A NEPHRECTOMY FOR NEPHROBLASTOMA**

### **Preoperative**

- Clinical stage
- Chemotherapy administration (NB echo may be indicated – see echo guidelines)
- Presence of hypertension, its' control and target blood pressure (omit ACE inhibitor on day of surgery)
- Presence of IVC & right atrial invasion
- Other paraneoplastic phenomena (polycythaemia, coagulopathy)
- Consent from parents for epidural, arterial line and central line.
- Counsel parents regarding blood transfusion
- In children at high risk of post-operative renal failure (e.g. Stage V disease) consider fluid loading overnight (discuss with surgeons)
- Ensure high care bed is available

### **Intraoperative**

- Discuss predicted blood loss with surgeons at the onset
- 2 IV lines, one large bore (gauge depends on size of the child)
- Suggest maintenance at 4:2:1 plus additional background infusion of 5-10ml/kg/hour
- Low thoracic epidural (T10/11)
- Arterial line
- Central venous catheter (selected cases)
- Nasogastric tube on free drainage
- Urinary catheter with ICU collection bag (ensure 1.5 - 2ml/kg/hour)
- Temperature monitoring

### **Postoperative**

- High care admission
- Epidural analgesia plus regular paracetamol
- Strict monitoring of urine output

## CRANIOFACIAL SURGERY

- Preoperatively:
  - o Important factors at the preoperative visit:
    - Syndromes
    - Difficult airway
- Theatre Prep:
  - o Table moved down so that theatre lights are over the patient's head
  - o Warm the theatre
- Airway:
  - o Reinforced endotracheal tube
  - o Flex & extend the head to ensure that the tube will not be endobronchial or too shallow (surgeons move the patient's head intraoperatively)
- CVS:
  - o 2 x IV lines
    - 1 for maintenance (standard giving set on infusion pump)
    - 1 for blood & resuscitation (filtered giving set on infusion pump)
  - o Have 1 whole blood leucodepleted & 1 adult packed cells ready from the start
    - Whole blood transfusion from beginning (8ml/kg to increase Hb by 1g/dL)
    - Top up with packed cells if need be (4ml/kg to increase Hb by 1g/dL)
  - o Aim to finish with Hb of 12g/dL (due to post-operative blood loss from drain)
  - o A-line (required for craniotomy or craniostomy)
  - o Consider femoral CVC – fluid administration & transducer as a trend monitor
  - o Urinary catheter with ICU collection bag
- Stitch through eyelids OR tegaderm (check with surgeons)– no tape / eye pads
- Lumbar drain – remove a few ml / 10 drops; no indwelling catheter. Cover with Tegaderm
- Bair hugger & oesophageal temp probe
- Screen at foot of the bed
- Antibiotics – Augmentin 30mg/kg
- Tranexamic acid:
  - o Load - 10mg/kg over 15min
  - o Infusion – 10mg/kg/hour
- Dexamethasone 200mcg/kg
- Dexmedetomidine: Load 1mcg/kg over 10 minutes Infusion 0.2 – 0.7 mcg/kg/hour; Continue into postop period
- Analgesia
  - o Opioid boluses or Sufentanil infusion:
    - Load 0.5-1mcg/kg
    - Infusion: 0.005 – 0.008 mcg/kg/min
  - o Perfalgan 15mg/kg
  - o Local infiltration GOSH solution (7ml/kg):

*Neil-Dwyer JG, Evans RD, Jones BM, Hayward RD. Tumescence steroid infiltration to reduce postoperative swelling after craniofacial surgery. British Journal of Plastic Surgery (2001), 54, 565 - 569*

	500ml	200ml
▪ Lignocaine (0.025%)	25ml 0.5%	10ml 0.5%
▪ Bupivacaine (0.0125%)	25ml 0.25%	10ml 0.25%
▪ Adrenalin(1:1 000 000)	0.5ml of 1:1000	0.2ml of 1:1000
▪ Hyaluronic acid (3 IU/ml)	1500 IU	600 IU
▪ Dexamethasone	8mg	3.2mg

- Extubate at the end except midface procedures
- Remember eye sutures at the end
- Be careful with the portovac drain – only close quarter way otherwise blood pours out
- ICU admission post operatively



## **GUIDELINES FOR ANAESTHESIA FOR CLEFT LIP & PALATE**

### **PREOPERATIVE**

- May be isolated clefts or part of another syndrome – check
- Children tend to have FTT and feeding difficulties
- Frequent URTI are typical – distinguish between innocuous URTI and systemic illness (parents insight is vital here)
- Careful assessment of the airway

### **INTRAOPERATIVE**

- Standard paediatric prep
- Possible difficulty with laryngoscope falling into cleft:
  - o Straight blades
  - o Ribbon cause to occlude the gap
- Volatile induction
- Cuffed south facing ETT (note we have the Microcuff Range for this purpose)
  - o Ensure that with head movement the ETT does not migrate endobronchially
  - o Strap the ETT directly in the midline & secure with tegaderm
- Throat pack – inserted by anaesthetist in lips, by the surgeon for palates. LABEL!!
- Tegaderms over the eyes for lips (standard cover for palates)
- Analgesia:
  - o Ketamine
  - o Nerve blocks (see below)
  - o Paracetamol
  - o Opiates: not contraindicated but great care in babies with airway difficulties or OSA. Preference for short acting over morphine
- Dexamethasone 200mcg/kg (PONV, swelling reduction & analgesia)
- Boyle Davis gag used for palates – watch PAWP following insertion
- Completion of surgery
  - o careful suctioning under direct vision
  - o REMOVE THROAT PACK
- Extubation:
  - o Lips
    - May have nasal stent inserted
    - Deep extubation can be performed
    - Avoid OP airway (may disrupt sutures)
  - o Palates
    - Some children have breathing difficulty as they adjust to the separation of the oro and nasopharynx
    - Nasopharyngeal airway may be necessary
    - Awake extubation may be safer (individualise)

## **BLOCKS FOR CLEFT LIP & PALATE SURGERY:**

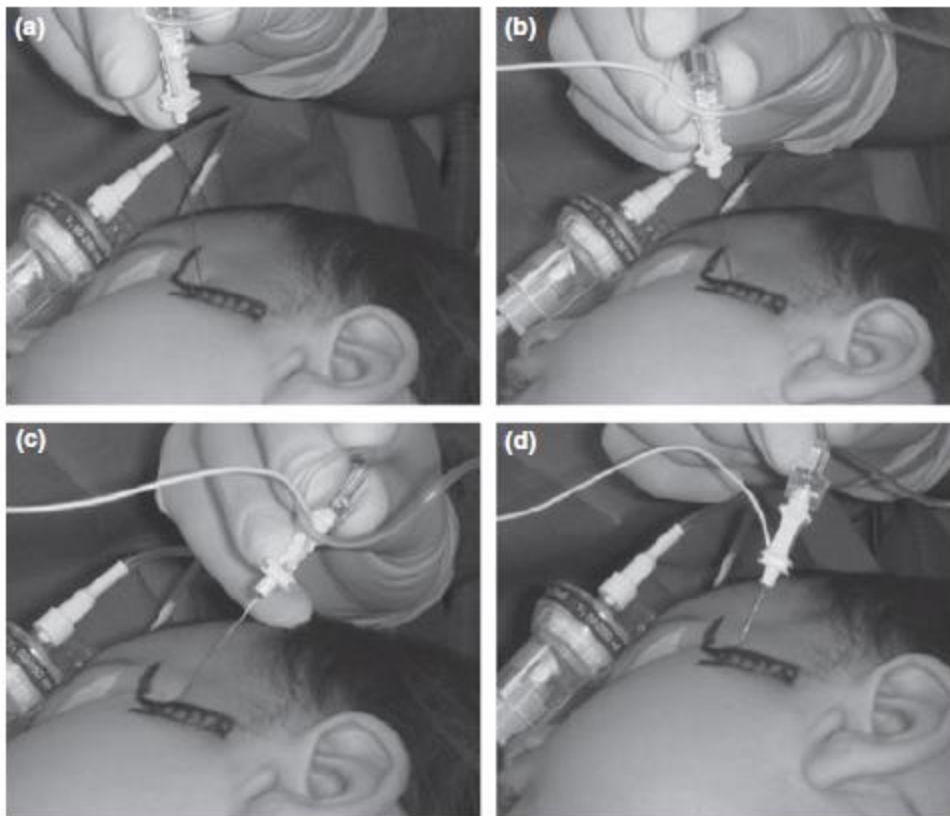
### **Infraorbital Nerve Block (lips)**

The extra-oral approach is useful when the infra-orbital foramen is impalpable. The landmark used is based on a line drawn from the angle of the mouth to the middle of the palpebral fissure.<sup>4</sup> At the point where midpoint of this line (16-17mm from palpebral fissure) and a line equal to half this distance (8mm) drawn from the alae nasi intersect, a fine needle (25-26g) is introduced perpendicular to the skin. When bony contact is made, the needle should be withdrawn slightly and 0.5-1ml of local anaesthetic injected.

- Bosenberg AT. Anaesthesia for Cleft Lip and Palate Surgery. SAJAA 2007; 13(5): 9-14

### **Maxillary Nerve Block (palates)**

The patient was supine with the head in neutral position. The needle entry point was situated at the angle formed by the superior edge of the zygomatic arch below and the posterior orbital rim forward (Figure 3a). The needle was inserted perpendicular to the skin and advanced to reach the greater wing of the sphenoid at approximately 20 mm depth (Figure 3b). The needle was then reoriented in a 20 degree anterior and 10 degree caudal direction toward the philtrum (Figure 3c) and advanced 35–45 mm deep to the pterygopalatine fossa (Figure 3d). A blood aspiration test was performed on each side before the injection of 0.15 ml/kg of 0.2% ropivacaine



- M Mesnil et al. A new approach for peri-operative analgesia of cleft palate repair in infants: the bilateral suprazygomatic maxillary nerve block. Pediatric Anesthesia 2010 20: 343–349

## **ANAESTHESIA FOR TONSILLECTOMY**

### **PRE-OPERATIVE**

- Exclude obstructive sleep apnoea & pulmonary hypertension
- Simple URTI are common & not necessarily a reason to postpone
- Caution in patients at high risk of complications:
  - o Under 2 years of age
  - o Pre-existing muscle hypotonia
  - o FTT
  - o Craniofacial abnormalities
  - o Severe OSA

### **INTRA-OPERATIVE**

- VIMA or IV induction (patient preference)
- Oral RAE ETT; consider reinforced LMA (discuss with surgeon)
- No throat pack – surgeon will insert swabs
- Analgesia
  - o Opioids:
    - Short acting e.g. alfentanil for induction
    - Longer acting e.g. Morphine 0.1 mg/kg
    - Caution with long acting opioids in OSA (consider fentanyl instead)
  - o Dexamethasone 200mcg/kg (helps PONV, swelling & reduces opioid requirements)
  - o Simple analgesics
    - Paracetamol suppository (or orally as part of premed)
    - NSAID suppository not contraindicated (unless haemostasis a concern)
- Consider dual PONV prophylaxis
- Extubation – discuss with consultant – deep or awake are both acceptable

### **POSTOPERATIVE CARE**

- OSA patients – High Care
- Pulmonary hypertension – ICU
- Caution in syndromic children
- Individualised care per patient

## **GUIDELINES FOR DEBULKING OF LARYNGEAL PAPILOMA**

The Friday ENT slate is the papilloma slate, although emergencies debulkings may be booked on other ENT slates.

### **PREOPERATIVE**

- Assess prior anaesthetic charts, paying special attention to size ETT used (this will be small for age)

### **INTRAOPERATIVE**

- Multiple approaches are described. The ideal anaesthetic technique (according to our surgeons) involves:
  - o Spontaneous ventilation (to allow for more time to desaturation)
  - o Prevention of laryngospasm (i.e. spontaneous ventilation without cord reactivity)
  - o "tubeless technique" as intubation has been linked with distal seeding of papilloma
  - o TIVA to prevent fluctuating depths of anaesthesia encountered with volatile maintenance with the shared airway
- A suggested approach is:
  - o Volatile induction (spontaneous ventilation with CPAP)
  - o IV line insertion
  - o Generous application of lignocaine to the vocal cords
  - o Ketamine 0.5mg/kg IVI
  - o Dexamethasone 200mcg/kg
  - o Conversion to Propofol TIVA – Kataria / Paedfusor model with Cp at 6.0 – 8.0 (titrate according to patient – aim for anaesthesia but spontaneous ventilation)
  - o Attachment of oxygen tubing to ENT laryngoscope and provide oxygen at approx. 10-12 litre/min. [An alternative is THRIVE (Transnasal Humidified Rapid-Insufflation Ventilatory Exchange) in bigger patients]
  - o ENT inserts laryngoscope and performs debulking (without intubation)
  - o At end:
    - TIVA stopped
    - Laryngoscope removed
    - Spontaneous ventilation with mask in situ
    - No need to intubate

### **POSTOPERATIVE**

- Adrenalin saline nebulisation

## **GUIDELINES FOR CARDIAC CATH LAB**

### **PREMEDS:**

- The list comes out on the Friday before and it is booked under "Cath Lab". The patients are usually in the ward on a Friday so they can be seen.
- The oral premedication is written up by the cardiologist. This must not be changed. Chronic medication can be added if necessary
- Antibiotics are given in the ward if necessary

### **THEATRE PREPARATION**

- Make sure everything is checked and ready as you are working in a remote environment
- Always have a 10ml syringe with Adrenaline 1 mcg/ml drawn up and ready
- Draw up: Propofol; Ketamine for analgesia; and lignocaine to spray the vocal cords and oropharynx
- Patients who are having a TOE need to be intubated
- Make sure there are bubble traps on all the IV giving sets
- If haemodynamic monitoring is going to be done, put  $fiO_2$  to 0.21 and ensure normal  $CO_2$
- Patients arms need to be strapped above the head for adequate access
- ECG leads must be peripheral/ not on the chest which can interfere with the cardiac images
- Always check with the cardiologist that they are happy for you to extubate the patient

## **Preoperative referral for Cardiology Evaluation and Echocardiography: Guidelines for Practice at IALCH**

- A. Emergency surgery: when echo will make a difference to your anaesthetic management. Important when surgical technique may be laparoscopic.
- B. Elective surgery: no urgency for surgery while waiting for echo

### **1. NEONATES:**

#### **Urgent – prior to surgery**

1. Any neonate in cardiac failure with or without shock – to exclude left obstructive lesions
2. Unexplained cyanosis in a neonate or cyanosis out of keeping with lung pathology.
3. Saturations less than 96% in room air beyond first 24 hours of life in otherwise well child.
4. Unexplained difference between upper and lower limb saturations more than 4% after 24 hours of life (on room air)
5. Suspected persistent pulmonary hypertension of the newborn
6. Significant arrhythmias on ECG
7. Where echocardiography is required for surgical approach eg: arch sidedness in Tracheoesophageal fistula

#### **Non urgent neonatal echos :**

Will be done at earliest convenience of the cardiologist on call.

These include echos to exclude associated abnormalities in an asymptomatic patient.

- Persistent loud murmur in absence of other signs of cardiac disease
- Dextrocardia
- Syndromes associated with congenital heart disease
  - o Tracheo-oesophageal fistula
  - o Omphalocele
  - o Trisomy 21 & other chromosomal disorders linked with CHD
  - o VACTERL association
  - o CHARGE
  - o Anorectal malformations
  - o Conjoined twins

The guideline may not be completely inclusive of all clinical scenarios, if there is any uncertainty this should be discussed with paediatric cardiology.

#### **Relative Indications (non-urgent neonatal echo)\***

- Duodenal atresia (Short et al 70% had clinically significant CHD) Not other small bowel atresias unless clinically indicated.
- Meningomyelocele / other complex neural tube defects

NB perform clinical assessment plus upper & lower limb oxygen saturation readings. Have high index of suspicion but echo only indicated if abnormalities are found clinically.

### **2. INFANTS UNDER ONE YEAR OF AGE**

- Those that have been missed as neonates (see all points above)
- Unexplained or new murmur
- OSA with cor pulmonale

### **3. MISCELLANEOUS:**

- Rheumatic heart disease
- Suspected pathological murmur on auscultation
- Cardiomegaly
- Anterior mediastinal mass
- SVC syndrome
- Muscular dystrophy (Duchenne & Becker in particular)
- OSA with cor pulmonale
- Arrhythmias on clinical examination and ECG
- Any child with a confirmed cardiac lesion who has not had a cardiology assessment in the previous 6 months
- Persistent Staphylococcal septicaemia
- Hypertension (need 4 limb BPS)

### **4. ONCOLOGY**

- Nephroblastoma:
  - o All hypertensive children
  - o Stage 4 patients on pre-operative epidriamycin
- All neuroblastomas

Prior to referral to Paeds Cardiology, please ensure the following are completed:

- Careful clinical examination by experienced clinician
- Pulse oximetry (upper & lower limbs)-in neonates
- CXR
- ECG where necessary

## **TRIGGER FREE ANAESTHETIC / PAEDS TIVA**

### **PREPARATION**

- Ideally aware of patient in advance & child to be booked first on the list
- Confirm flushing protocol of anaesthetic machine (each machine is different)
- Discuss with night on call team to facilitate theatre preparation
- NB remove vaporiser before starting the flush
- Ensure adequate stock of dantrolene is available
- Examine veins and order EMLA application
- Ensure adequate infusion pumps & syringe drivers are available
- Preventing drug delivery problems:
  - o IV site always visible if possible
  - o 1-way valve on giving set / infusion pump to prevent backflow
  - o Minimal dead space
  - o Use of claves with small dead space
  - o Always flush dead space at end of case

### **INTRAOPERATIVE MANAGEMENT**

- Awake IV line (consider 2<sup>nd</sup> tier oral premed / IM ketamine / N2O to facilitate)
- Pain on injection of propofol (consider lignocaine to vein) or co-induction with N2O
- Commencement of TIVA or TCI (see below)
- Advise the use of adjuncts to reduce the total dose of IV hypnotic and therefore improve recovery time
  - o Ketamine, opiates, NDMR, Clonidine, Dexmedetomidine, blocks
- Make use of BIS monitor if possible (keeping in mind limitations in paed patients)
  - o Suitable over 1 year
  - o Aim for 40 – 60
  - o Strongly recommended if NDMR used
- Temperature monitoring

### **PAEDIATRIC TCI MODELS:**

- Kataria
  - o lower limit 3 years / 15 kg
- Paedfusor
  - o Lower limit 1 year / 5kg
  - o More extensively investigated
- No effect site prediction with either, may overestimate initial boluses
- Obese children – Ideal Body Weight (IBW) plus 20%
- Cp targets:
  - o 4 – 6 mcg/ml (sole agent)
  - o 3 – 4 (other agents, may be less with NDMR)

### **MANUAL PUMP SETTINGS**

Children under 1 – 3 years of age. Dose as mg/kg/hour

Induce with 3 – 5 mg/kg, then convert to maintenance:

Age	0 – 10 min	10 – 20 min	20 – 30 min	30 – 40 min	40 – 100 min	> 100 min
< 3 months	25	20	15	10	5	2.5
3 – 6 months	20	15	10	5	5	2.5
6 – 12 months	15	10	5	5	5	2.5
1 – 3 years	12	9	6	6	6	6

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### **POSTOPERATIVE MANAGEMENT**

- Placement in high care setting (MH can be precipitated by stress)
- Temp & urine output monitoring



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