

Paediatric Anaesthesia Rotation
Orientation Booklet

Inkosi Albert Luthuli Central Hospital
University of KwaZulu-Natal



Compiled by Dr Jenna Taylor
MBChB DA (SA) FCA (SA)
Updated November 2015

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 paed anaesthesia is Dr Kampik.

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

Contents:

- 1) Contact numbers
- 2) Core knowledge
- 3) Skills
- 4) Reading material
- 5) Block structure
- 6) The preoperative visit
- 7) Normal physiological variables
- 8) Emergency drugs
- 9) Antibiotics
- 10) CVS drugs
- 11) Other drugs
- 12) Analgesia
- 13) Regional anaesthesia
- 14) Patient transfer
- 15) Equipment guide
- 16) Fluids & transfusion
- 17) Burns guide
- 18) Ketamine Ophthalmology EUA guide
- 19) Craniofacial guide
- 20) Nephrectomy guide
- 21) Tonsillectomy guide
- 22) Acknowledgements

IMPORTANT CONTACT NUMBERS

Name	Speed dial	Cellular	Office
Dr Christian Kampik	6526	083 589 2894	1766
Dr Petrus Doubell	6545	082 560 3112	1766
Dr Alex Torborg		083 385 0217	1769
Dr Jenna Taylor	7332	083 6314816	1769
Dr Belinda Kusel	/	072 420 1529	1769
Theatre 9			2453
CCTs			2076
Anaesthetic Tea Room			2450
Prof Hadley			
Prof Hadley	6228		1580
Mr Wiersma	6230		1583
Mr Sheik Gaffoor	6567		1581/4
Mr Maharaj	6571		1609
Ms WJonker		082 563 7266	
Ms S Govender		083 227 8545	
Dr Anjana Bairagi	7360	084 318 4304	
Dr Lulama Luthuli		076 309 9982	
Dr Yashoda Manickchund		078 703 3969	
Dr Sanele Madziba		072 1704 623	
Dr Shamaman Harilal		074 101 9038	
Dr Janice Sewlall		082 373 4232	
Dr Mark Wagener		071 689 8795	
B3W – Ward			1604 / 5
B3W – Call Room			1597
C4W (Paeds High Care)			2073/4
ICU 4 (Paeds ICU)			2038; 2040
NICU			2485
Neonatal Isolation			2489
Blood Bank			1502
TSSU Intercom			241 / 219

CORE KNOWLEDGE

- Physiology; transitional physiology; ex-prems
- Paediatric Resuscitation
- Fluids / Glucose / Blood transfusion
- Regionals in paed; Perioperative analgesia
- Surgical diseases:
 - o Abdominal wall defects
 - Gastroschisis
 - Omphalocele
 - o Oesophageal atresia & tracheoesophageal fistula
 - o Pyloric stenosis
 - o Congenital diaphragmatic hernia
 - o Malrotation & volvulus
 - o Intestinal atresia
 - o NEC
 - o Imperforate anus
 - o Biliary atresia
 - o Intussusception
 - o Nephroblastoma

- Airway
 - o Difficult airway
 - o Approach to URTI
 - o Asthma
 - o Paeds ENT – Stridor, airway emergencies, T&A, papillomas
 - o OSA
 - o Cleft lip & palate
- PONV in paediatrics
- Emergence delirium
- CVS:
 - o Murmurs (physiological vs pathological)
 - o Congenital heart disease
 - o Hypertension
- Burns
- Day case surgery
- Paeds sedation
- Important syndromes
 - o Trisomy 2, 18, 14
 - o Beckwith Wiedemann
 - o Pentalogy of Cantrell
 - o VATER, VATREL
 - o CHARGE
- MH; muscular dystrophies; myopathies
- Propofol infusion syndrome

SKILLS

- Airway management in children
- Fluid management in children
- Intravenous access in children (peripheral, central, intra-osseous access)
- Paediatric caudals, epidurals and peripheral nerve blocks
- Management of all common paediatric surgical conditions
- Paediatric pain management
- Paediatric resuscitation

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

BLOCK STRUCTURE:

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

The following is the generic block structure. This system does not operate properly if there are registrars on leave:

Week	Days	Slate
Week 1	Monday	Paeds emergencies & call
	Tuesday	Paeds elective slate & call
	Wednesday	Paeds elective slate & call
	Thursday	Paeds elective slate & call
	Friday	ENT Emergencies
	Saturday	OFF
	Sunday	OFF
Week 2	Monday	Paeds plastics
	Tuesday	Orthopaedics
	Wednesday	Craniofacial
	Thursday	Paeds Ortho
	Friday	Paeds elective slate & call
	Saturday	On Call
	Sunday	On Call
Week 3	Monday	Paeds Ophthalmics
	Tuesday	Paeds cardiac
	Wednesday	Cath lab
	Thursday	Paeds cardiac
	Friday	Paeds plastics
	Saturday	OFF
	Sunday	OFF
Week 4	Monday	Burns
	Tuesday	Burns
	Wednesday	Burns
	Thursday	Burns
	Friday	Burns
	Saturday	OFF
	Sunday	OFF

PREOPERATIVE VISIT

Elective Slates

- See all patients on the afternoon / evening before the slate
- Discuss all cases with the consultant
- 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

Age	Liquids	Fasting Time
All	Clear sweet fluids	2 hours
< 6 months	Breast / formula milk	4 hours
6 – 36 months	Breastmilk	4 hours
6 – 36 months	Formula	6 hours
> 36 months	Breast / formula milk	6 hours
All ages	Solids	6 hours

Clear sweet fluids are any fluids that are non-particulate & contain no milk. Examples include apple juice, Energade, coke, sweetened black tea etc. The child can drink as much as she likes to a maximum of 10ml/kg.

Please be clear with your orders on the yellow form, e.g: "last breastfeed at 4am. Clear sweet fluids orally until 6am".

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
			20mg/kg	Load if receiving paracetamol
			10mg/kg	Following 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

Paeds database – All 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.

NORMAL PHYSIOLOGICAL VARIABLES

Age	Pulse*	Resp Rate	SBP	DBP
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 – these values are a guide only

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:

Age (minutes)	Value
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

Parameter	Neonate	1 – 24 Months	> 24 Months
pH	7.30 – 7.40	7.30 – 7.40	7.35 – 7.45
PaCO ₂	30 – 35mmHg	30 – 35mmHg	35 – 45mmHg
HCO ₃ ⁻	20 - 22mEq/L	20 – 22mEq/L	22 – 24mEq/L
PaO ₂	60 – 90mmHg	80 – 100mmHg	80 – 100mmHg

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 (maximum 10mg/kg)

Hydrocortisone

- 2mg/kg

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

MgSO₄

- 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

Hyperkalaemia (K⁺ 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

Drug	Dose (mg/kg)
Cefoxitin	25 – 60 (30)
Cefazolin	10 - 15
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

Drug Regimes:

- Dental procedures: single dose 30 – 60 minutes prior to procedure
 - o Either:
 - Ampicillin 50mg/kg
 - Cefazolin 50mg/kg
 - Ceftriaxone 50mg/kg
 - o Penicillin allergic:
 - Clindamycin 20mg/kg
- Nasal packing / nasal intubation
 - Flucloxacillin 50mg/kg
 - o Penicillin allergy:
 - Clindamycin 20mg/kg
- Genitourinary / GI
 - Gentamycin 1.5mg/kg
 - PLUS either:
 - Ampicillin 30mg/kg OR
 - Teicoplanin 10mg/kg (penicillin allergy)

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						
0.05	1								
0.1	2	1							
0.2	4	2	1						
0.3	6	3	1.5						
0.4	8	4	2	ml/hour					
0.5	10	5		1					
0.6	12	6	3						
0.7	14	7							
0.8	16	8	4						
0.9	18	9			ml/hour				
1.0	20	10	5	2	1				
1.5		15		3	1.5	ml/hour			
2.0		20	10	4	2	1			
3.0				6	3	1.5			
4.0			20	8	4	2	ml/hour		
5.0				10	5		1		
6.0				12	6	3			
7.0				14	7				
8.0				16	8	4			
9.0				18	9			ml/hour	
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	ml/hour
25.0							5		1
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

Coagulation Indices

Parameter	24 - 29 wk	30 – 38 wk	Term	Adult
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)

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:	0.2 – 0.4mg/kg
Mivacurium :	0.1- 0.2 mg/kg
Pancuronium:	0.1mg/kg; then 10 – 20mc/kg topups
Rocuronium :	0.6mg/kg; RSI – 1mg/kg
Suxamethonium:	1-2 mg/kg
Vecuronium :	0.1mg/kg

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

PONV

Dexamethasone:	200 mcg/kg (maximum 8mg)
Droperidol:	20 mcg/kg
Ondansetron:	100 - 150 mcg/kg

ANALGESIA

FLETT Score:

Category	0	1	2
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

Opioids

Drug	IV Boluses	IV Infusion	Oral
Morphine	50 – 200 mcg/kg	2 – 5mcg/kg/hour (child must be in High Care or ICU)	Oral – 0.3mg/kg 6 hourly (morphine syrup = 10mg/ml)
Fentanyl	1 – 4 mcg/kg		
Pethidine	0.5 – 1mg/kg	Infusion: Load 1mg/kg, then 100 - 400mcg / kg / hour	
Alfentanil	10 – 20mcg/kg	0.5-1.0 mcg/kg/min	
Tilidine (Valaron)			0.5 – 1mg/kg (1 drop = 2.5mg)
Ketamine	0.25 – 0.5 mg/kg IVI	TIVA: 1-3 mg/kg/hour Analgesia: 0.25mg/kg/hr	4mg /kg 6 hourly po
Gabapentin			2mg/kg tds OR 10mg/kg nocte (maximum 70mg/kg/day)

Anti-hyperalgesics:

Diclofenac 1mg/kg pr (over 1 year)

Ibuprofen 5-6mg/kg PO 6 – 8 hrly

Paracetamol:

Oral:

- Load 30mg/kg
- Then 10mg/kg/dose

Rectal:

- 30 – 40mg/kg stat (if > 44 wk Post conceptual age)

IV (Perfalgan):

- do not re-use vials – the drug must be discarded 15 minutes after the bottle is opened as oxidation occurs which biodegrades the product (a sealed bottle contains argon which prevents oxidation)
- dosing interval always 4 – 6 hourly
- Children 33 – 50kg
 - o 15mg/kg
 - o Not to exceed 3g/day
- > 1 year / 10kg
 - o 15mg/kg
 - o not to exceed 60mg/kg/day (or 2 g/day)
- < 1 year / 10kg (including term neonates):
 - o 7.5mg/kg
 - o Not to exceed 30mg/kg/day
- Premature neonates
 - o No data

REGIONAL ANAESTHESIA

Epidurals

- All epidurals to be managed in high care or ICU
- No 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

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% + Sufentanil 1mcg/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 (maximum 30ml)]

Peripheral Nerve Blocks:

- Drug: Bupivacaine 0.5% with Adrenalin 1:200 000
- NO adrenalin in penile & digital blocks
- Max dose: 2mg/kg (up to 3mg/kg)
- 1 nerve: 0,3ml/kg
- 2 nerves: 0,2ml/kg per nerve
- Sciatic – 0.5ml/kg (may need 0.25% bupivacaine)
- Ultrasound guided – 0.1 – 0.2ml/kg

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 [#]	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

[#] 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 1st 10kg
- 2ml/kg/hr for the second 10kg
- 1ml/kg/hr for each subsequent kg
- Use MRL, plasmalyte or equivalent isotonic fluid

Replacement

- Starvation period x hourly maintenance
 - o Half in first hour, remaining half in next five hours

Ongoing Losses

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

Glucose Management:

All children should have a finger prick glucose performed following induction

Intra-operative Fluids should be dextrose free unless the child has hypoglycaemia

Certain children are at higher risk of hypoglycaemia (prems, liver disease, TPN)

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

Management of hypoglycaemia (GM < 3.6 mmol/L)

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

To make a glucose containing fluid:

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

Blood Volumes:

Age		Blood Volume
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:

- 10ml/kg

Platelets:

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

Vitamin K –

- Neonates 1mg (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)

(Kids: 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 highly 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
 - 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

- Occasionally children with glaucoma require an EUA to measure intra-ocular pressure (IOP)
- Sevoflurane, propofol and other agents affect IOP
- Intramuscular ketamine provides excellent conditions for this procedure, however injections hurt!
- 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
 - o Ketamine 1mg/kg
 - o Switch off volatile & N₂O – flush out for at least 5 minutes (watch end tidal concentrations)
 - o Additional bolus of IV ketamine 0.5 – 1mg/kg
 - o IOP monitoring can proceed

PREPARATION FOR A NEPHRECTOMY FOR NEPHROBLASTOMA

Preoperative

- Clinical stage
- Chemotherapy administration
- 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 over night (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)
- Low thoracic epidural (T10/11)
- Arterial line
- Central venous catheter (selected cases)
- Nasogastric tube on free drainage
- Urinary catheter with ICU collection bag (aim for 1.5ml/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
 - o Discuss with consultant whether or not clonidine will be used. If so, consent needs to be obtained from the parent.
- 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
Throat pack to prevent kinking & excessive movement with head turning
 - 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, 1 for resuscitation)
 - o Blood warmer & Paediatrol
 - 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 – 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
- Tranexamic acid:
 - o Load - 10mg/kg over 15min
 - o Infusion – 10mg/kg/hour
- 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 Clonidine – start at 1mcg/kg, total 2mcg/kg
 - o Local infiltration GOSH solution (7ml/kg):

Neil-Dwyer JG, Evans RD, Jones BM, Hayward RD. Tumescant 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
- High care or ICU admission post operatively

ANAESTHESIA FOR TONSILLECTOMY

PRE-OPERATIVE

- Exclude obstructive sleep apnoea & pulmonary hypertension
- URTI are common & not necessarily a reason to postpone

INTRA-OPERATIVE

- VIMA or IV induction (patient preference)
- Oral RAE ETT
- 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
 - 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)

ACKNOWLEDGEMENTS

- Dr Christian Kampik
- Dr Larissa Cronjé
- Prof Adrian Bosenberg
- Dr Ian Osborn
- Prof Jenny Thomas