Paediatric Intensive Care Unit

Admission to Paediatric Intensive Care Unit Following Cardiac Surgery.

Staff relevant to:	Medical staff and nurses on PICU who will be managing patients following Cardiac Surgery
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1. Introduction & Scope:

This guide is intended to assist junior medical and nursing staff working in cPICU –who will manage patients following Cardiac Surgery. The aim of this clinical guideline is to enable health professionals to make informed decisions about the postoperative management.
This clinical guideline is based on available evidence in conjunction with clinical expertise and experience. This does not replace clinicians' judgment and does not override the autonomyof healthcare professionals making treatment decisions about care on a case-by-case basis. (in alignment with clinical assessment, knowledge, expertise as well as patient/family wishes). Users are encouraged to seek out newer information that might impact the diagnostic and treatment recommendations contained within this guideline.

Related guidelines:

C44/2016 Thromboprophylaxis Post Congenital Heart Surgery UHL Childrens Intensive Care Guideline
C10/2009 Analgesia and Sedation UHL Paediatric Intensive Care Guideline
C60/2016 Atrial ECG UHL Paediatric Intensive Care Guideline
C149/2016 Handover of Post-Operative Cardiac Patients to PICU UHL Childrens Intensive Care Guideline
C156/2016 Junctional Ectopic Tachycardia (JET) UHL Childrens Intensive Care Guideline
C120/2016 Severe Bleeding Prevention - Following Cardiac Surgery UHL Childrens Intensive Care Guideline

Contents

2. Guideline standards and procedures

2.1 Preparation before the arrival of the patient.

For most post–operative cases, there will be sufficient time to prepare for their arrival in ICU. It is ideal to review the notes and document a pre-operative examination if the patient has been admitted to ICU prior to the operation. Preparations should be made for the routine post-operative tasks and potential common and uncommon complications can be considered and planned for.

Planned cases are typically discussed and reviewed at the EMCHC Multi-disciplinary Team meeting in the RMO/EMCHC Seminar Room (Jarvis Building) on the prior week. Attendance at this meeting can be useful to gain familiarity with the known pre-operative status, planned procedure as well as the parental and team mind-set.

I. Reviewing the case notes prior to admission of the patient to identify the clinical problems, surgical plan and expected complications
II. Ensure that a 'crash sheet' and crash drugs has been correctly prepared for the patient.
III. Set up the ventilator and check settings are appropriate for expected requirements e.g. does the child need a ventilator with inhaled Nitric Oxide ventilator capability?
IV. Consider if the patient will require cooling to decrease oxygen consumption in presence of low cardiac output. Prepare a cooling mat if in doubt. (Risk factors include long bypass, deep circulatory arrest or right ventricular outflow incision)?
V. Complete a request form on ICE for CXR + routine post-operative bloods (see below).
VI. Prescribe 'Routine' Drugs and Infusions on drug chart.

2.2 Routine drugs (see appendix A)

Analgesia, sedatives and muscle relaxant agents:

All opiate analgesics, the majority of sedatives and all muscle relaxing agents have a negative inotrope effect. As they are potentially dangerous they should be administered with care in the postoperative cardiac patient and titrated against the target comfort score.

Analgesia:
Handover from the Anaesthetist should detail drugs administered prior to arrival and a recommendation of whether an opiate bolus will be required.
Simple analgesia – Paracetamol should be prescribed regularly and reviewed at 48 hours post operatively.
First line: - Morphine Sulphate commenced at a rate of 10- 40 micrograms/kg/hour (for > 50kg use adult prescription chart), depending on the surgery performed, the post-op plan and the consultant's decision. Morphine boluses should be prescribed on the drug chart (50micrograms/kg IV).

Morphine is also preferred analgesia for ECMO patients due to high fentanyl absorption to the circuit.

Fentanyl infusions are preferred for some patients, e.g. those with pulmonary Hypertension or neuroprotection where rapid or deep sedation is required.

In adolescents and children with clear communication, the use of morphine PCA (Patient Controlled Analgesia) should be considered.

Sedation:
For patients planned for waking and extubation in the immediate post-operative period, a sedative may not be required.
Clonidine is preferred in the neonatal age group, given the cardio-depressive properties of Midazolam. See PICU Sedation guideline.

Midazolam (avoid in neonates)) dose **50-250 micrograms/kg/hour,** bolus midazolam written up in the PRN section starting at 50micrograms/kg (for > 50kg see the Adult prescription chart)
Note: midazolam can be hazardous in hypotensive patients on significant inotropic support groups.

Muscle Relaxation:
Muscle relaxation decreases oxygen consumption, can be helpful in managing patients in Low cardiac output state.
The usual choices include:-
Atracurium (its metabolism is not affected by liver/ kidney dysfunction, but beware of histamine release properties which can cause vasodilatation & hypotension) or
Rocuronium infusion or boluses.

All analgesia, sedative and muscle relaxation doses should be prescribed as per UHL IV AB policies.

Inotropic Support:

1. Milrinone is aphosphodiesterase III inhibitor and as such is a synthetic non-catecholamine inodilator. It has inotropic qualities and promotes lusitropy which is particularly helpful in treating diastolic dysfunction in hypertrophied ventricles. It has a longer half-life than catecholamines, and can cause **hypotension** in the context of hypovolaemia. It can also affect platelet function and aggravate post-operative bleeding. It can accumulate in renal impairment and small infants thus caution use and lower doses may be needed.
2. Dose: 0.25 - 0.75 micrograms/kg/min Adrenaline is used predominantly for its beta-agonist properties that enhance myocardial contractility. At higher doses, there is increased α-adrenergic activity which causes peripheral vasoconstriction.
   Dose: Preferred dose is 0.05 micrograms/kg/min

If additional inotropes are required these will be decided by the consultant Intensivist.

2.3 Immediate post op care

In this phase some key activities are:
- Preparation prior to transfer including allocation of roles and responsibilities
- Handover
- Decisions and plan

For guidance regarding the above, please see **C149/2016** Handover of Post-Operative Cardiac Patients to PICU UHL Childrens Intensive Care Guideline

See also Appendix C - Admission checklist – What to do when taking a patient out of theatre, a quick guide.

- Note: In the event that on arrival on PICU the post-operative cardiac surgical patient is unstable, then a common-sense approach to the handover process must be used; it is not appropriate to allow a patient to deteriorate whilst the above 'order of handover' takes place; the patient should be assessed and managed in the same way as any critically ill, unstable patient, with the ABC approach.

A primary survey and secondary survey is to be completed by both doctors and nurses.
A management plan should be put in to place and clearly document to all team members. It should include:

- **haemodynamic targets (BP, CVP, LAP, Sats, Hb.)**
- **identification of any existing or anticipated problems - bleeding, pulmonary hypertensive crisis, arrhythmia.**
- **anticoagulation plan**
- **plan for anticipated recovery:**

1. Warm, wake and wean
2. Review in 2-4 hours
3. Leave ventilated overnight
4. ECMO high risk

The plan should be recorded on the post op admission sheet and placed in the patient notes.

2.4 Investigations:

- FBC, U&E+ LFT
- Clotting (consider TEG if bleeding)
- Arterial blood gas with lactate and mixed venous blood gas (from jugular CVL looking particularly at the Saturations)
- Chest X-ray
- 12 lead ECG (Atrial wire study if possible)
- Screening for MRSA, CRO and COVID

2.5 Ventilation:

- Ventilation represents an afterload to the right ventricle; therefore, consider early extubation in children post Glenn and Fontan procedures.
- Children whose pulmonary and systemic circulations work in balance with each other should be managed in the lowest tolerated FiO2 (ideally air FiO2 0.21 - Single ventricle physiology E.g. post BT shunt/ Norwood stage 1). Oxygen and alkalosis (caused by hyperventilation or other reasons e.g high doses of furosemide) decreases pulmonary vascular resistance and may cause a profound drop in blood pressure and coronary hypoperfusion (precipitating cardiac arrest in the worst-case scenario).
- Children at risk of pulmonary hypertensive crisis may need iNO and high FiO2. A lower comfort score may be targeted. Supplementary bolus sedation may be required prior to procedures such as suctioning. Prevent and treat acidosis promptly as this can precipitate pulmonary hypertension. Emergency inhaled nitric oxide should be available on the unit at all times. Further strategy will be decided by the consultant Intensivist.

Guide to initial ventilation settings in a child with bi-ventricular (normal) circulation in parallel:

Assuming normal lung compliance (0.8-0.9ml/cmH2O/kg)

- FiO2 40% or more to achieve target saturation
- PEEP 5 cmH_2O
- Tidal volume 6-8ml/kg (usually needs 7-10cmH2O of driving pressure)
- PIP (Pplat) 12-15cmH_2O (watch for adequate bilateral chest movement)
- RR normal for age (to achieve pCO_2 targets)

Assuming reduced lung compliance

- FiO2 40% or more to achieve target saturation
- PEEP 5 cmH_2O or more depends on lung recruitment and haemodynamics
- Tidal volume 4-5ml/kg (usually needs 10 - 15cmH2O of driving pressure)
- PIP (Pplat) 15 – 20 H_2O (watch for adequate bilateral chest movement)
- RR normal for age (to achieve $ETCO_2$ and $paCO_2$ targets)

Ventilation setting for age	Resp rate (breaths/min)	Inspiratory time(s)
Newborn	30-40	0.5-0.6
Infant	25-30	0.5-0.6
1-5yr old	20-25	0.6-0.8
5-10	15-20	0.8-1.0

2.6 Stabilisation and interpretation of initial survey and investigations:

This stage involves implementing the management plan and regular review of the patient. This includes looking at the adequacy of cardiac output, reviewing blood gases, reviewing ventilation, ECG's and X-rays.
Adequate cardiac output includes a combination of clinical and laboratory parameters.
Concerning features include: High lactate or rising lactate, increasing inotropic support, low mixed venous oxygen saturations, high oxygen extraction and low Systemic NIRS readings. These need to be discussed with a senior colleague.

Temperature Control:

Central temperature should be monitored (especially at Low cardiac output state risk). Rectal probes and patients on cooling mats may pose a source of error in small children and should be avoided wherever possible (use oesophageal probe or temperature probe which is part of urinary catheter). Muscle relaxants may be used when a child is being actively cooled to prevent shivering (after adequate sedation has been administered).

Haemostasis:

- Usually accepted ranges for bleeding - drain losses: The first hour 2 - 4mls/kg, if the trend is showing improvement.
- Second and third hours 2mls/kg or less
- 1ml/kg is acceptable as long as is not fresh blood and has started to turn haemo-serous

Definition of severe bleeding (see C120/2016 Severe Bleeding Prevention - Following Cardiac Surgery UHL Childrens Intensive Care Guideline**)**

Bleeding is considered to be severe post cardiac surgery or ECMO cannulation or procedure when drain/measured losses **exceed**:

- 4ml/kg/hr in the first hour
- 2ml/kg in the second hour
- 1ml/kg in subsequent hours or any bleeding below this threshold associated with haemodynamic instability.

Sudden stoppage of drain loss should also be a concern and alert the nursing and medical team to possible developing **tamponade.** Milking of the drains is essential too. The context in which the loss occurs is important.
It is expected in a coagulopathic patient or a 'redo' surgery with significant adhesions.
A baseline TEG (thromboelastograph test of clotting) will be ideal if the drain loss more than expected. Ideally, if the bleeding is excessive (>4ml/kg/h), the drain losses should be evaluated every 15 minutes and management strategy should be revised.

X-rays:

Check for the position of tip of endo tracheal tube, bilateral lung fields and lung perfusion, position of drains, pneumo-thoraces, pleural effusions, heart size etc.

Cardiac Rhythm:

Check for the rhythm and signs of myocardial ischaemia. ECG recording should be done routinely in all post-op patients as a baseline. Care should be taken not to lift the sternal dressing as adequate recordings can be made without risking wound infection. If there is a

question about the P waves an Atrial wire study can be obtained by inserting the ends of the atrial pacing wires into leads V2 and V4 (it is important to use gloves when handling leads to avoid giving arrhythmogenic electrostatic micro-shocks from your hands via the wires directly to the patient's heart). See **C60/2016** Atrial ECG UHL Paediatric Intensive Care Guideline and **C156/2016** Junctional Ectopic Tachycardia (JET) UHL Childrens Intensive Care Guideline

2.7 Continuous Monitoring

Continuous monitoring is essential for management of most patients in the post-operative period. The type of monitoring depends on the type of surgery, the duration of bypass and cardiac function assessment in the immediate post-operative period

1. Arterial Blood Pressure – In all cases

2. Paired Pre and Post Repair Invasive BP Monitoring – Gradient indicates the effectiveness of repair and any impending stenosis (Coarctation repair)

3. Pre and Post ductal Paired Saturation Monitoring – Indicates shunting

4. CVP Monitoring – In all cases and especially more important in patients with right heart repairs. These patients are dependent on having the appropriate filling pressures sometimes specific as assessed in the immediate post op period. The CVP monitoring also sometimes used to assess the gradient pressures in repairs like Glenn repairs

5. Near Infra Red Spectroscopy(NIRS) – Has become a standard of care both during intra operative period and post-operative period. Cerebral NIRS with two probes for both sides of the brain is essential for arch interventions, otherwise one probe is sufficient. Renal and Muscle NIRS monitoring is used in selected cases to monitor the perfusion of the kidneys and muscles.

6. LA pressure Monitoring – Indicated in selected cases where impaired left ventricle function is expected. This facilitates the monitoring when fluid boluses are essential and avoids deterioration of function above the starling curve equation.

7. Pulmonary Artery pressure monitoring – to monitor pulmonary hypertension.

2.8 Electrolyte Management

Potassium: (target potassium levels: 3.5 - 4.5 mmol/L)

Potassium is the major intracellular cation and regulates cellular 'resting membrane potential'. Therefore, high or low plasma potassium levels precipitate cardiac arrhythmia by changing cellular membrane potentials.
Abnormal potassium levels are to be expected in patients in the first 24 following cardiac surgery because of the effects of bypass on renal function and the frequent need to use diuretics to prevent fluid overload. These factors tend to deplete potassium from the body leading to low plasma levels. Potassium should be administered when the levels are at the lower end of the normal range so long as the child is passing adequate amounts of urine.

HIGH K+ is much more dangerous than low K^+
HYPERKALAEMIA KILLS

When to start -
Needs to be passing urine. Potassium below 3.5 mmol/l. Able to monitor K^+ hourly.

How to give - See Potassium IV Monograph

Other significant ions: (Ca2+, Mg2+, PO4-)

Calcium should be maintained above ionized 1.0 (in neonates at 1.2mmol/l due to immaturity of calcium handling mechanisms and dependency on external delivery in this age group) (available on the gas)

Titrating Mg2+ to high normal values (over 1mmol/l) is indicated if the patient is experiencing rhythm disturbance or is at high risk of rhythm disturbances.

Phosphate - consider supplementation if <1mmol/l. Be aware that phosphate is normally combined with either Sodium or potassium.

Make sure that everything is clearly documented and that both nursing and medical teams are aware of any potential problems as early as possible.

Review for feeding 6 hours post operation – See C90/2016 Feeding UHL Childrens Intensive Care Guideline

2.9 Open Chest and Chest Closure

Important points in managing a patient with open chest

1. Paralysing the child is not always necessary - keep the child analgised and well sedated.
2. Volume controlled SIMV mode is preferable – offers stable minute ventilation.
3. Observe the patch over the open chest for bleeding, bulging or pressure.

Preparation for chest closure

1. Review chest X ray and ET tube position – head tilt is required during the procedure which might dislodge ET tube in a high position.
2. Review labs – order Blood, Platelets and FFP/Cryoprecipitate depending on the recent bloods and bleeding status
3. Review ECHO and clinical picture - Inotropes preparation and connection to the patient depending on the pre closure status.
4. Prophylactic antibiotic if the child is not on suitable antibiotic or additional antibiotic if the regular one does not cover chest closure.
5. Long access lines to a central venous line, fluid bolus and sufficient sedative and paralysis drugs
6. Pacing box available

2.10 Criteria for referral for ECMO

In most of the cases the assessment is done in theatre and the patient is placed on ECMO if the function is identified as being poor. Patients do however deteriorate on ICU and proactive consideration is necessary to prevent cardiac arrest and deaths in ICU. Inspite of having a very experienced ECMO team, it still takes time to mobilise. The accepted indications for consideration of ECMO in the post-operative period are

1. Refractory Low cardiac output state
    a. Hypotension despite maximum doses of two inotropic or vasopressor medications (Adrenaline and Noradrenaline requirement of more than 0.2 microgram/kg/min)
    b. Low Cardiac Output with evidence of end organ malperfusion despite medical support (Persistent oliguria, diminished peripheral pulses)

c. Low Cardiac Output with mixed venous, or superior vena caval central venous (for single ventricle patients) oxygen saturation < 50% despite maximal medical support or Cerebral Saturations of less than 40 for more than 4 hours
d. Low Cardiac Output with persistent lactate > 4.0 mmol/l and persistent upward trend despite optimisation of volume status and maximal medical management.

2. Hypoxia

2.11 Antimicrobials in the Post-Operative period

Surgical antibiotic prophylaxis should continue for 24h post procedure, or 24h post chest closure if the chest is open. If there are concerns regarding infectious complications, collect blood / wound swab cultures and escalate antibiotic cover based on assessment.

Consider antifungal prophylaxis, especially with high risk diagnoses: low cardiac output state, ECMO, NEC, multiple antibiotics (> 2). Nystatin should be prescribed if the patient requires more than 24 hours of antibiotics.

Consider Procalcitonin measurement if there is suspicion of infection and is not easy to assess using WCC and CRP measurement.

3. Education and Training

1. Training and raising awareness remains a continuous process. On-going awareness is promoted through the induction and regular bedside teaching.
2. Training / learning opportunities are accommodated in weekly junior medical staff sessions on Tuesday afternoons, other sessions and at junior doctors' induction training.
3. Nursing education is supported by the Practice Development teams, and nursing educators.

Monitoring and audit criteria

Key performance indicator	Method of Assessment	Frequency	Lead	Reporting Arrangements
Treatment algorithm followed and documented	Audit	As required	Consultant Intensivist	Clinical Practice Meeting

4. References and Supporting information

Admission to PICU Following Cardiac Surgery
Author: Dr's Luyt-Pandya-Duthie, Consultant Paediatric Intensivists Written November 2005 Rewritten: M.Duthie, S.Pooboni, J.Whitelaw, July 2011

5. Keywords

Paediatric postoperative care, paediatric cardiac surgery, cardiac surgery postoperative care PICU, heart surgery, quick guide to drugs, ecmo cannulation, admission checklist

The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs.
As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.

CONTACT AND REVIEW DETAILS	
Guideline Lead **Raghu Ramaiah – Consultant PICU**	**Executive Lead** Chief Medical Officer
Details of Changes made during review: Antibiotics to be continued when chest is open and stopped 24h post chest closure Continuous monitoring and Indications Criteria for referral for ECMO Dopamine changed to Adrenaline as the first choice of contractility support Fluid maintenance changed to 60% D1 post bypass surgery Nystatin to be prescribed only if antibiotics are continued longer than 24hours Removed reference to Ranitidine and replaced with Omeprazole per BNFc Updated format Added links to related documents	

Appendix A: Quick Guide to drugs required in PICU after Cardiac Surgery

Prescriptions required immediately post Cardiac Surgery

The following dosing information assumes **normal renal & hepatic function.** Please contact the ward pharmacist for dosing advice if renal/hepatic function is impaired. Antibiotics are stopped 24h post operatively. If sternal closure delayed, continue antibiotics and stop them 24h post sternal closure.

1) **Surgical antibiotic prophylaxis:**
   Flucloxacillin IV 25mg/kg (max 1g) for 24 hours – frequency dependant on age.
   a. < 1 week of age every 12 hours
   b. 1-3 weeks of age every 8 hours
   c. 3-4 weeks of age every 6 hours
   d. >4 weeks of age every 6 hours

   Gentamicin one dose off in a theatre (normal renal function)
   < 2months of age IV 5mg/kg
   > 2months of age IV 7mg/kg

   For penicillin allergy:
   Teicoplanin
   < 2months: IV Teicoplanin 16mg/kg intial dose, consult BNF for further doses if needed
   2 months – 16 years: IV Teicoplanin 10mg/kg (max 400mg) dose repeated after 12 hours, consult BNF for further doses if needed

   Gentamicin one dose off in a theatre (normal renal function)
   < 2months of age IV 5mg/kg
   > 2months of age IV 7mg/kg

   If sternum left open continue Teicoplanin 24h post closure (Gentamicin only one off dose in a theatre).
   For continuing Gentamicin therapy refer to Gentamicin monographs and prescribing guide.

2) **Omeprazole** as per BNFc (stress ulcer prophylaxis) 0.5mg/kg iv OD (max dose 40mg OD) to stop when oral feeding established (a patient is able to tolerate between 2/3 up to full intake).

3) **Nystatin** if > 24h on antibiotics or high risk diagnosis (e.g. Low cardiac output state, ECMO). Nystatin drops 100 000 units (= 1ml) 6 hourly orally – continue till on antibiotics.

4) **MRSA prophylaxis** - Bactroban nasal ointment 1 application to both nostrils 8hourly and Stellisept wash once daily on skin & twice weekly to wash hair **(**pre-printed on page 1 of regular section of drug chart). The alternative to Stellisept (if patient has an allergy) is Octenisan.

5) If child over 6 years age – **Chlorhexidine 0.2% mouth rinse BD** to help prevent ventilator associated pneumonia

6) **Maintenance fluid:**

   Plasmalyte + 5% glucose for > 1 month of age
   For neonates between 0 and 5 days of age commence 5% glucose with 0.45% sodium chloride Only for initial prescription post op – reassess fluid requirements daily thereafter (10% glucose could be required, especially for neonates or infants).

   Calculate fluid based on Segar Holliday formula where 100% intake is
   100ml/kg for the first 10kg, +

50ml/kg for the second 10kg and +
20ml/kg for the subsequent kg's; max 2500ml for male and 2000ml for female.

Neonates: 100% intake is D1 60ml/kg/d; D2 80ml/kg/d; D3 100ml/kg/d
Reduce fluid intake in congestive cardiac failure or when ventilated.

Post bypass:	D1: 60% of maintenance
	D2: 80% of maintenance
	D3: subsequent days maintenance is based on clinical condition
Non-bypass:	D1: 80% of maintenance

For children over 30 kg use 1ml/kg/h as fluid regime

7) Analgesia & Sedation (see C10/2009 Analgesia and sedation UHL CICG):

a) **Paracetamol:** Regular paracetamol for the first 48 hours (oral preferred to IV), then review to prn. See BNF Postoperative pain section. Please note paracetamol suppository sizes & prescribe only measurable doses 60mg (can halve lengthways to give 30mg dose if necessary), 125mg, 250mg & 500mg
b) **IV Morphine** infusion **10- 40 micrograms/kg/hour**, bolus Morphine written up in the PRN section starting at 50micrograms/kg. For children > 50kg use adult prescription with max 50mg of Morphine in 50ml – be aware of different dose range 1-10mg/h of Morphine; different bolus dose for > 50kg 2.5 – 5mg of Morphine.
c) **Midazolam (**avoid in neonates)) to run at **50-250 micrograms/kg/hour,** bolus midazolam written up in the PRN section starting at 50micrograms/kg (for > 50kg see the Adult prescription chart)

See IV infusion poster for drug dilutions & sedation policy for dosing of adjuvant agents if required.

8) Arterial line: Heparin 500 units in 500ml bag:

Neonate: 0.5ml/hour
1 month – 5 years: 1ml/hour
> 5 years: 3mls/hour

Please ensure all prescriptions for arterial (heparin) & CVP lines are signed for.

9) Potassium to maintain serum concentration 3.5-4.5 mmol/L (4-5mmol/L is indicated if the patient is experiencing rhythm disturbance)

Initially 0.4mmol/kg over 1 hour centrally (prescribed on the prn section of drug chart)

Two short infusions can be given to correct potassium, after which a continuous infusion may be necessary:

10 mmol in 20mls, dose range 0.1- 0.5mmol/kg/hour = 0.2-1ml/kg/hour (in patients > 20kg more concentrated infusion can be required - 1mmol/1ml (60mmol in 60ml usually)

10) Magnesium Sulphate 50 – 100mg/kg iv over 15 - 30 min (max 2g per dose iv)

Appendix B: Prescription for patients on ECMO

All patients on ECMO should also be routinely prescribed MRSA prophylaxis, omeprazole & nystatin.

The cannulation:

1. Gentamicin 2mg/kg IV (check to see if the patient has had gentamicin at the referring hospital in the last 24 hours – if so, do not give further doses until the next dose is due).
Gentamicin levels are routinely checked before the *3rd dose for neonates*: pre & 1 hour post dose for multiple daily dosing.

2. Flucloxacillin 25mg/kg stat IV
Alternative in patients with penicillin allergy is Teicoplanin.

3. Ketamine 2mg/kg IV

4. Atracurium 1mg/kg IV

5. Loading dose of **heparin 75 units/kg IV**

6. Heparin infusion for the ECMO circuit:

< 10kg - 5000 units in 50mls
10 – 30kg - 10,000 units in 50mls
>30kg – 20 000units in 40mls

Appendix C: Admission checklist – What to do when taking a patient out of theatre, a quick guide

The bedside nurse must co-ordinate this:

As soon as the patient arrives from theatre:

- Connect patient to the ventilator and turn on humidifier, this is the role of the anaesthetist.
- Connect patient to the monitor, this is the role of the ODP.
- Put chest drains on suction, if chest is open check with surgeons before putting drains on suction.
- Read the chest drains and document drain losses (preferably, every 15 minutes if drain losses are high)
- Zero the urine catheter. (This does not get documented on the chart as it has been collecting the whole time in theatre and makes the overall balance inaccurate.)

Everybody stops and listens to handover:

- Full patient assessment – be aware of the patient's vital signs at all times (Pressure areas)
- Full set of observations including GCS – review sedation requirement/plan
- Full set of bloods, arterial gas and mixed venous gas if required
- Connect end-tidal CO_2 monitoring
- Work out drug infusion doses
- Start pain relief/sedation if requested by consultant
- Order X-ray. (Make sure defib pad/diathermy pad have been removed)
- Temperature – peripheral and central
- Insert NG tube before x-ray, put on free drainage
- Bed at 45 degree angle
- Make sure transducer is in correct position
- Zero transducer
- Turn off CVP flush. (This will continue to monitor but saves the patient receiving 3 ml/h of unrequired fluid. Add a flush to arterial line if patient is less than 10kgs.)
- Connect cerebral saturation monitor (NIRS)
- Check for pulses/Assess limb perfusion
- Paracetamol - (if not given in theatre, check times.)
- Work out fluid allowance
- Start maintenance fluid if required
- Assess Lines – Compatibility of drugs/Line for emergency

These things need completing but they are not the priority of nursing staff.

- ECG
- ECHO (? Needed if not had TOE)
- Set monitor alarms
- Tidy lines and sort patient
- MRSA, CRO and COVID swabs within 4 hours of admission
- Antibiotics check times on drug chart correlate with the anaesthetic chart

Check and document patient's pressure areas and then complete 4 hourly after this.