

Pacing Post-op: Atrial wires on Right, Ventricular wires on Left; also transvenous (endocardial), transthoracic & transoesophageal.

Pacing Modes: **Chamber Paced**= Atrial (A) / Ventricular (V) / Dual (D)
("PSM") **Chamber Sensed**= Atrial (A) / Ventricular (V) / Dual (D) / Asynchronous (O)
Response Mode= Inhibitory (I) / Excitatory (E) or Triggered (T) / Dual (D) / Asynchronous (O)

Asynchronous (O): atrial pacing=A00; ventricular pacing= V00

AAI = atrium paced and sensed, VVI = ventricle paced and sensed; DVI atrium and ventricle paced, ventricle sensed=

DDD = dual chambers paced, sensed.

Setting up a pacemaker: 1connect wires (as above); 2 select mode (usually Atrial or AV sequential pacing); 3 set rate to 20 > pt's rate (or expected 'normal' in case of CHB); 4 set sensitivity (usually 2-5) 5 set AV interval to 100-150 ms; 6 switch unit on, slowly increase output until there is consistent 'capture' (=threshold); 7 take note of output level, then double it. May need to adjust rate to achieve optimal haemodynamics Threshold should be checked daily and output adjusted accordingly.

Some Selected Drug Doses:

Acetazolamide (metabolic alkalosis) 5 mg/kg po/iv q6-12h
Adrenaline 1:1000 (airway obstruction) 0.5 ml/kg, to max 5 ml, via neb prn
Alimemazine 1 mg/kg/dose q6h po (max 4 mg/kg/day or 100 mg/day)
Amiloride 0.2 mg/kg/dose q12h po (to max 20mg/day)
Amiodarone 5-10 mg/kg q12h po for 7-10days then reduce to once daily maintenance dose (NB interacts with digoxin - halve dig dose)
Aspirin (anti-platelet not on Berlin heart) 5 mg/kg po od
Atracurium neonates 300-500 mcg/kg iv, >1mth 300-600 mcg/kg; supplemental doses of 100-200 mcg/kg iv
Calcium gluconate 1.0% First-line for calcium replacement (0.225mmol/mL): 0.11 mmol/kg (max 4.4 mmol) slow iv usually over 30 mins
Calcium chloride 10% (0.68mmol/mL): 0.11mmol/kg (max 6.8mmol) slow IV
Captopril initial test dose of 0.1mg/kg then 0.1-1.1 mg/kg/dose q8h po
Chloral hydrate 15-30mg/kg (max 1g) q6h po/pr
Max 50 mg/kg q6h ventilated patients only
Clonidine test dose 1 mcg/kg then increase stepwise from 1-5 mcg/kg/dose q6-8h po/slow iv; sedation, IV infusion: 0.1-2 mcg/kg/hr
Dalteparin S/C Prophylaxis: <12yrs 100 units/kg od; >12yrs:2500 -5000 units od.
Treatment (min vol 0.2ml): <12yrs 100 units/kg q12h, >12yrs 200 units/kg od
Dexamethasone -to prevent post-extubation stridor: 0.25-0.5 mg/kg iv stat then 0.1-0.2mg/kg q6h x 3 doses
Diclofenac 1mg/kg q8h po/pr(CI<6mths,transplant,renal,platelet/coag abn,asthma)
Fentanyl 2mcg/kg initially iv bolus then 1-5mcg/kg (Hypotension with high doses)
Furosemide 1-5 mg/kg/dose q6-24h iv/po. Round dose to CIVAS syringes.
Ibuprofen 5 mg/kg q6-8h po (not recomb in renal pts, platelet/coag abn,asthma)
Ketamine 0.5-2 mg/kg iv over 1min, 4-10 mg/kg im
Lorazepam 50-100 mcg/kg/dose (max 4mg) po / iv over 2 min
Magnesium sulphate 0.4 mmol/kg (max. 8 mmol) iv usually over 15 mins

DRUG	NORMAL DOSE RANGE	CONCENTRATION	CALCULATION
Adrenaline	0 – 0.2 mcg/kg/min (higher doses with cons. approval)	0.3 mg / kg in 50 ml	1 ml / hr = 0.1 mcg / kg / min
Noradrenaline	NB Noradrenaline incompatible with sodium chloride		
Aminophylline	Diuresis: 0.5 mg/kg/hr	Peripherally: 50 mg in 50ml Centrally: 1250 mg in 50ml	0.5 ml / kg / hr = 0.5 mg / kg / hr 0.02 ml / kg / hr = 0.5 mg / kg / hr
Amiodarone	25mcg/kg/min for 4hrs then 5-15 mcg/kg/min	120 mg in 50ml (Glucose only)	0.125 ml / kg / hr = 5 mcg / kg / min
Aprotinin	10, 000 Kallikrein Inactivator (KI) Units / kg / hr	500, 000 KI units in 50ml	1 ml / kg / hr = 10,000 KI units/kg/hr
Clonidine	0.1 – 2 mcg/kg/hr	50 mcg / kg in 50ml	1 ml / hr = 1 mcg / kg / hr
Dinoprostone	5 – 50nanograms/kg/min	50 mcg in 50ml	0.3 ml / kg / hr = 5 nanog / kg / min
Dobutamine	0-10 mcg/kg/min (higher doses with consultant approval)	< 15kg: 15 mg / kg in 50ml > 15kg: 250 mg in 50ml	1 ml / hr = 5 mcg / kg / min 0.012 ml / kg / hr = 1 mcg / kg / min
Dopamine	0-10 mcg/kg/min (higher doses with consultant approval)	Centrally: 15 mg / kg in 50ml	1 ml / hr = 5 mcg / kg / min
Epoprostenol	2 - 40 nanograms/kg/min	70 mcg in 50ml (500mcg vial)	0.43 ml/kg/hr = 10 nanog/kg/min
Esmolol	25 – 200 mcg/kg/min	Centrally: 1000 mg in 50ml	0.15 ml / kg / hr = 50 mcg / kg / min
Fentanyl	0-8 mcg/kg/hr	< 25kg: 100 mcg/kg in 50ml > 25kg: 2.5 mg in 50ml	1 ml / hr = 2 mcg / kg / hr 0.02 ml / kg / hr = 1 mcg / kg / hr
Furosemide	0.1 – 0.5 mg/kg/hr (higher doses with cons. approval) NB Incompatible with glucose	100 mg in 50 ml 500 mg in 50ml	0.5 ml / kg / hr = 1 mg / kg / hr 0.1 ml / kg / hr = 1 mg / kg / hr
Glyceryl trinitrate	0.5-10 mcg/kg/minute	50 mg in 50ml	0.06 ml / kg / hr = 1 mcg / kg / min
Heparin	10 – 40 units/kg/hr	1000 units / kg in 50ml	1 ml / hr = 20 units / kg / hr
Hydralazine	12.5 – 50 mcg/kg/hr; max: 3 mg/kg/day (= 125mcg/kg/hr) Ecmo: max 240 mcg/kg/hr; NB Incompatible with glucose	< 10kg: 5 mg / kg in 50ml > 10kg: 40 mg in 40ml	1 ml / hr = 100 mcg / kg / hr 0.1 ml / kg / hr = 100 mcg / kg / hr
Insulin	ChiP: see flow charts; Diabetics: see diabetic clinical guideline on intranet; All others: see control arm of ChiP protocol		
Isoprenaline	CHB and resistant bradycardias: 0.01 – 0.5 mcg/kg/min Transplant patients: 0.01 – 0.05 mcg/kg/min	Peripherally: 200 mcg in 50ml Centrally: 1000 mcg in 50ml	0.15 ml / kg / hr = 0.01 mcg /kg/ min 0.03 ml / kg / hr = 0.01 mcg /kg/ min
Labetalol	0.5mg/kg/hr , adjusted according to response See Infusion Prescribing Guideline for maximum doses.	Peripherally: 50 mg in 50ml Centrally: 200mg in 40ml	0.5 ml / kg / hr = 0.5 mg / kg / hr 0.1 ml / kg / hr = 0.5 mg / kg / hr
Midazolam	0 – 4 mcg/kg/min	<40kg: 6mg / kg in 50ml >40kg: 250 mg in 50ml	1 ml / hr = 2 mcg / kg / min 0.012 ml / kg / hr = 1 mcg / kg / min
Vecuronium	0 – 4 mcg/kg/min	Refer to Infusion Prescribing Guideline	
Milrinone	0.25-0.75 mcg/kg/min (up to 1mcg/kg/min with approval)	Refer to Infusion Prescribing Guideline	
Morphine	0-40 mcg/kg/hour	< 50 kg: 1 mg / kg in 50ml > 50 kg: 50 mg in 50ml	1 ml / hr = 20 mcg / kg / hr 0.02 ml / kg / hr = 20 mcg / kg / hr
Sodium nitroprusside	0.5-8 mcg/kg/min. Max 4 mcg/kg/min if for >24hrs. Monitor serum lactate. Incompatible with sodium chloride.	< 15 kg: 3 mg / kg in 50ml > 15 kg: 30 mg in 50ml	1 ml / hr = 1 mcg / kg / min 0.06 ml / kg / hr = 1 mcg / kg / min
Vasopressin	Resistant Hypotension: 0.0003-0.002units/kg/min	20 units in 50ml	0.045 ml/kg/hr =0.0003 unit/kg/min

Mannitol 20% 250-1500 mg/kg/dose (=1.25-7.5 ml/kg) IV over 30 min
Metolazone 1mth-12y: 0.1-0.2 mg/kg od-bd po; >12y: 5-10mg od-bd
Morphine Sulphate 20 mcg/kg iv boluses when on infusion (max 100mcg/kg/hr); 0.05-0.2mg/kg q4-6h po
Ondansetron iv / po 0.1mg/kg 8hrly
Pancuronium100mcg/kg iv then neonate 50mcg/kg;>1mth 20mcg/kg
Paracetamol po/pr: <1mth max 60 mg/kg/day; >1mth max 90mg/kg/day; iv: <1mth 10mg/kg max 6h; >1mth -50kg: 15mg/kg q4-6h (max 60mg/kg/day); >50kg: 1g 4-6h (max 4g / day)
Phenobarbital Loading dose: 20 mg/kg (max 1g) IV over 30min.
Repeat doses (ongoing seizures) 5-10 mg/kg in ventilated pts. 12 hrs later: Maintenance: <12 yr: 5mg/kg/day in 1-2 divided doses po/iv; 12-18yr: 300mg bd po/iv
Phenytoin Loading dose: 18 mg/kg IV over 20 min (with ECG); 12 hrs later: maintenance: neonates 2.5 -5 mg/kg q12h iv/po, 1mth-12yrs: 2.5-7.5 mg/kg q12h iv/po (usual maint = 5mg/kg bd, max 150 mg bd po for <12yrs, > 12yrs max 300 mg bd po or 100 mg qds iv)
Potassium canrenoate: 1 – 2mg/kg (max 200mg) bd
Potassium chloride 0.1-0.5mmol/kg (max 20 mmol) iv over 1hr
Propranolol(TOF)20 mcg/kg test dose iv then 20-100 mcg/kg over 10 min neonate;q12h;>1mth;q6h, maint :neonate:0.25-2 mcg/kg po q8h
>1mth 0.25-1mg/kg q6-8h po (max 5mg/kg/day) or 0.1mg/kg iv q8h.
Rantidine IV: 1mg/kg (max 50mg) q6-8h (q12h in renal failure/RRT)
PO: <6mth 1-3 mg/kg tds, >6mth 2-4mg/kg bd (max 150mg bd)
Spironolactone neonate: 0.5-1mg/kg bd; >1mth: 0.5-1.5mg/kg bd; > 12yrs: 25 -50mg od - bd
Sildenafil 0.25-0.5 mg/kg/dose po q4-8h (max 1-2 mg/kg q4h)
Vecuronium 0.1 mg/kg/dose IV

A 'Rough Guide' to the CARDIAC CRITICAL CARE UNIT

MON.	TUES.	WED.	THURS.	FRI.	SAT. / SUN.
0745: Surg.Rnd 0815: Teaching 08:45 ICU Rnd	0745: Surg.Rnd 0815: Teaching 0830: ICU Rnd	0745: Surg.Rnd 0815: Teaching 0830: ICU Rnd 1-5pm Core teaching 4 th wed	0730: JCC 0830: ICU Rnd	0745: Surg.Rnd 0815: M&M 0900: ICU Rnd	 0830: ICU Rnd
				0900: 'Pump list' meeting	
1600: ICU Rnd	1600: ICU Rnd	1600: ICU Rnd	1600: ICU Rnd	1600: ICU Rnd	
2015: Handover	2015: Handover	2015: Handover	2015: Handover	2015: Handover	2030: Handover

*NB attendance at these scheduled teaching sessions is 'protected' and compulsory.

Dr Ian James	Ext. 8208 / bleep 0119	Prof Martin Elliott	Ext. 5300
Dr Allan Goldman	Ext. 5969 / bleep 0737	Mr Victor Tsang	Ext. 5298
Dr Kate Brown	Ext. 8016 / bleep 0505	Mr Martin Kostolny	Ext. 8013
Dr Cho Ng	Ext. 5729 / bleep 0188	Dr Mike Broadhead	Ext. 5308 / bleep 0053
Dr Aparna Hoskote	Ext. 5492 / bleep 0596	Dr Troy Dominguez	Ext. / bleep
Dr Ann Karimova	Ext. 8014 / bleep 0539	Dr Tim Thiruchelvam	Ext 5969 / bleep 0737
Dr Richard Paget	Ext. 5308	ECMO Fellow	Ext. 8180 / Bleep 0410

CCC4: 8652/8312 Fax:02078138170	CCCU: 1st-on:bleep 0542	Cardiac Theatres: 5181/5182/5185
CCC4 Team Room: 8625/7835	CCCU: 2nd-on: bleep 0547	Cardiac Cath: 5247 / Co-ordinator bleep 0686
PICU: 8808/8283 Fax:02078138206	Cardiology Registrar: bleep 0548	ECG: 5241
NICU: 8812/8285	Cardiothoracic Reg.: bleep 0530	X-ray: 5261/8677, Bleep 0634
ECMO office: 8180 / 8802	CCCU Fellow: bleep 0410	Ultrasound: 5265, Bleep o/c SpR
CATS hotline: 4850, 0800 0850003	CCCU Co-ordinator: bleep 0531	CT scan: 5264, Bleep Neuroradio SpR
Coffee room: 5751	ECMO Co-ordinator: bleep/MP	MRI: 8510/Bleep 2060
Intensivist PA (Lisa) 8180/8400/8483	NICU Registrar: bleep 0638	Interventional Radiology: 7856 / blp 0914
PICU secretary (Paula): 8213	PICU Registrar: bleep 0523	Haematology: 5390 / bleep 0590
Switchboard: 5000	General Surgical Reg: bleep 0777	Blood bank: 8527
Cardiac arrest: 2222	Anaesthetic Reg.: bleep 0510	Biochemistry: 5009 / bleep 0589
Non medical emergency: 5999	Vent. tech's: ext 5143/bleep 0561	Microbiology: 5280/ 5282, Bleep 0670
CSP: bleep 0313	Porters: 5257	Virology: 2401 Immunology lab: 8835
Camden Coroner: 020 7387 4884	EEG: ext.5153	Genetics: 8870

External referral/retrieval: refer calls to the CATS (Children's Acute Transport Service) hotline - 0800 0850003

Direct dialing: for extensions beginning 81xx-85xx: preface=813 xxxx; for extensions 86xx and 88xx, preface = 829.

Bleep someone: dial 76, then 4-digit bleep no., then your 4-digit extension no. (76.xxxx.xxxx) (National Hosp: 77)

Transfer a call: press "R" or "recall" on 'phone, dial no. to transfer to, and then hang up after call answered.

'Call-back'/'camp-on-busy' for engaged no.: R#1

Post-op cardiac cases:

On return of patient to the ward: 1. Get handover from the anaesthetist and the surgeon. Note operation performed and any complications encountered; cardiac rhythm, RAP, LAP and MAP, and inotropes/dilators required coming off bypass. What was the duration of CPB and aortic cross-clamping (latter being time of 'cardioplegia')? Are there concerns regarding anatomy/repair (e.g. coronaries, size of shunt, etc.) or pulmonary hypertension? What oxygen saturations are to be expected/aimed for? 2. Request: ABG/ K/ iCa"/HCT/Lactate, and formal FBC and Mg. Also, Urea, Creat, Ca and Phos in Transplants. Add Coag profile if neonate, redo surgery or if bleeding excessively. CXR (check position of ETT, lines, drains,? pneumothorax/effusion). Order baseline ECG and request postop Echo? 3. **Bleeding.** Ask what blood products are available (unused from theatre) - you may need to order more. 4. **Ventilation.** Anaesthetist will set the initial settings; these should be checked and recorded, and these may require adjustment according to ABG. Remember to put on SIMV if not muscle relaxed.

Antibiotic prophylaxis:

Age	Flucloxacillin	Amikacin	*Teicoplanin
< 1 wk of age	25 mg/kg/dose q12h	See neonatal dose in table below: one dose only	16 mg/kg one dose only
1-3 wks of age	25 mg/kg/dose q8h	See neonatal dose in table below: one dose only	16 mg/kg one dose only
3-4 wks of age	25 mg/kg/dose q6h	See neonatal dose in table below: one dose only	16 mg/kg one dose only
> 4 weeks	25 mg/kg/dose q6h	10 mg/kg/dose q12h for 2 doses	10 mg/kg/dose q12 h for 2 doses

***Penicillin allergy; MRSA carriers; if received penicillins in past 2 wks; and re-ops during same hospital admission.**

Antibiotics are usually continued for 24 h (from 'induction') only. If receiving >24 h antibiotics, prescribe nystatin 100,000 U (1ml) po q 6h prophylactically. **Any manipulation/intervention on CCC** – Teicoplanin and Amikacin – 1 dose

Analgesia and Sedation: Most post-op ventilated neonates and children usually receive an opiate (+/- benzodiazepine) by infusion, the most frequent agent being morphine (10-40 mcg/kg/hr). Use midazolam with caution in the cardiovascularly unstable pt as has been shown to decrease BP and CO. Occasionally, fentanyl will be the opiate of choice. In the longer term, or prior to extubation, chloral hydrate, or alimemazine may be used. Paracetamol is given via iv route post-op. See over page for doses NB: iv doses are different to oral. In patients at risk of pulmonary hypertensive crises, prescribe fentanyl 2-4 mcg/kg prior to suction.

Muscle relaxation Pancuronium boluses. Vecuronium infusion is only prescribed if the patient is cardiovascularly unstable, or the sternum has been left open. Please discuss with Consultant on service. Muscle relaxants should be suspended every morning on all pts (as tolerated) to allow neurological assessment, as well as to ensure that there is no 'accumulation.'

¹ ©CICU Guide: To be used as a guide only. Whilst all care has been taken in the preparation of this guide, no responsibility will be taken by the authors for the drug doses, which should always be confirmed independently by the prescriber. Updated Dec 2011 by LC & TT.

Bleeding: Any bleeding more than 3mls/kg/hr warrants attention. Blood loss of >10 ml/kg/hour at any stage requires immediate surgical review. (Est. blood vol. $\approx$ 85 ml/kg<10kg, 80ml/kg 10-20 kg, & 75 ml/kg >20kg).

Management: fluid resuscitation, check formal FBC/coagulation profile/TEG & replace factors as indicated (most likely to need cryo and platelets); consider Aprotinin 10,000 KI units/kg/hour; watch for tamponade (sudden cessation of drainage, decreased CO, increased atrial pressures - ECHO/? TOE required); keep drains patent, ensure 2 units blood are available; notify Surgeons (may need to re-explore).

Packed cells 10-20 ml/kg (check HCT/Hb at end of transfusion; more blood may need to be given; 4 mls/kg raises Hb by 1g/dl
FFP 10-20 ml/kg **Platelets** 10ml/kg (generally maintain plts>50 if bleeding),(hospital emergency pool available if urgent transfusion required, **Cryoprecipitate** 5-10ml/kg (for Fibrinogen < 0.8). Each pack contains 0.15 to 0.30 g of Fibrinogen. Five packs will provide approx 1g of Fibrinogen)

Post op fluids: neonates:10% Gluc./0.45% NaCl & 30mmol KCl/500ml; infants: 5% Gluc /0.45% NaCl & 30mmol KCl/500ml
For fast-track cases use KCl 10mmol/500ml additive instead. Bypass cases: **D1** - 50% maintenance.

Non-bypass cases; patients with recent CCF; shunt/valvotomy with ↑PBF; or pulmonary oedema - 70% maintenance

Maintenance Fluids: (reduce in presence of CCF); Fluid type as for post-op pts above as per age but 10 mmol KCl/500 ml

Neonates D1: 60; D2: 90; D3: 120; D4: 150 ml/kg day

Infants and children 100% = 100 ml/kg/day for the first 10kg; 50 ml/kg/day for the next 10kgs; 20 ml/kg/day for subsequent kg's. Although a child's fluid regimen may be expressed as "kg maintenance", fluid orders must be written as "**ml/kg/day**".

Nutrition / electrolytes: Potassium: target range 3.8-4.3 mmol/l; usual maintenance=2 mmol/kg/day, but may require more with diuretic therapy or metabolic alkalosis; **Hypokalaemia:** infusion if serum K+ <3.3 (<4.0 in presence of tachyarrhythmias) 0.25mmol/kg (over 30min)-0.5mmol/kg (over 60min) [Max 20 mmols]. Potassium infusions are not to be used on the Unit unless discussed with Consultant. If patient is tolerating oral or NG feeds, give enteral supplements 2 mmol/kg/day in divided doses.

Hyperkalaemia: stop any K+ containing infusions; consider furosemide 1 - 5 mg/kg; calcium resonium (0.125-0.25g/kg pr, repeat if necessary q6-8h); Ca gluconate (0.067 - 0.11 mmol/kg over 10-30 min) or; glucose 10% 5 ml/kg/hr +/- insulin 0.05- 0.1 units/kg/hr; sodium bicarbonate 1mmol/kg over 30 mins; salbutamol (2.5 - 5 mg nebulised, repeated if necessary or 4mcg/kg over 5 mins iv); CVVH or PD.

Protein: 1g/kg/day initially, increasing daily to 3g/kg/day (1g protein = 0.16g nitrogen). **Lipid:** 1 g/kg/day initially, increasing daily to 3g/kg/day (over 20 h)

Sodium: target range 135-145 mmol/l; usual maintenance = 2 - 3 mmol/kg/day. **Hyponatraemia:** give sodium chloride 3 ml/kg of 2.7% NaCl over 1 hour to raise serum Na to $\geq$ 125. Then aim to increase Na by 10 mmol/L/day

Calcium: target range for ionised Ca 1.05 - 1.25; usual maintenance = 1.0 mmol/kg/day

Hypocalcaemia: 10% Ca gluconate 0.11mmol/kg IV. Incompatible with bicarbonate soln. Oral replacement - 0.25 mmol/kg q 6h

Mg⁺⁺ usual maintenance 0.2mmol/kg/day. Oral replacement: Mg glycerophosphate 0.2mmol/kg (max 8mmol) q8h.

Glucose: 10 -15% (usual requirements = 4-6 mg/kg/min.) Glucose requirements of >10 mg/kg/min usually assoc. with hyperinsulinism. Glucose (mg/kg/min) = (ml/hr x % gluc.) / (6 x wt). In the event of 'unexplained' hypoglycaemia, draw blood for cortisol, insulin and GH levels (and formal BSL) prior to administering 2.5-5 ml/kg of 10% glucose.

Oliguria: Exclude blocked catheter, hypovolaemia, poor cardiac output, furosemide 1 mg/kg; if poor response 5 mg/kg; consider mannitol / metolazone in 'stable' cases; if no previous response to furosemide and if unstable patient, consider proceeding to definitive treatment early, i.e. renal replacement therapy.

Intubations: It is considered 'best practice' for two doctors to be present at all intubations.

Drugs: most 'cardiovascularly stable' induction:

- Fentanyl 2-5 micrograms/kg (or Morphine 0.1-0.2 mg/kg) (including neonates!)
- +/- Ketamine 1-2 mg/kg
- Atracurium 0.5-1.0 mg/kg (or Suxamethonium 1-2mg/kg)
- +/- Atropine 20 micrograms/kg

Other agents: thiopentone / midazolam may decrease BP +/- CO and should be avoided

Tube size (age/4) +4 **Tube length**-oral (cm): (age/2) +12 (nasal add 2-3); or: 3 x's internal diameter (oral)

HFOV: usually set MAP 2-6 cm>MAP on conventional vent, Freq. 5-10Hz; amplitude 'enough to make the chest wriggle'.

"Oxygenation" related to fiO₂ and MAP; "Ventilation" related to freq. (inversely related-decreased freq.→increased amplitude) and amplitude (Vt²)(related to 'power' and ETT/ tubing diameter). Check ABG within 20 min. as CO₂ may drop precipitously.

Neonatal ECMO criteria: OI > 40 (OI = MAP x F_{O₂} x 100/ PaO₂ (mmHg)) (1kPa =7.5 mmHg); don't apply OI alone for CDH or in the presence of air-leaks – consider early rather than late.

Pulmonary hypertension Mx: iNO: useful for (PPHN, post-op cardiac). During normal hours consult ventilator technicians. Directions for set up are in CCUC. Usually begin at 20ppm; if a definite response occurs, attempt to wean after an hour to 2-5ppm, **other agents – Epoprostenol, oral Sildenafil.** Maintain sedation (Fentanyl boluses). Consider muscle relaxation and magnesium.

Cardiac arrest/ dysrhythmias: paediatric arrests are usually secondary to hypoxia - remember O₂

Asystole/ non-VT/VF arrest: CPR+ Adrenaline 1:10 000, 0.1 ml/kg, then 1.0 ml/kg; repeated q 3 min

EMD arrest: consider-

4 H's: Hypoxia; Hypotension/Hypovolaemia; Hyper-/Hypo-kalaemia/calcaemia; Hypothermia

4 T's: Tension pneumothorax; Thromboembolism; Toxin/Therapeutic failure (tricyclics,β-blockers, Ca⁺⁺ channel blockers); Tamponade (not uncommon in CCUC; much may need to be re-opened to identify retrocardiac thrombus)

VT/VF:defibrillate 2J/kg initially, then 4J/kg;repeat q 1 min; IV Lidocaine: neonate-12y: 1mg/kg (max 50mg) then infusion, >12y: 50-100mg then inf.

SVT: vagal maneuvers; Adenosine: neonates-12yr: 150 mcg/kg rapid iv; increase by 50 mcg/kg/dose to max of 500 mcg/kg (300 mcg/kg in neonates) if needed, > 12 yr: 3mg followed by 6mg then 12mg at 1-2 min intervals if necessary ; consider DC cardioversion (0.5-1 J/kg); consider loading with IV digoxin: neonates-5yrs: 35mcg/kg/24h in 3 divided doses over 30-60mins; 5-10yrs: 25mcg/kg/24h (max 500mcg) in 3 divided doses over 30-60mins; 10-18 yrs: 0.5 -1mg/24h in 3 divided doses over 30-60mins then maintenance.

JET: analgesia/sedation, filling, avoid pyrexia, active cooling (34-36°C), decrease inotropes, correct Ca⁺⁺/K⁺, consider magnesium, A-V sequential pacing when ventricular rate <160, Amiodarone 25 mcg/kg/min for 4 hours then 5-15 mcg/kg/min.

AE: overdrive pacing, cardioversion (0.5-1 J/kg)

Anticoagulation Guidelines: Shunts - Heparin at 10 units/kg/hr once bleeding stops, then aspirin when feeds established. **Norwood Stage 1 and 2** – full heparinisation (APTT 60-80 secs) till CVL out, then aspirin. **Prosthetic valves and Fontan** – full heparinisation once bleeding stops, then warfarin. **Discuss/confirm with surgeons regarding anticoagulation.**

Antibiotic Guidelines: Liaise with the ID/Micro (ext. 5282/7930/8594/5237)(Micro SpR/Dr Dixon/Hartley/Soothill), to discuss appropriate antibiotic choices and culture results. All recommendations should be discussed with the CCC consultant prior to implementation. Review all antibiotic regimens at 48 hours & 5 days, & when culture and sensitivity results become available.

- **Post-op chest infection:** Piperacillin/tazobactam & amikacin, review with culture results (clarithromycin for pre-op community acq. pneumonia)
- **Cardiac postop ECMO if chest open:** Co-amoxiclav 30 mg/kg q12h if neonates <7days, q8h if >7days-12 years, 1.2 g q8hrly if 12-18 years
- **Neonatal sepsis:** Cefotaxime, amikacin and ampicillin; (If already started on benzylpenicillin this may be continued instead of cefotaxime and ampicillin if there are no CNS concerns; give in combination with amikacin)
- **Fever without localising signs if meningitis not suspected:** Piperacillin/tazobactam & amikacin; add vancomycin if pt has central lines
- **Gram Neg. line sepsis (if meningitis ruled out):** Piperacillin/tazobactam and amikacin; may need Echo. LP if <3months of age
- **Staph Epidemidis line infection:** Vancomycin. Line removal may be needed & consider Echo
- **Wound infection:** Flucloxacillin (50 mg/kg/dose) and amikacin

Aciclovir (iv) *Adjust in RF	<3 mth: 20mg/kg q8h 3 mth -12yrs: 500mg/m ² q8h >12 yrs: 10mg/kg q8h	Ciprofloxacin *Adjust in RF	<4wks: 6-10mg/kg iv q12h, 10-15mg/kg q12h po >4wks: 6-10mg/kg (max 400mg) iv q8h, 10-20mg/kg (max 750mg) q12h po
Amikacin (iv) Levels: T<5mg/L P=20-30mg/L P only for doses<20mg/kg	<2 kg <4 wks of life: 10 mg/kg q24h; T+P <2 kg >4 wks of life: 15 mg/kg q24h; T+P >2 kg <4 wks of life: 15 mg/kg q24h; T+P >2 kg >4 wks of life: 20 mg/kg q24h; T+G Renal Imp: 10mg/kg, take PEAK after 1 st dose then T+H at 24 hours	Clarithromycin (iv/oral) *Adjust in RF Avoid in LF	< 4 wks of life: not recommended iv: >4 wks of life - 12yrs old: 7.5mg/kg q12h iv: 12-18yrs old: 500mg q12h (max dose) oral: all ages 7.5mg/kg; see BNFc for pts >8kg
		Erythromycin (iv/oral) Avoid in LF	12.5mg/kg/dose iv q6h all ages (po : see BNFc) Meningitis: 25mg/kg/dose iv q6h all ages (max 4g/day) Gastric Stasis: 3mg/kg q6h po/ng
Liposomal Amphotericin	Give test dose of 100 mcg/kg (max 1mg) over 10 mins, followed by rest of dose 1hr later Prophylaxis: 1 mg/kg q24h T/m: 3mg/kg q24h (5mg/kg micro advice only)	Flucloxacillin (iv) *Adjust in RF	Sensitive Staph: 25mg/kg/dose (doubled in severe inf.) <1 wk of life: q12h; 1-3 wks of life: q8h >3 wks of life: q6h (max 8g/day)
Ampicillin (iv) *Adjust in RF	Meningitis/Neonatal sepsis: <2kg <1wk of life: 50mg/kg q12h >2kg <1 wk of life: 50mg/kg q8h <2kg >1 wk of life: 50mg/kg q8h >2kg >1 wk of life: 50mg/kg q6h Listeria meningitis: <1wk of life: 50mg/kg q6h; >1wk of life: 50mg/kg q4h	Fluconazole (iv/po) * Adjust in RF	Prophylaxis: 3mg/kg; Treatment: 6-12mg/kg <2wks of life: q72h; 2-4wks of life: q48h; >4wks of life: q24h (max 800mg daily)
Benlycil Penicillin (iv) *Adjust in RF Neonatal Sepsis: 50mg/kg/dose	25-50 mg/kg/dose (max 2.4g/dose, 14.4g/day) <1 wk of life: q12h, 1- 4 wks of life: q8h >4 wks: q4-6h Meningitis: <4 wks of life: 75mg/kg q8h >4 wks of life: 50mg/kg q4h	Meropenem (iv) *Adjust in RF Micro /ID approval	<1 wk of life: 20mg/kg q12h, >1 wk of life: 20mg/kg q8h; Meningitis: 40mg/kg/dose (max 2g q8h)
Cefotaxime (iv) Neonatal Sepsis: 50mg/kg/dose	Neonates: 25-50mg/kg/dose, < 1 wk: q12h, 1-3 wks: q8h, 3-4 wks: q6-8h > 4 wks: 50mg/kg q6-8h (max 12g/24h) Meningitis: 50mg/kg: <1wk of life: q12h; 1-3wks of life: q8h; >3 wks of life: q6h	Metronidazole (iv/oral) *Adjust in RF	<4 wks: IV:15mg/kg stat, then 7.5mg/kg q12h after 24 hrs <4 wks of life: iv/po: 7.5mg/kg q8h (Max IV dose = 500mg, max PO dose = 400mg)
		Micafungin (iv)	<40kg: 2mg/kg q24h (increase to 4mg/kg if inadequate response) >40kg: 100mg q24h (200mg if inadequate response)
		Piperacillin/tazobactam *Adjust in RF	<4 wks of life : 90mg/kg q8h >4 wks of life : 90mg/kg q6h >15kg: dose banding (pharmacy)
		Teicoplanin (iv) *Adjust in RF on day 4	<4 wks of life: 16mg/kg for 1 dose then 24 hrs later 8mg/kg q24h; >4 weeks of life: 10mg/kg (max 400mg) q12h for the first 3 doses then 10mg/kg q24h
Ceftazidime(iv) *Adjust in RF	25mg/kg/dose (severe inf: 50mg/kg/dose) <1wk of life: q24h; 1-3wks of life q12h; >3wks of life: q8h (Max 2g q8h, CF 3g q8h)	Vancomycin (iv) Levels: T=5-15mg/L Peak levels not required	<2 kg<4 wks of life: 15 mg/kg; T+H at 12hrs >2 kg<4 wks of life: 15 mg/kg q12h; T+G >2 kg>4 wks of life: 15 mg/kg q8h; T+G 2 nd or 3 rd dose Renal Imp: 10mg/kg, mild-mod imp T+H at 12 hrs, severe imp T+H at 24 hours

Cardiac Operations

Arterial switch: divide and transpose aorta and MPA, re-implant coronaries.

Blalock-Taussig shunt (BTS): 'classical'=divided subclavian artery to R or L PA; 'modified'=goretex tube from systemic to PA.

Central shunt: goretex shunt from aorta to MPA

Damou-Kaye-Stansel: aortic reconstruction with divided MPA (proximal) end to side →aorta, plus BTS, Glenn or Fontan.

Norwood I (HLHS): create unobstructed RV→(neo) aortic flow (eg.with DKS), with systemic→pulmonary RmBTshunt, atrial septectomy and PDA ligation. **Qp/Qs ratio:**(S₂O₂-S₁O₂) / Sp₂O₂-Sp₁O₂) Normal =1.0 (Post Norwood I, S₂O₂ = Sp₂O₂)

Sano modification of Norwood Stage 1: reconstruction of aorta, RV to PA conduit (no BT shunt), atrial septectomy
Glenn shunt: bidirectional Glenn=cut SVC to (undivided) RPA; bilateral bidirectional – R and L SVCs to respective PAs.

Fontan/total cavopulmonary connection/TCPC (single vent.): IVC to PA anastomosis, Lateral tunnel or Extracardiac with fenestration (allows R-L shunt and improves CO in the presence of elevated PVR), RA to PA, close ASD

Mustard/Senning (TGA): intra-atrial goretex/atrial or pericardial baffle directing flow PV's→RV→aorta, vena cavae→LV →PA

Rastelli (TGA+VSD+LVOTO): divide PA, close proximal end (from LV), prosthetic tunnel VSD→aorta, and valved conduit from RV→MPA.

Ross (ASIAR): PV autograft to replace AV, and RVOT reconstruction with valved conduit.

Konno: Enlarge Ao root and LVOTO with incision across both, Ao valve prosthesis or homograft or Ross.

Tetralogy of Fallot repair: VSD closure, RVOTO relief; ideally with preservation of valve function, but may require transannular patch (→free PI). Approach is usually transatrial; rarely with ventriculotomy.

Unifocalisation: centralizing pulmonary blood flow +/- central shunt or RV-PA conduit +/- VSD closure depending on anatomy.

Discharge Summaries: See D/S template and directions on K\CCC Handover\CCC4 Discharge summaries. Please inform Lisa Sharman of any discharge summaries asap as she can then post it out to relevant consultants, GP, parents etc. D/S have to be sent out within 3 days of discharge. In the event of death:

1. Ensure that the child's parents are informed immediately. Notify the CCU consultant, the child's surgeon and cardiologist.
2. Certify the child's death in notes. Include time of death, cause of death, if known, as well as circumstances of the death.
3. D/W consultant if case needs to be referred to the Coroner (within 24 h of admission, accidental or violent death, cause of death uncertain, within 24 h of operation etc). If the case is not to be referred to the Coroner, discuss need for PM. A 'limited PM' is another option, e.g. thoracic contents. Inform pathology if PM is to be held (Dr Ashworth/Seibre).
4. Notify referring consultant, in addition to the family GP. Complete death certificate (and cremation certificate if appropriate) for every child (if not a Coroner's case). Give it to the parents, who must register at the Camden Registry within 5 days.
5. Inform the parents that they will be offered bereavement counselling (if they wish) in approx. 6 weeks time.