

Hospital Raja Permaisuri Bainun

PICU Nurse Handbook

2021



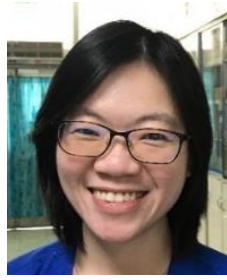
Welcome to PICU HRPB!

Meet the PICU Doctors



Dr Tan Kai Xian

Paediatrician



Dr Susie

Paediatrician



Dr Ramneeta

Paediatrician



Dr Pravin

Paediatric Intensivist

The PICU Team have compiled this booklet of key information to help you as you settle in to the unit and for years to come. The information may go out of date with time, so please check the version with the PICU Nurse Leaders to check you are using the most recent version.

Meet the PICU Nurse Leaders



KJ Amutha

Quality and Research



KJ Razilah

Clinical



KJ Shahrul

Training and Education

If you need to contact us please call: 05-2085000- PICU

Contents

Welcome	2	Disability, Pain and Sedation	21
Contents	3	Traumatic Brain Injury	22
Staff Key Information	4	External Ventricular Drain Care	23
PICU Fire Policy	5	Nasogastric Tube Placement	24
Infection Control	6	Nasogastric Tube Feeding	25
Personal Protective Equipment	7	IV Maintenance Fluids & Infusions	26
Communication in PICU	8	Drug and Fluid Compatibilities	27
Safety and Quality	9	Blood Gas Interpretation	28
Training, Credentialling & Privileging	10	Blood Sampling	29
PICU Nurse Competencies	10	Blood Results	30
Buzzers and Emergencies	12	Sepsis 6	31
Emergency Calculations	12	Healthcare Associated Infections	32
Advanced Paediatric Life Support	13	Central Venous Catheter Bundle	33
Intubation and RSI	14	Ventilator Associated Pneumonia Bundle	34
Extubation	16	Urinary Catheter Bundle	35
Ventilation	17	Pressure Sore Prevention	36
Circulation	18	Pre-Transfer Checklist	37
Emergency Drugs	19	References and Acknowledgments	38
Emergency Drug Dilution Guide	20		

Staff Key Information

Our Vision

The vision for the department is that all children in the region should be assured of an excellent standard of health and wellness.

Our Mission

- providing safe high-quality care for all children in a holistic manner for optimum outcome
- working as a professional team to deliver service with kindness and respect
- emphasising the individuality and rights of the child during decision making
- working with parents and community as partners in the care of children
- promoting and advocating child wellness as a means towards a healthy society
- training all health care providers in a supportive work environment to grow and learn
- promoting research activities to improve care of children

We have an open and friendly unit and hope that patients, families and staff can all share in the care-delivery. Parents are encouraged to visit their child as often as possible, any time of the day, any day of the week. Friends and other relatives are also able to visit during visiting hours, but we only allow two people around each bed space at any one time.

Please share the Parent and Carer Information Folder with family members in PICU. **The PICU Specialists and Nursing Leaders** are always there to help you provide holistic care to the children and families. Please contact them for assistance.

We wish to demonstrate our approachable and professional qualities at all times, building the trust and rapport necessary at these difficult times for families.

Your safety and security are a key priority—if **you have any concerns in this regard, do not hesitate to escalate. The Ward Sister, Nurse Team Leader or Specialist on Duty will always be willing to help and should be called immediately.**

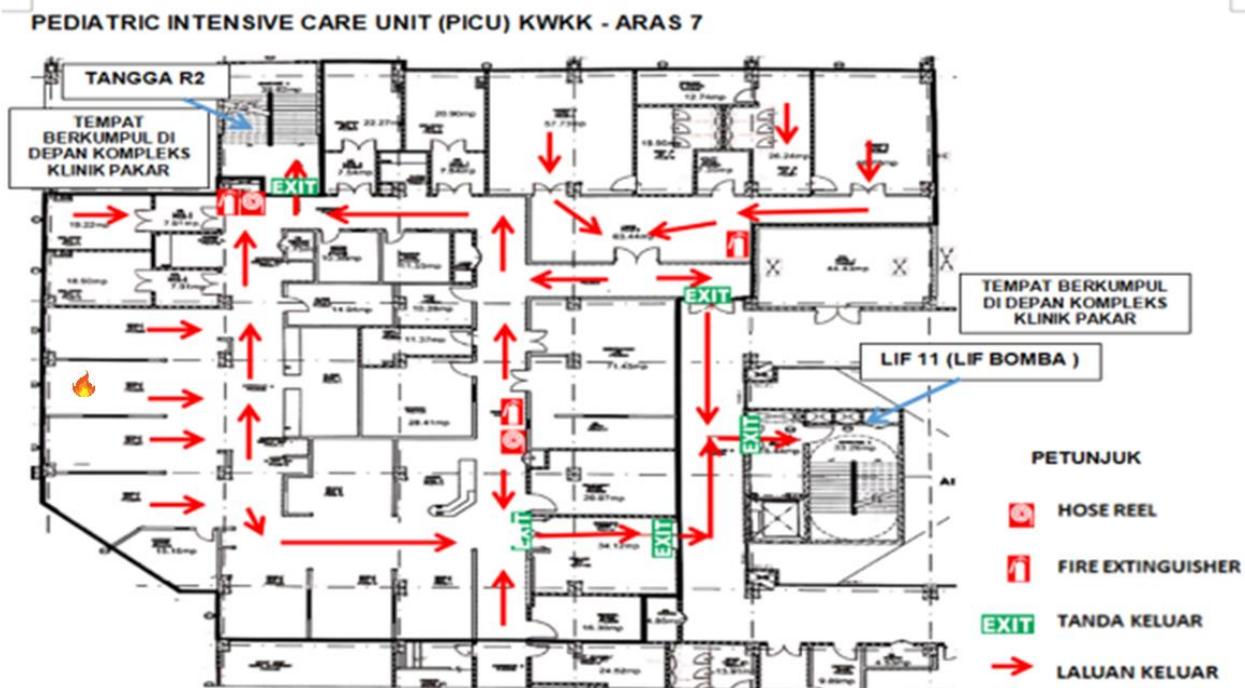


There are staff support services available—Our hospital counsellors and Psychological First Aid team are always ready to help.

Alternatively **get in touch with your Nursing Leaders or PICU Specialist for more information and support.**

PICU Fire Policy

Please ensure that you are familiar with the PICU Fire Policy. The full policy is displayed in PICU and available in the PICU Sister's office. We hold yearly training sessions to prepare us for any fire-related emergencies.



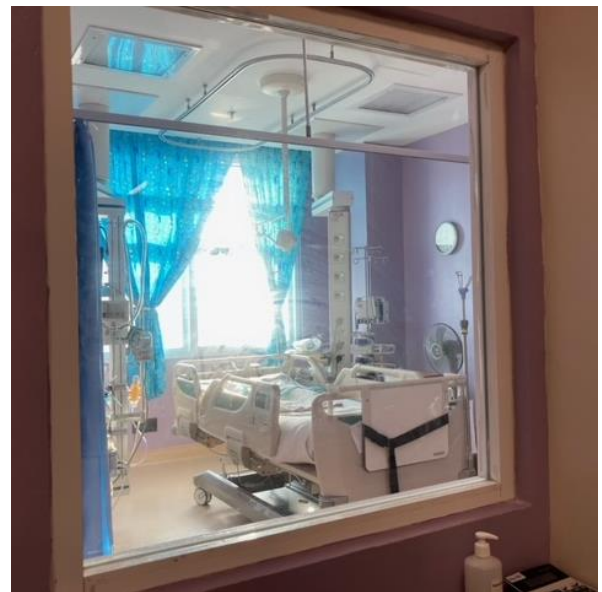
Pelan Bencana PICU



Infection Control

The PICU follows HRPB's Infection Control Policy. Handwashing and simple barrier protection is our most effective preventative strategy. Patients with infectious conditions will be in Isolation Rooms. Other children with immune deficiency will be in Protective Isolation. Please adhere to the Policy and challenge those who appear to be non-compliant. Infection control is our shared responsibility. Direct physical contact with patients should be minimized to reduce infection risk, e.g. avoid unnecessary repeated examinations.

Staff should use appropriate Personal Protective Equipment (PPE) at all times when working in PICU, to keep ourselves and our patients safe. Please refer to the HRPB and PICU PPE Guidelines for more information.



Isolation Room

Your 5 Moments for Hand Hygiene



Five (5) moments in Hand Hygiene:

1. Before and after having direct contact with patients.
2. Before handling an invasive device for patient care, regardless of whether or not gloves are used.
3. After contact with body fluids or excretions, mucous membranes, non-intact skin, or wound dressings.
4. If moving from a contaminated body site to a clean body site during patient care.
5. After contact with inanimate objects (including medical equipment (in the immediate vicinity of the patient).

Personal Protective Equipment (PPE)

3 ply surgical mask should be used by all staff when in PICU. Face shield should be used whenever approaching a patient who is not wearing face mask. 3-ply surgical mask and white plastic apron should be used when handling non-respiratory patients. Apron should be changed if soiled or moving between different areas, e.g. from HDU to the Isolation Room, or from ICU to HDU.

PPE Usage for Severe Acute Respiratory Illness (SARI) patients:

ACTIVITY	PPE
Aerosol-generating Procedures: Intubation/ Extubation BiPaP/CPAP Open suction Nebuliser therapy (Avoid if possible) SARI swab sampling	Full PPE I. OT cap, II. Long sleeved disposable gown, III. N95 mask, IV. Face shield, V. 2 layers of gloves, VI. Shoe cover, VII. Plastic white apron VIII. PAPR for intubator & intubation assistant
IV line insertion Blood taking CBD insertion Closed suction	I. 3 ply surgical mask II. White plastic apron III. Gloves IV. Face shield

PPE Usage for Management of Respiratory patients Negative for Covid-19

PERKARA	PPE
Aerosol-generating Procedures: Intubation/extubation BiPaP/CPAP Open suction Nebuliser therapy (Avoid if possible)	I. 3 ply surgical mask II. Plastic white apron III. Gloves IV. Face shield
IV line insertion Blood taking CBD insertion Closed suction	

Management of Covid-19 POSITIVE patients

ACTIVITY	PPE
Aerosol-Generating Procedures: Intubation/extubation *Avoid open suction *Avoid BiPaP/ CPAP *Avoid nebulizer therapy IV line insertion Blood taking CBD insertion Closed suction	Full PPE I. OT cap, II. Long sleeved disposable gown, III. N95 mask, IV. Face shield, V. 2 layers of gloves, VI. Shoe cover, VII. Plastic white apron VIII. PAPR for intubator & intubation assistant

Communication in PICU

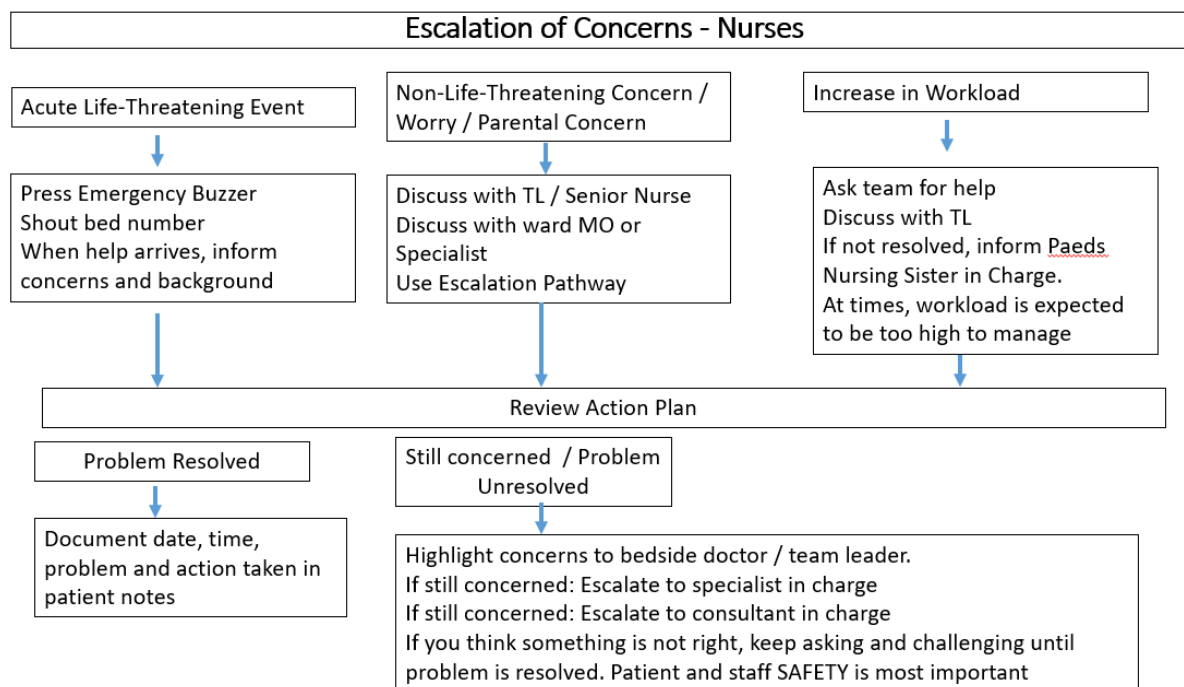
Safe and effective communication is very important in PICU, especially during emergencies. Many errors and adverse events are related to poor communication.

Communication may fail in a crisis for many reasons. Doctors often fail to communicate what they are doing, and why, in a crisis — and when they do they often only do so with other doctors. With nurses there is often a delay between identifying a problem and communicating it to the rest of the team.

Team members must feel empowered to question and/or correct the decisions of the team leader and other team members if it is in the patient's interest. The purpose is not to undermine or overrule anyone, but simply to ensure that all patients in PICU receive the safest and highest quality care possible.

ALL PICU Nurses have the right to say: "I'm worried, please see this patient now" and expect doctors to do so. If a nurse is still worried, she should escalate her concerns accordingly.

In PICU HRPB, we encourage a culture of questioning, raising concerns and challenging our team members, to ensure patient and staff safety. Please do not hesitate to ask a question if you're unsure, and always speak up, question and express your concerns to the rest of your team, following the protocol below:



Safety and Quality

Improving quality is about making healthcare safer, effective, patient-centred, timely, efficient and equitable. In the history of KKM; there has never been a greater focus on improving the quality of health services.

In PICU we measure the safety and quality of our care regularly so we can work to make it even better. Every month we aim to measure the following:

- Nursing care quality indicators
- Health care associated infections
- Hand hygiene
- Medication Safety

The PICU Safety Team is a group of doctors and nurses in PICU. **Dr Pravin** is the medical lead and **SN Sumiyati** is the nursing lead. Please contact the safety team if you have any concerns or areas that you observe we could learn to be better.

The PICU has a high incident reporting culture—and is proud to take every opportunity to learn from experiences. If you are involved in a clinical incident (including a medication incident, emergency event, unplanned extubation, near miss) then please complete the **IR1** with as much anonymised detail as possible. We are also wishing to learn from areas of good / excellent practice — these can be reported via email to Dr Pravin (sdnh82@yahoo.com) or by using the **IR2 form (to be introduced soon)**.

Nursing Care Quality Indicators

What Nursing Care Quality Indicators do we measure?

OBSERVATIONS: Alarm limits, Parameters, Appropriate charts, Documentation, Event/Description. Making sure any problems are detected early.

FOOD AND NUTRITION: Balance, Weight, Height, Feeding plan, Oral Fluids, Weighing and measuring patients and providing the right support

SKIN CARE: Documentation, Inspection, Assessment and Prevention of Pressure Sores.

PAIN MANAGEMENT: Documentation, Analgesia Prescription, Assessment tool available, Baseline score, Assessment and Management of Pain in PICU patients.

DRUG ADMINISTRATION: Charts, Check Name band, Avoid errors, Drug Security.

COMMUNICATION: Advance Directives, Documentation, Negotiation, involving patients and their families in care planning and talking to them in the correct way.

PERSONAL HYGIENE: Assessment, Helping patients clean their teeth, hair, nails, skin etc.

CANNULA CARE: Appropriate observations, Date of insertion, appropriate dressing, Type of fluid, Care Plan, Avoiding injuries caused by cannulas and central lines.

Training, Credentialling and Privileging

Our PICU team is committed to providing regular training and continuous medical and nursing education for all our PICU staff. This training happens in the form of departmental and PICU-level CME and CNE sessions, hands-on skills training, simulation training sessions, and user training by product specialists for handling specialized equipment.

Besides training our team in basic nursing competencies, we are also developing specialized skills among senior PICU nurses, e.g. handling of mechanical ventilators, EEG machine, haemodialysis equipment etc. PICU nurses and MA's are also encouraged to enroll in post-basic training programs to further develop their knowledge and skills.

We are refining our credentialling and privileging processes for PICU nurses, to ensure that all nurses are given opportunities to obtain documented proof of their competence in procedures and skills related to paediatric intensive care.

We hope that, in the long term, this will facilitate the retention of experienced PICU nurses and MA's as **'Subject Matter Specialists'** in Paediatric Intensive Care, enabling our staff to progress in their careers and promotions while remaining in PICU, so that the entire team can benefit from their knowledge, leadership and experience. We will continue advocating for this at hospital, state and national levels, as staff retention is crucial for the advancement of Paediatric Intensive Care in HRPB and throughout the nation.

PICU Nurse Competencies

All PICU nurses should receive training and gain competence in the following competencies, based on their job scope, and maintain a logbook for documentation. Competency training and credentialing will be led by Nurse Managers with the assistance of Nursing Team Leaders.

Level 1 (General Paediatrics)

- Handwashing and basic infection control measures
- Suctioning, airway clearance
- Vital signs monitoring including pain scoring, and observation charting
- Recognition of emergencies/ deterioration, e.g.: seizures, desaturation, hypotension, tachycardia. (Basically ANY threat to Airway, Breathing, Circulation or Neurologic Function-ABCD)
- Oxygen delivery and management of associated equipment (nasal prongs, face mask, high flow mask oxygen)
- Securing and maintenance of peripheral intravenous lines
- Enteral feeding (oral, nasogastric tube, gastrostomy)
- Wound dressing and pressure sore management
- Input and output charting, urine output monitoring.
- Weight, height and head circumference measurement
- Basic nursing documentation

- Escalating concerns- must know PICU Escalation Protocol.

Level 2 (HDU)

- Managing a CPAP/BiPAP machine including placement of filters, ensuring functionality of machines, and troubleshooting alarms
- Competent in setup and monitoring of patients on high flow nasal cannula and non invasive ventilation (BiPaP/CPAP).
- Securing and maintenance of peripheral intravenous lines
- Securing and maintenance of arterial lines
- Securing and maintenance of central venous catheters
- Able to safely administer Inotropes, Parenteral Nutrition and Blood Products, and monitor patients on these infusions.
- Able to monitor and manage patients on External Ventricular Drains and Chest Drains.
- Able to monitor and chart hourly urine output.
- Basic tracheostomy care
- Knows PICU Feeding Protocols, able to give bolus and infusion feeds as per protocol
- Donning and doffing appropriate personal protective equipment
- Escalating concerns- must know how to escalate concerns to Team Leader / Ward Manager / Specialist if needed.

Level 3 (PICU)

- Able to perform pre-use check for Ventilators used in PICU, assemble ventilator circuits correctly for neonates and paediatric patients, and monitor patients on invasive ventilation.
- Competent in implementing all elements of PICU Ventilator-Associated Pneumonia Bundle
- Familiar with common modes of ventilation used in PICU. Can troubleshoot ventilator problems and respond appropriately to ventilator alarms
- Preparing premedication for intubation
- Able to wean inotropes as per doctor's instruction, assist and perform extubation without supervision.
- Able to administer and monitor intravenous sedation and analgesia for PICU patients.
- Assisting doctors by inflating ETT cuff/ providing cricoid pressure etc during intubation process
- Anchoring an endotracheal tube
- Monitoring invasive blood pressure through arterial lines
- Able to monitor and chart patients on renal replacement therapy, e.g. CAPD, Haemodialysis
- Able to assist doctors in preparation and insertion of central lines.

Level 4 (PICU Expert Nurse / Team Leader)

- Able to advise ward doctors on bed capacity per shift based on PICU nurse numbers and competence
- Able to support Ward Specialist and medical officer in deciding bed allocation / cohorting.
- Able to escalate concerns related to nursing or doctor workload / parental or staff concerns / emergencies
- Able to coordinate nursing team response to cardiac arrest and other emergencies, working with PICU doctors.
- Able to lead nursing team response to Code Blue / Code Grey / Code Black emergencies.
- Expert in setting up and troubleshooting all equipment in PICU, including HFOV, invasive ventilators and NIV machines.
- Able to support and lead nursing team, ensuring staff are well supported and work effectively as a team.
- Able to raise concerns and express opinions to Ward Specialist / Consultant and other team members to ensure patient safety.

Buzzers and Emergencies

An emergency call for assistance can be made using the bedside 'buzzer' (red button at each bedspace), or by shouting out for assistance. All emergency situations in PICU are managed as a team with patient assessments and interventions following the APLS ABCD approach.

Roles and allocations can be challenging because there are plenty of helping hands. Each resuscitation requires an easily identified TEAM LEADER, DRUGS NURSE, SCRIBE and those doing AIRWAY/BREATHING and CPR.

At PICU HRPB we have some special patients, e.g. patients with Difficult Airway or Tracheostomy, who require additional teams in an arrest. If this is the case you can activate through the **Operator** for '**AIRWAY Emergency**' (call Anaesthesiology and ENT MO/Specialist on call).



Call '**CODE GREY OR BLACK**' (for threat or physical harm to staff-call 4000).

Call '**CODE BLUE**' If an adult collapses on the PICU-call 3999. The PICU emergency team will also respond. Patient will be sent to ED once stabilized.

Call '**CODE RED**' for a Fire Emergency.

Emergency Calculations

Emergency calculations are available in the PICU Emergency Drug Calculator, which should be printed out for ALL patients upon admission.

APLS CALCULATIONS

Weight: (Age (in years)+4) x2

Birth weight 3.5 kg, at 6 months 7 kg.

Defibrillation: 4 Joules / kg

ETT Size: (Age (in years) ÷ 4) + 4

ETT Length: (Age (in years) ÷ 2) + 12

Fluid bolus: 5-20ml/kg

Adrenaline: 0.1ml/kg ml/kg of 1:10,000

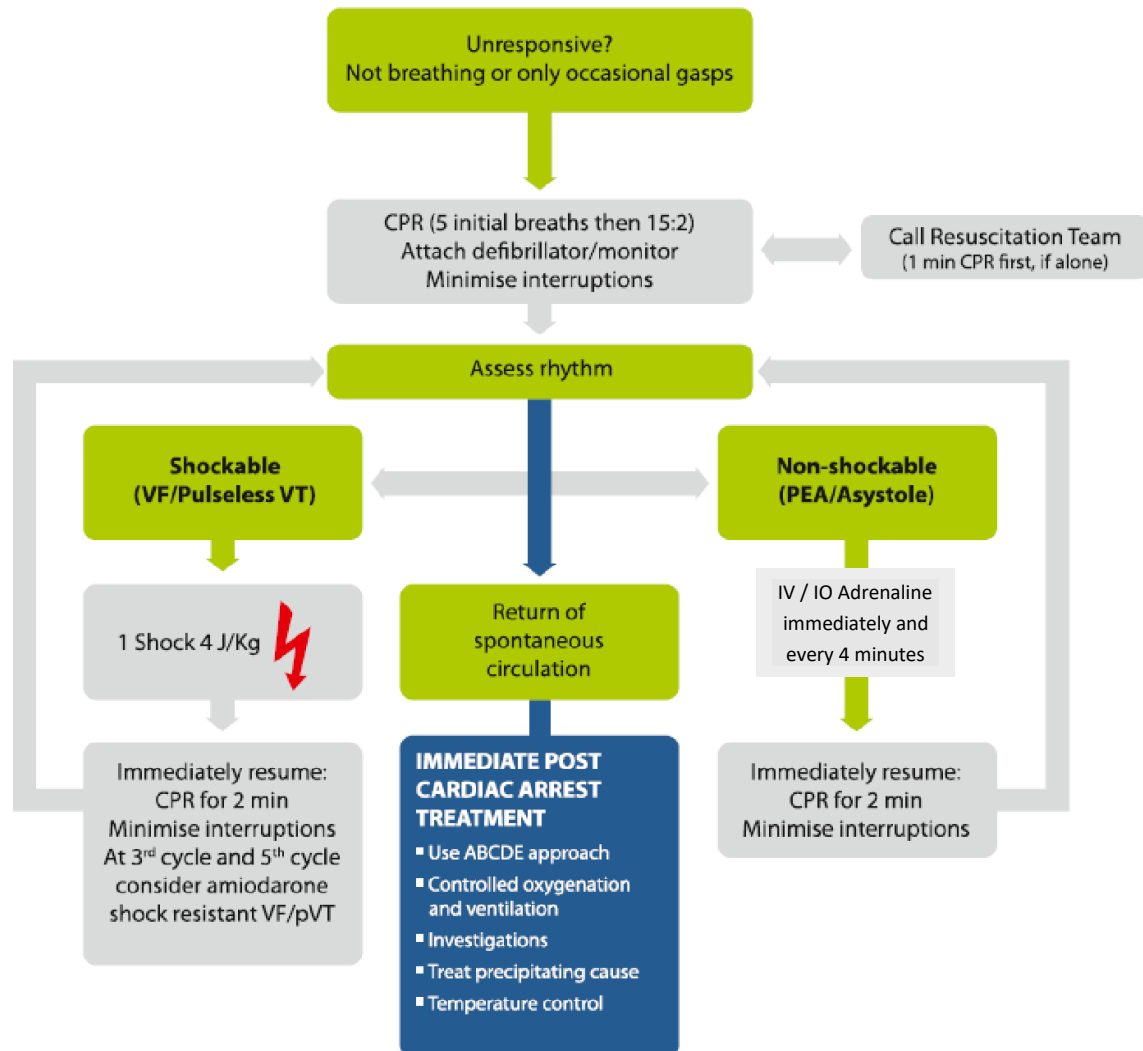
(1 ml 1:1000 dilute in 10ml NS)

Glucose: 2ml/kg ml/kg of 10% glucose solution & start Dextrose-containing Infusion

PICU Resuscitation Emergency Calculator									
Name:		RN:							
Age (in Years):		Weight (in kg):		(Method of Weighing:)					
1	Endotracheal Tube Size - Uncuffed ETT Size	=	4	Only Applicable for Children 1 - 12 Years Old					
2	Endotracheal Tube Size - Cuffed ETT Size	=	3.5						
3	Length of ETT Insertion (in cm)	=	12						
4	IV Adrenaline (1:10,000 Dilution)	=	0.2	ml					
5	IV Glucose 10%	=	4	mL					
Rapid Sequence Intubation									
6	IV/IM Fentanyl	=	2	to	4	mg			
7	IV/IM Midazolam	=	0.2	to	0.4	mg			
8	IV Succinylcholine	=	4	mg					
9	IV Rocuronium	=	2	mg					
Checked by:									
Name:									
Signature:									

Advanced Paediatric Life Support

**Team Leader must ensure that all members of the team are wearing
Safe and Appropriate PPE throughout Resuscitation**



DURING CPR

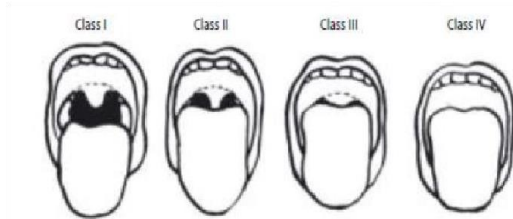
- Ensure high-quality CPR: rate, depth, recoil
- Plan actions before interrupting CPR
- Give oxygen
- Vascular access (intravenous, intraosseous)
- Give adrenaline every 3-5 min
- Consider advanced airway and capnography
- Continuous chest compressions when advanced airway in place
- Correct reversible causes

REVERSIBLE CAUSES

- Hypoxia
- Hypovolaemia
- Hyper/hypokalaemia, metabolic
- Hypothermia
- Thrombosis (coronary or pulmonary)
- Tension pneumothorax
- Tamponade (cardiac)
- Toxic/therapeutic disturbances

Intubation

ALWAYS ASSESS FOR POSSIBLE DIFFICULT AIRWAY



Risk Factors:

Underlying diagnosis, e.g. Mucopolysaccharidoses, Pierre-Robin. Limited neck movement or neck injury. Limited mouth opening. Small mouth and chin.

CALL ANAESTHESIOLOGIST via Operator if anticipated difficult airway, and bring PICU Resus Trolley to bedside.

If NOT a Predictable Difficult Airway:

Use Pre-Intubation Checklist

Pre-oxygenation in 100% Oxygen

For Newborns with Cyanotic Heart Disease: Pre-oxygenate until SpO₂ reaches target 75-85%.

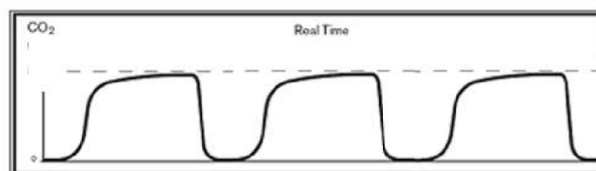
Rapid Sequence Intubation Protocol- see next page.

Use clinical examination and END-TIDAL CO₂ to confirm ETT position.

Examples:

Normal –

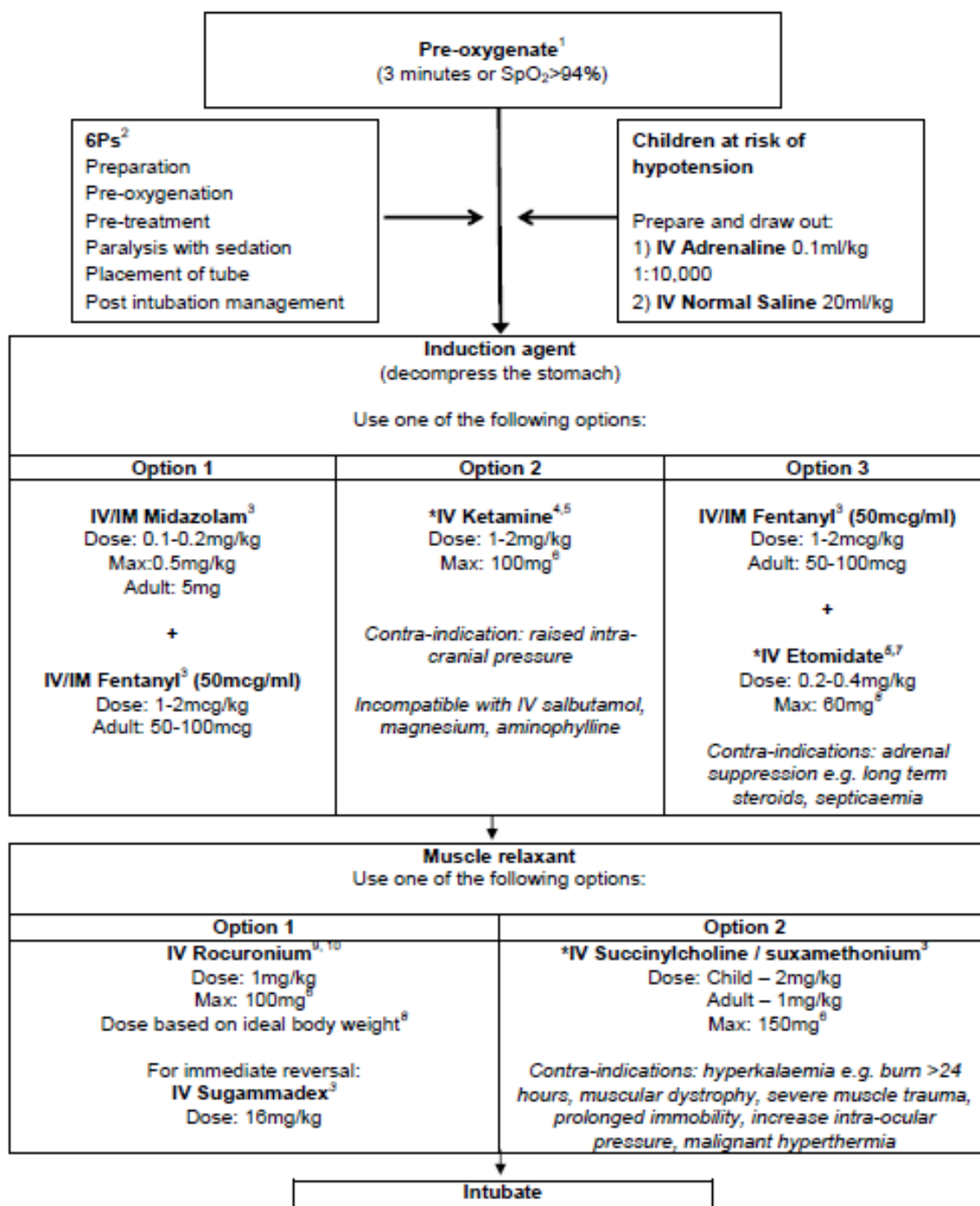
ET tube is in the airway
Patient is being ventilated
appropriately



Secure with ETT tapes and order a CXR for all patients post intubation.

Rapid Sequence Intubation

Rapid Sequence Intubation Algorithm in Children



***Notes:**

1. Ketamine – risk of direct myocardial depression in severe shock state when patient has depleted catecholamines store
2. Etomidate – higher risk of adrenal suppression at higher dose
3. Succinylcholine/suxamethonium – repeat dose increase risk of heart block, bradycardia

Rapid sequence intubation in children. Paediatric Department, HRPB, Ipoh. January 2017

Extubation

A guide to which patients can be extubated

Always assess patient for risk of re-intubation.

Decision for extubation should be made by the PICU doctors, with input from the attending PICU Nurse.

Extubation can be considered when:

- Sedation and muscle relaxant effects have worn off.
- Adequate respiratory drive
- No increased work of breathing
- Normal blood gas
- Stable
- No planned procedures needing intubation
- GCS>8 with good cough and gag reflexes
- Ventilator pressures <16/8, FIO₂<0.4.
- Spontaneous regular breathing
- Consider Dexamethasone if any risk of vocal cord edema, or prolonged ventilation >1 week.

Process of Extubation in PICU HRPB

- Keep NBM for at least 4 hours before extubation
- Start IVD maintenance while NBM (usually NSD5% + 1/2g KCl per pint)
- Aspirate Ryle's tube / Gastrostomy
- Suction, clear secretions as needed
- Ensure child is awake, alert, wean sedation to minimum or off.
- Prepare oxygen / BiPAP / CPAP / HFNC for post extubation support as needed.
- Ensure resuscitation trolley and all resus equipment is ready at the bedside
- Ensure Nursing Team Leader is aware child is being extubated, enough staff are available for safe extubation and emergency reintubation if needed.
- Deflate ETT cuff, remove tapes and ETT.
- Suction nose and oropharynx after ETT removal.
- Ensure child has stable vital signs post extubation, and assess for any signs of airway obstruction (stridor, recessions, respiratory distress, desaturation, etc.)
- Restart feeding after 4 hours if stable and no contraindications, then off IV drip.

Ventilation

- ETT Size (mm):
 Uncuffed: Age (in years)/4 +4
 Cuffed: Age (in years)/4 +3.5
 Preterm: 2.5-3.0mm
 Term baby: 3.5-4.0mm
 Infant <1 yr: 4.0-4.5mm
- ETT Length (cm):
 Age (in years)/2 +12 (Oral intubation)
 Age (in years)/2 +15 (Nasal intubation)
 Neonates: Wt(kg) +6 cm
 Infant <1 yr: Around 9-10cm
 Order CXR post intubation, ETT tip should be at T1-T3 level.
- Ryle's Tube Size (Fr): ETT size (mm) x2
- Urine Catheter Size (Fr): ETT size (mm) x 2
- Chest Drain Size (Fr): ETT size (mm) x 3

Always keep one size smaller and one size larger catheter at the bedside.

SpO2 targets: Normal Children: Usually >94%

Cyanotic heart disease: Usually 75-85%, or as decided by Specialist

Preductal SpO2: Right hand. Postductal SpO2: Left hand or lower limbs.

Normal Respiratory Rates in Well Children

Age (Years)	Respiratory Rate
<1	30-40
1-2	25-35
2-5	25-30
5-12	20-24
>12	12-20

Average Ventilator Alarm Limits

Parameter	Normal Setting
PEEP	2 above and 2 below set PEEP
Tidal Volume	5-8ml/kg
Minute Volume	TV x Rate / 1000
Peak Inspiratory Pressure (PIP)	30-32 cm H2O (servo I will alarm at 5 below this, eg 25-27)

- For Invasive Ventilation in PICU, **PLEASE ENSURE Inspiratory Time is 0.5 seconds or higher** for ALL patients, and **I:E Ratio is set at 1:2. MO MUST discuss with specialist** before using I time or I:E ratio outside this range.

Circulation

We have many children with CVS abnormalities, e.g. Down's syndrome, congenital heart disease, septic shock, trauma, hypertension. Please discuss targets for each patient with the PICU specialist / MO.

Estimated Normal Blood Pressure Range

(please refer to Malaysian Paediatric Protocol for more detailed BP charts if needed)

Age	Systolic BP 5 th centile (mmHg)	Systolic BP 50 th centile (mmHg)	Mean BP 5 th centile (mmHg)	Mean BP 50 th centile (mmHg)
0-1 month	50	60	35	45
1-12 months	70	80	40	55
1-10 years	$70 + 2 \times \text{Age (years)}$	$90 + 2 \times \text{Age (years)}$	$40 + 1.5 \times \text{Age (years)}$	$55 + 1.5 \times \text{Age (years)}$
>15 years	90	120	65	80

Heart Rate Range

Age	Mean	Awake	Deep Sleep
0-3 months	140	85-205	80-140
3mo- 2 years	130	100-180	75-160
2-10 years	80	60-140	60-90
>10 years	75	60-100	50-90

Urine output- a good guide for systemic / end organ perfusion

Normal Urine Output - Neonates: >2ml/kg hour Children: >1ml/kg/hour

- NG tube losses**
- Usually <5ml/kg.
 - In NBM patients, If NG losses >5ml/kg/shift, replace losses with Hartmann's equal volume per shift, or as per doctor's orders.
 - NG tube position must always be confirmed as per protocol (Aspirate pH<5.5 or position confirmed on CXR)

Emergency Drugs

Adrenaline

Increases heart rate, cardiac contractility, cardiac output and blood pressure. Causes vasoconstriction at higher doses ($>0.2\text{mcg/kg/min}$).

Noradrenaline

Predominantly vasoconstriction, also increases contractility. Increases BP.

Dobutamine

Inotrope with vasodilatory effects, especially at lower doses. May improve myocardial blood flow and coronary perfusion, for children in cold shock with high systemic vascular resistance.

Milrinone

Increases contractility, improves cardiac relaxation and filling, causes vasodilatation. Usually improves cardiac output, but **can cause fall in BP, especially in hypovolemic patients.**

Prostaglandin

Opens and maintains patency of ductus arteriosus in neonates. Can be life-saving in babies with duct-dependent congenital heart disease, e.g. Hypoplastic left heart syndrome, Severe coarctation of aorta, pulmonary atresia.

Calcium

Key electrolyte in the blood which is crucial for heart contractility and important for formation of blood clots (coagulation). Can be given **centrally by infusion (distal lumen of CVL)**, to improve blood pressure.

Sodium Bicarbonate

Used to correct severe metabolic acidosis ($\text{pH} < 7.2$) in cardiac arrest or decompensated shock, to improve response of the myocardium to inotropes. Bolus may be used in acute life-threatening situations, otherwise use infusion. May cause hyponatremia and hypercarbia.

Ketamine

Sedative and analgesic effects, with dissociative anaesthesia. Less respiratory and cardiac depression compared to other sedatives, induction drug of choice in septic shock, trauma. Causes increased secretions, which may need suctioning and/or glycopyrrolate.

Rocuronium

Nondepolarising muscle relaxant. **Drug of choice** for paralysis in PICU HRPB.

Suxamethonium

Depolarising muscle relaxant. Contraindicated in hyperkalemia, severe burns, major trauma, severe liver disease, malignant hyperthermia, raised intraocular pressure.

Emergency Drug Dilution Guide

PICU QUICK DRUG DILUTION

* Central line preferred for more reliable drug delivery and prevent the possibility of extravasation*

Drug	Diluent	Peripheral Line dilution*	Central line dilution	Maximum infusion rate
Dopamine	D5%/ NS ¹	<30kg: 15mg/kg in 50ml ² 1ml/h = 5mcg/kg/min	<30kg: 30mg/kg in 50ml ² 1ml/h = 10mcg/kg/min	20mcg/kg/min ¹
Dobutamine		≥30kg: 7.5mg/kg in 50ml ⁴ 1ml/h = 2.5mcg/kg/min	≥30kg: 7.5mg/kg in 50ml ⁴ 1ml/h = 2.5mcg/kg/min	
Adrenaline	D5%/ NS ¹	≤20kg: 0.15mg/kg in 50ml ³ 1ml/h = 0.05mcg/kg/min >20kg: 3mg in 50ml ³ 0.1ml/kg/h = 0.1mcg/kg/min	0.3mg/kg in 50ml ² 1ml/h = 0.1mcg/kg/min	1.5mcg/kg/min ¹
Noradrenaline	D5% ¹	≤10kg: 0.15mg/kg in 50ml ¹ 1ml/h = 0.05mcg/kg/min >10kg: 1.5mg in 50ml ¹ 0.1ml/kg/h = 0.05mcg/kg/min	0.3mg/kg in 50ml ² 1ml/h = 0.1mcg/kg/min	2mcg/kg/min ³
Midazolam	D5%/ NS ¹	3mg/kg in 50ml ² 1ml/h = 1mcg/kg/min		Ventilated: 4mcg/kg/min ² Fitting: 24mcg/kg/min ²
Morphine	D5%/ D10%/ NS ¹	1mg/kg in 50ml ² 1ml/h = 20mcg/kg/h		40mcg/kg/hr ³
Fentanyl	N/A	1000mcg in 20ml (undiluted) ² 0.1ml/kg/h = 5mcg/kg/h		10mcg/kg/hr ²

Disability, Pain and Sedation

Infants and children all require assessment and management for pain and sedation. Some will also develop withdrawal symptoms and require slow weaning of sedation and analgesia.

Pain Score for Young Children (FLACC Score)

(Each category is scored 0-2, total score range 0-10)

Categories	Scoring		
	0	1	2
Face	No expression / Smiling	Occasional grimace or frown, withdrawn or 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, distractable	Difficult to console or comfort

Wong-Baker FACES® Pain Rating Scale



Sedation Score

1	2	3	4	5
Wide awake	Awake but sleepy	Asleep but moves spontaneously	Asleep, but responds to stimulation	Hard to rouse

Opioid and Sedation Withdrawal

Please refer to our PICU Guideline on Weaning of analgesia and sedation & management of withdrawal syndrome, February 2017 for further guidance.

Traumatic Brain Injury

CHECKLIST FOR CEREBRAL PROTECTION IN PAEDIATRIC TBI

1. Prop up 30° with head in midline position
2. Consider cervical spine protection
3. Ensure child is on ripple mattress; prophylactic Duoderm patch placed over occiput
4. Check nasogastric tube position and consider early enteral nutrition within 48 hours of admission. Administer iv pantoprazole 1mg/kg BD while nil by mouth
5. Bowel care with lactulose- avoid constipation
6. Continuous bladder drainage
7. Ventilation: PRVC+PS mode preferred (Alarm limits must be set safely)
PaO₂ target: 90-120mmHg PaCO₂ target: 35-40mmHg
FiO₂ titrated to saturation and PaO₂, aim tidal volume of 6ml/kg
8. Monitoring with invasive BP, ETCO₂, temperature. Insert central and arterial lines.
9. Avoid hypotension. Aim SBP>50th centile with adequate MAP for age
Consider ivi Adrenaline to achieve target blood pressure

Age (years)	Respiratory rate (breaths/min)	Systolic BP (50 th centile)	Pulse rate (beats/min)
<1	30-40	80-90	110-160
1-2	25-35	85-95	100-150
2-5	25-30	85-100	95-140
5-12	20-25	90-110	80-120
>12	15-20	100-120	60-100

10. Consider iv tranexamic acid
11. If child develops signs of raised ICP (Hypertension/ bradycardia/ unequal pupils):
Ensure all routine measures to ensure cerebral protection are instituted
Inform neurosurgical team immediately, child will need repeat CT brain
Check on drain volume if child is on an external ventricular drain
3% hypertonic saline bolus 2-5ml/kg over 5 minutes (Avoid if serum sodium >160mmol/L)
12. Initial iv fluids of NSD5% if less than 2 years, NS if more than 2 years
Restrict total fluids to 80% maintenance
Aim for a high normal serum sodium of 145mmol/L (Hyponatremia may worsen cerebral edema)
Aim for an even 24-hour fluid balance
13. Aim Hb 10-12, with normal clotting profile and platelets.
14. Aim a sugar level of 4-12mmol/L
15. Keep child well sedated with iv morphine/fentanyl infusion + iv midazolam infusion
16. Iv fentanyl 1mcg/kg prior to painful procedures
17. Aim normothermia 36 to 37C, consider paracetamol and gradual cooling therapy
18. Antibiotic choice: Consider iv Co-amoxiclav to prevent risk of pneumonia, or iv Ceftriaxone if at risk of meningitis
19. Consider prophylactic iv Phenytoin or iv Levetiracetam to prevent seizures
20. Consider use of compression stockings in post-pubertal age children with severe traumatic brain injury, unless lower extremity injuries prevent their use.

External Ventricular Drain Care

PICU HRPB External Ventricular Drain Care Protocol

To be completed on INSERTION by Neurosurgical MO / Specialist

Insertion Date : _____ Location : _____
 Inserted by: _____ Signature/Stamp: _____
 Diagnosis / Indication: _____ EVD Level set at: _____
 Aim for EVD drainage of _____ mls per shift. Chart EVD drainage every _____ hours.
 Inform Neurosurgical team if drainage is less than _____ mls within _____ hours.
 Clamp EVD immediately and inform Neurosurgical team if drainage more than _____ mls within _____ hours.

To be completed on ADMISSION to PICU by PICU MO/ Specialist

Handover of any special instructions by Neurosurgical team? (circle) Yes No
 Special Instructions:
 Replace CSF losses **ml for ml with Normal Saline** every _____ hours.
 Monitor **RP daily**, correct electrolyte abnormalities as needed.
 Monitor **Anterior Fontanelle** per shift- Sunken / Normotensive / Bulging or Tense?
 Completed by: Name: _____ Signature/ Stamp: _____

PICU Nurse in charge to ensure the following for any child on EVD:

1. **EVD drainage charting** as per Neurosurgical / PICU order (every _____ Hours).
2. HOURLY checks of **tubing, clamps, EVD level** and secure **attachment to drip stand**.
3. Check **EVD site dressing** HOURLY-if soaked / leaking inform Neurosurgical immediately.
4. Monitor **Anterior Fontanelle** per shift- Sunken / Normotensive / Bulging or Tense?
5. Inform PICU MO and Neurosurgical MO STAT if any concerns re: **CSF underdrainage or overdrainage** as detailed above.
6. Ensure **EVD is clamped before patient is moved or lifted**, to avoid overdrainage.
7. **GCS and Pupil Charting** to be done at least 4 hourly for all children, or more frequently if abnormal, as decided by PICU or Neurosurgical MO / Specialist.
8. Inform Neurosurgical team immediately if **EVD is blocked, dislodged, infected**, or child has any **EVD complication causing clinical deterioration**.
9. **Educate family members and staff** per shift with daily reminders re:
 importance of **maintaining EVD position** relative to the tragus,
 and need to **clamp EVD prior to moving patient**.

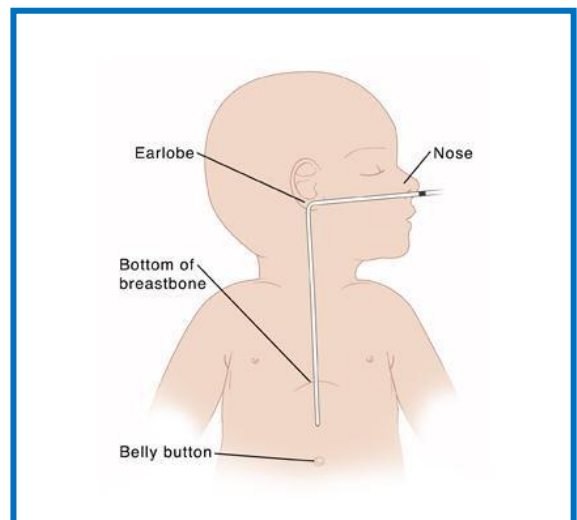
EVD Level Changes – To be done ONLY by Neurosurgical MO or Specialist

Date: _____ Name: _____ EVD New Level set at: _____
 Date: _____ Name: _____ EVD New Level set at: _____

Nasogastric Tube Placement

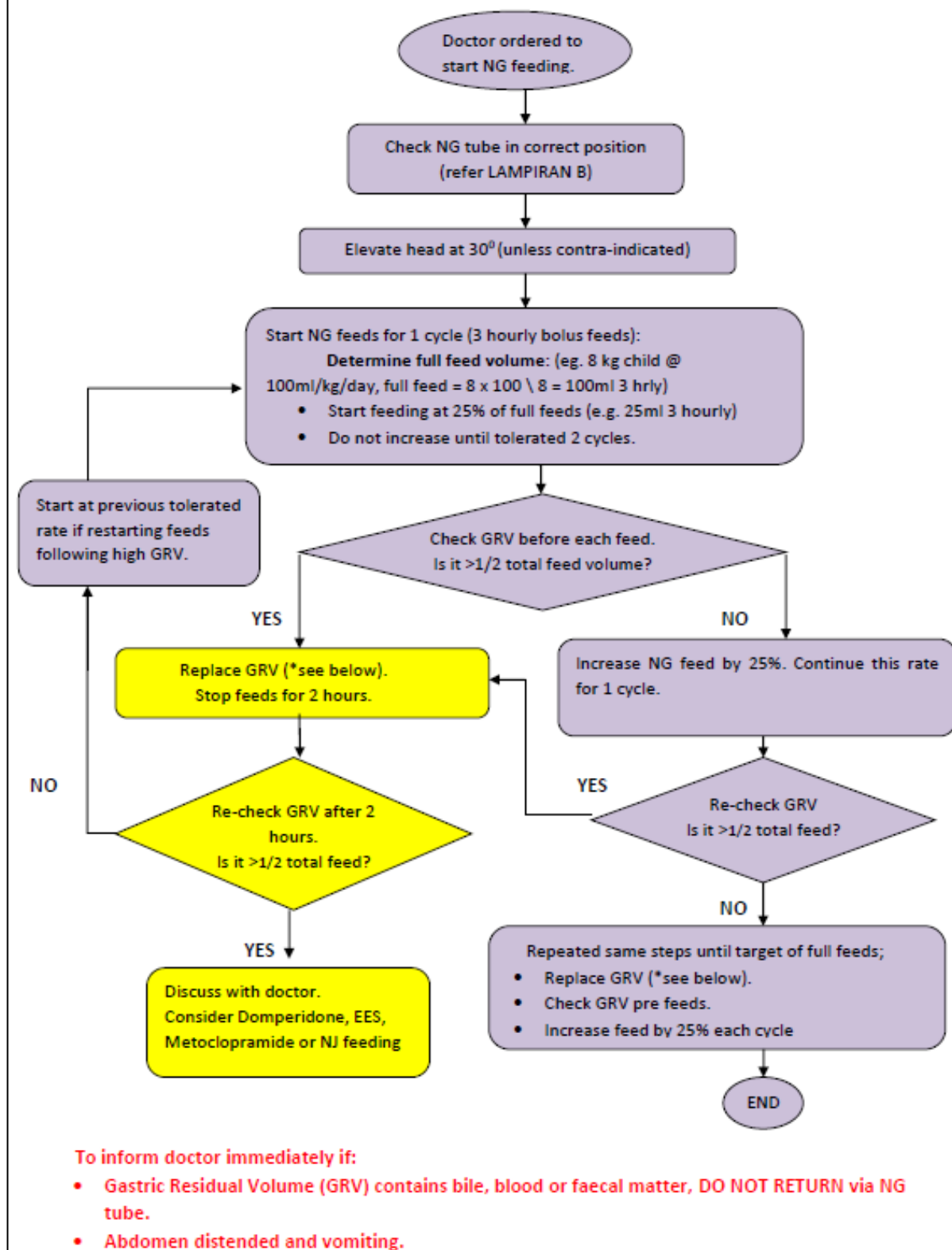
Guideline for Insertion of Nasogastric Tube

1. Preferable to fast for at least 3-4 hours before NG tube insertion (except in emergency!)
2. Using tape measure, **MEASURE DISTANCE** from tip of the patient's nose to the base of ear to xiphisternum and end at midpoint between xiphisternum and umbilicus (see diagram below).
3. Lubricate the tip of the NG tube with water or water-based gel, e.g. KY jelly.
4. Gently insert NG tube through nostril, and advance along the floor of the nose, through naso- and oropharynx, and down the oesophagus to the length measured. You can provide pacifier for infants during the procedure. **DO NOT FORCE.**
5. If the child chokes, coughs, turns cyanosed or becomes breathless, remove the tube immediately and repeat the procedure.
6. Insufflate 5-10 ml of air (not more than 3ml/kg) through the NG tube, and auscultate for a 'whoosh' sound over the epigastrium and at the sides of the lower chest bilaterally (3-point auscultation).
7. Confirm gastric placement by **aspirating NG tube and measuring pH**. (pH test is useless if child on acid suppressors)
 - a. -If **pH is 5 or less**, likely correct placement, can start feeds.
 - b. -If **pH is >5**, possible wrong placement, remove NG tube and reinsert.
8. If **UNABLE TO GET ANY ASPIRATE** from NG tube, can repeat aspiration 20-30 minutes later after manoeuvres, e.g.: changing patient position, push in or pull out 1-2 cm. If still no aspirate, a **CHEST X-RAY including upper abdomen MUST BE DONE AND REVIEWED** to confirm NG tube position prior to feeding.
9. Once NG tube position is confirmed, place a mark with plaster at the level of the nostril, and tape to the skin with clear plastic dressing.
10. Please document the following:
 - a. Size and type of NG tube
 - b. Length of insertion of NG tube
 - c. Date of insertion
 - d. pH of first aspirate
11. Cautions in NG tube insertion in certain situations:
 - a. Nasal, maxillofacial or base of skull fractures
 - b. Known oesophageal injury, varices, tracheoesophageal fistula or larynx surgery
 - c. Patients with known coagulopathy or on anticoagulants



Nasogastric Tube Feeding

NASO-GASTRIC (NG) FEEDING FLOW CHART FOR NURSES - BOLUS FEEDING IN PICU/PHDU



IV Maintenance Fluids & Infusions

Intravenous fluid calculations are very important in PICU. **Always ask what the target fluid allowance and fluid balance are for your patient every day.**

Remember that in certain cases (e.g. Diabetic Ketoacidosis) there are special fluid regimes which the MO / Specialist will plan. 2/3rd maintenance is standard for ventilated children in PICU. Non-ventilated children on enteral feeding can usually be given full maintenance fluids.

Calculation of maintenance fluids in children using the Holliday-Sagar formula:

First 10kg	= 100ml/kg/day	=4ml/kg/hour
Second 10 kg	=50ml/kg/day	=2ml/kg/hour
Every further kg	=20ml/kg/day	=1ml/kg/hour

*Example: 35 kg child, **full maintenance** fluid = (100x10) + (50x10) + (20x15)*

= 1000 + 500 + 300 = 1800ml/day. 1800/24 = 75ml/hr.

Maintenance Fluids for infants <1 year old:

0-6 months:	150ml/kg/day
6-12 months:	120ml/kg/day

Neonates and preterm infants: Follow NICU guidelines.

Infusions

200 cm lines are used for continuous & intermittent infusions. Lines should be flushed with a saline flush after completing infusion. For inotrope infusions, 'double pumping' with a fresh syringe should be started 1 hour before the previous infusion finishes.

Needleless connectors are preferred, to reduce need for disconnections.

The infusion of drugs is a **high risk** component of our practice. We must **always take the time to check the 5**

RIGHTS:

- **Patient**
- **Drug**
- **Dose**
- **Time**
- **Route**

There are resources available to check drug information. Please use them!

- **HRPB Paediatric Injectable Drugs Dilution Protocol**
- **Frank Shann**
- **BNF for Children**
- **Consult Pharmacist or PICU Specialist if advice needed.**

[illegible]

Blood Gas Interpretation

Blood gases are commonly monitored 6-hourly in PICU for ventilated patients. Arterial and capillary blood gases are measured for ventilated patients, and venous blood gases are used for patients with metabolic problems, such as DKA. **Always inform the PICU Specialist or Medical Officer about any abnormal blood gas results AS SOON AS POSSIBLE!**

A basic understanding of blood gas interpretation is essential for anyone working in PICU.

		Blood Gas Parameter	Normal Range
Acid/ Base	H+	pH	7.35-7.45
	PaO ₂	Oxygen	80-100 mmHg
	PaCO ₂	Carbon Dioxide	35-45 mmHg
	HCO ₃ ⁻ std	Bicarbonate	22-26 mmol/L
	BE (ecf)	Base Excess	+/- 2
Electrolytes / Metabolic	Na ⁺	Sodium	135-145 mmol/L
	K ⁺	Potassium	3.5-5 mmol/L
	Ca ²⁺	Ionized Calcium	1.2-1.3 mmol/L
	Glu	Glucose	3.6-6 mmol/L
	Lac	Lactate	<2.5 mmol/L
Co-oximetry	Hct	Haematocrit	0.35-0.55
	Hb	Haemoglobin	9-14 g/dL
	sO ₂	O ₂ saturation	Arterial 94-100% Venous >70% Arterial-venous difference <30%
	FCOHb	Carboxy-haemoglobin	0-5%
	FMetHb	Methaemoglobin	0-3%

	Acidosis (pH <7.35)	Alkalosis (pH >7.45)
Respiratory	CO ₂ HIGH	CO ₂ LOW
Metabolic	Base Excess LOW or Bicarbonate LOW	Base Excess HIGH or Bicarbonate HIGH

Blood Sampling

Guidelines for Blood Collection at Hospital Raja Permaisuri Bainun, Ipoh, Perak

No	Stopper Colour (Specimen Container)	Additives	Draw Volume (mL)	Tests	Number of Inversions
1	Blue Cap 	Na Citrate (3.8% = 0.129M)	1.8	PT, aPTT, Fibrinogen, Factor Assay, Inhibitor Assay, Coagulation study	3-4
2	Gold Cap 	Plain with Clot Activator & Gel Separator	4	<i>Clinical Chemistry:</i> - LFT, LSB, RP, CE, FSL, Calcium, Fe, UIBC, Mg, Phosphate, etc) <i>Immunochemistry:</i> - TFT, Troponin, HCG, Tumor Marker, Hormones, Ferritin, Folate, B12 etc	6-8
3	Lavender cap 	EDTA-K2	2.0	FBC, FBP, Hb Analysis, CD4/CD8, DNA for Thalassemia, iPTH, ACTH, HbA1c, Ammonia, Renin, Cyclosporin, Tacrolimus	8-10
4	Gray Cap 	Fluoride + EDTA-Na2	2.0	Glucose, Lactate	6-8
5	Lavender Cap (Paediatric) 	EDTA-K2 (Microtainer)	0.5	Paediatric Hematology Test (FBC, FBP), Ammonia	8-10
6	Gray Cap (Paediatric) 	Fluoride + EDTA-Na2 (Microtainer)	0.5	Paediatric Blood for Glucose, Lactate	8-10
7	Gold Cap (Paediatric) 	Plain with Clot Activator & Gel Separator (Microtainer)	0.7	Paediatric Blood for; <i>Clinical Chemistry :</i> - LFT, LSB, RP, CE, FSL, Calcium, etc <i>Immunochemistry:</i> - TFT, Ferritin, Folate, B12 etc	-
8	ESR Tube 	Na Citrate (3.2%)	1.6	ESR	4

Blood Results

Some patients may have specific targets for values, e.g. Traumatic Brain Injury Target Hb usually 10-12g/dL. Values may also vary with age. **Please consult / inform the PICU MO or Specialist immediately if you are worried or unsure** about a patient's result.

	Normal value	Units
Full Blood Count (FBC)		
WBC	4.5 - 13.5	10 ⁹ /L
Hemoglobin (Hb)	11.0-16.0	g/dL
Hematocrit (HCT)	34-40	%
Platelet	150 - 400	10 ⁹ /L
Renal Profile (RP)		
Urea	1.7 - 8.3	mmol/L
Sodium	135 - 145	mmol/L
Potassium	3.5 - 5.2	mmol/L
Chloride	97 - 107	mmol/L
Creatinine	28 - 52	μmol/L
Liver Function Test (LFT)		
Total Protein	60 - 80	g/L
Albumin	35 - 54	g/L
Alkaline Phosphatase (ALP)	1 - 269	U/L
Alanine Transaminase (ALT)	0 - 40	U/L
Aspartate Transaminase (AST)	0 - 40	U/L
Total bilirubin	1 -17.1	μmol/L
Electrolytes		
Calcium	2.19 - 2.69	mmol/L
Inorganic Phosphate	0.87 - 1.45	mmol/L
Magnesium	0.65 - 1.05	mmol/L
Other Blood Tests		
Erythrocyte Sedimentation Rate (ESR)	<35	mm/hour
C-Reactive Protein (CRP)	0 - 5	mg/L
Coagulation profile		
PT	12.4 - 15.2	sec
INR	<1.1	ratio
APTT	29.5 - 43.6	sec

Sepsis 6

The PICU team is committed to reducing the risk of Sepsis in PICU for our patients.

The HRPB Sepsis 6 Protocol is aimed at making sure that we recognise sepsis early, and start appropriate treatment as soon as possible.

Recognition (PICU Nurse or Doctor)

1. If patient meets criteria for **Febrile Neutropenia***
 - follow the HRPB Paeds Oncology Guideline on Management of Haematology / Oncology patients with Fever, 2012.
 - **Febrile neutropenia criteria: Temp >38 C AND oncology or stem cell transplant patient, aplastic anaemia, confirmed neutropenia or active chemotherapy)*
2. **If a child with suspected / proven infection has at least 2 of:**
 - Core T <36 C or >38 C
 - Inappropriate tachycardia
 - Altered mental state (e.g. irritable, lethargic, floppy)
 - Reduced peripheral perfusion / prolonged capillary refill

→ **Refer to PICU doctor for clinical decision**

Diagnosis – Does this child have sepsis?

Sepsis is a clinical diagnosis. If in doubt, consult a senior doctor / Specialist.

Important Red Flags (lower threshold to treat): Age <3 months, immunocompromised, hypotension, purpuric rash)

- **If Confirmed Sepsis – Start Treatment as below. Look for Probable Source of Infection to guide choice of Antibiotics.**
- **If Unsure – Review again within 1 hour, and consult senior doctor.**
- **If Sepsis Excluded – Continue management and monitoring as usual.**

Treatment – Paediatric Sepsis 6 (Within 1 hour of diagnosis)

1. **Give oxygen** (if required, and not contraindicated)
2. **Obtain IV or IO access, and take blood tests as needed** (e.g. blood culture, glucose, blood gas, full blood count, CRP)
3. **Give IV / IO antibiotics AS SOON AS POSSIBLE** – within 1 hour of sepsis diagnosis, record time of administration (follow HRPB Antimicrobial Guidelines)
4. **Consider fluid resuscitation**
 - a. Aim to restore normal physiologic parameters-HR, BP, urine output etc.
 - b. Titrate 5-20ml/kg Isotonic fluid boluses over 5-10 mins
 - c. Repeat as necessary
 - d. Caution / look out for fluid overload
5. **Involve Senior Doctors (PICU Specialist / Consultant)**
6. **Consider Inotropic Support**
 - a. If normal physiologic parameters are not restored after 40ml/kg fluid, inotropes are usually required.
 - b. 1st line usually Adrenaline or Noradrenaline, run centrally whenever possible.

Healthcare Associated Infection

What is a HCAI?

The term “healthcare associated infections” is used to describe infective complications of treatment that patients develop while receiving hospital care. Some examples of HCAIs are blood stream infections, ventilator-associated pneumonia, surgical site infection or urinary tract infections with a urinary catheter in situ. Many (but not all) of these infections are preventable.

It is important that we are compliant to care bundles, to reduce HCAIs.

BLOODSTREAM INFECTION:

Bloodstream infection rate (infections per 1,000 central line days).

Why we measure it - Central venous catheters or central lines are commonly used in the paediatric intensive care unit to administer medications and fluids. **A central line bloodstream infection can occur when bacteria enter the blood stream** causing a patient to become sick. The bacteria most often come from the patient's skin but can also come from a patient's wound and even from the environment.

VENTILATED ASSOCIATED PNEUMONIA:

VAP rate (cases per 1000 ventilator days).

Why we measure it- Ventilator-associated pneumonia (VAP) is a major cause of hospital morbidity and mortality despite recent advances in diagnosis and accuracy of management. Prevention is better than cure and decreases the hospital stay, cost, morbidity and mortality.

URINARY TRACT INFECTIONS:

Catheter-associated UTI rate (cases per 1,000 catheter days).

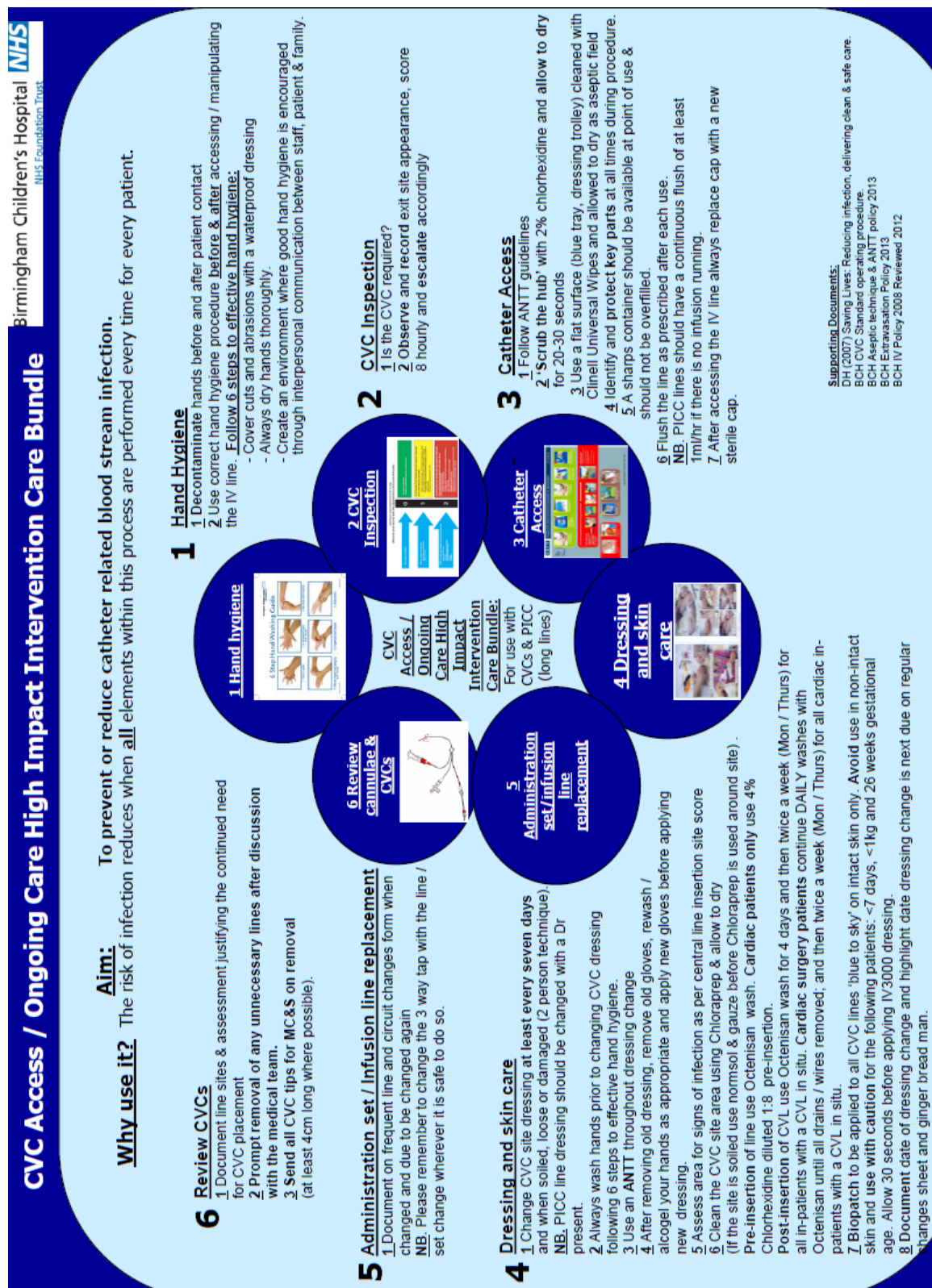
Why we measure it? **Patients who have a urine catheter in situ are at high risk for a urinary tract infection.** The longer a patient has a catheter in place to drain urine from his or her bladder, the higher the risk of infection.

ARE YOUR LINES / CATHETER NECESSARY and

ARE YOU 'CARE BUNDLE COMPLIANT'?

Central Venous Catheter Bundle

An example of a CVC Care Bundle from Birmingham Children's Hospital is shown below. We are developing our own bundle for PICU HRPB, which will be available soon.



Ventilator Associated Pneumonia Bundle

Ventilator Associated Pneumonia Care Bundle Bedside Guide

These measures should be part of an overall strategy to reduce HCAI's including hand hygiene & the use of personal protective equipment (PPE).

6) Preventing aspiration of contaminated oro-pharyngeal secretions:

Oro-pharyngeal suction:
-As indicated to clear any secretions that have pooled at the back of the mouth
-With mouth care
-Prior to cuff deflation
-Prior to extubation.



Cuff Pressure:
-Measure once a shift & document on PICU chart
-Maintain cuff pressure less than or equal to 25cmH₂O

Deflating the cuff (2 person procedure):
-Perform oro-pharyngeal suction before deflating
-One person performs ET suction while the second holds the tube & deflates the cuff.

1) Elevation of head of bed



Avoid supine position (lying flat on back)

Infants & above: minimum of 30° tilt unless contraindicated

Neonates: 25° (max tilt on incubators)

Discuss with doctor:

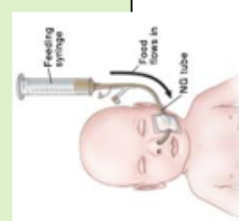
- If tilting causes cardiovascular instability
- Acute head injury (whole bed tilted to 30°)
- Suspected/actual spinal cord injury (follow medical instructions)
- Acute abdominal conditions (avoid bending)



4) Minimising the risk of aspiration:

Aspirate the NG tube:

- at least 4hrly
- before administration of feed / medication
- following episodes of vomiting / coughing / retching
- following evidence of tube displacement
- Document the length of the NG tube.



5) Oral Hygiene:

Brush teeth TWICE DAILY when present

- Children up to 2yrs - a smear of toothpaste
- Children 2yrs & older- a pea sized blob

Suction excess & avoid rinsing with lots of water.

Use sterile water at least 4hrly to keep mouth moist.

Clear oral secretions regularly to prevent accumulation of secretions in the oro-pharynx.

If brushing teeth is not possible gauze swabs should be used moistened with water or chlorhexidine gluconate 0.2%w/v (should only be used for a max of 1 week, to avoid brown staining).

Contraindications for brushing teeth:

- Bleeding gums, platelets < 20,000, severe mucositis.
- Contraindicated due to dental / maxillofacial conditions

2) Care of ventilator tubing:

Position ventilator tubing down to allow any condensate to collect away from the patient

Drain condensate before moving the patient & at least every 2 hrs

Change when soiled / every 7 days



Disconnection = potential for contamination

THINK BEFORE DISCONNECTING



- Appropriate hand hygiene
- Excess condensate should be collected in a glove wrapper or tissue.
- DO NOT SHAKE INTO THE BED OR ALLOW TO DRIP ONTO PATIENT
- Use clean test lung where possible.

3) Suction technique

- Appropriate hand hygiene
- Use Aseptic Technique & appropriate PPE when performing suction.
- Clearance of oral & nasal secretions to prevent aspiration of contaminated secretions
- Keep the end of suction tubing covered when not in use.
- Rinse tubing through with sterile water.
- Change suction tubing every 24hrs.
- Change suction canister with each new admission or when ¾ full.

To be used in conjunction with supporting document 'PICU Ventilator care bundle Supporting evidence(2018) V1'

Version 2.0, Dec 2019, Pravin Vasanthen, Jeyaseelan Nachiappan, PICU HRPB

Urinary Catheter Care Bundle

Aims: To reduce or prevent incidence of Catheter Associated Urinary Tract Infections (CAUTI)

1. Five C's

- a. Correct reason- urinary retention, pre-op drainage and measurement, chemotherapy, neurologic bladder, prior to investigation, etc.
- b. Correct patient- is the catheter needed?
- c. Correct catheter size- for age and sex
- d. Correct experience- competence/ training / supervision
- e. Correct preparation- patient, environment, apron, face protection, sterile trolley/ field and sterile gloves

2. Hand Hygiene

- a. Correct hand hygiene procedure before and after insertion
- b. Hand scrubbing before inserting catheter, hand decontamination before and after each patient contact

3. Insertion

- a. Procedure explained and appropriate consent obtained.
- b. 5Cs followed as above
- c. Remove stylet from urinary catheter
- d. Urethral meatus is cleaned with sterile saline with non-sterile gloves
- e. Sterile anaesthetic lubricant is applied, then wait 2-3 minutes.
- f. Remove non-sterile gloves, decontaminate, then wear sterile gloves.
- g. Using sterile trolley and field, urethral catheter is inserted using Aseptic Non Touch Technique (ANTT)

4. Drainage

- a. ANTT is used to connect urinary catheter to closed urinary drainage bag
- b. Observe colour and volume of urine drained. Inform doctors if any discolouration or blood in urine.
- c. Catheter drainage bag placed above floor, and below level of the bladder.

5. Ongoing Care

- a. Daily review of catheter, remove as soon as not needed.
- b. Daily cleaning of catheter site and whenever soiled.
- c. Regular emptying of drainage bag, change bag every 5 days.
- d. Foley Catheter should be changed monthly.
- e. Access port should be cleaned with chlorhexidine / alcohol wipes and allowed to dry.

Document all procedures clearly

- Date and time of insertion.
- Name and designation of staff inserting catheter.
- Date and time of flushing or sampling from catheter
- Date and time of catheter removal
- Date and reason for catheter replacement.

Pressure Sore Prevention

Pressure ulcers can cause pain and discomfort as well as prolong hospital stay. Key risk factors are immobility, poor perfusion, poor nutrition and reduced sensation.

Use of medical devices such as NIV can also increase risk of pressure sores. Measures to prevent pressure sores include frequent skin inspection and repositioning, encouraging ambulation and minimising sedation and paralysis, good nutrition and the use of ripple mattresses and Duoderm patch over pressure areas.

Areas which are prone to development of pressure sores in PICU patients include:

- **Occiput** (especially in infants requiring cerebral protection following traumatic brain injury or neurosurgical intervention)
- **Sacral region**
- **Angle of the mouth** (pressure from Endotracheal tube)
- **Nostrils** (pressure from NG tube or Nasotracheal tube)
- **Forehead** (pressure from Oronasal mask used for delivery of NIV)



Duoderm



Ripple Mattress

Pre-Transfer Checklist

Occasionally, the PICU team will be required to conduct emergency primary transfers to other centres, e.g. IJN. The following checklist is to be used in preparing for these transfers. Not all items will be required for every patient.

Airway and Cervical Spine

- Cervical collar (if needed)
- Oropharyngeal airways
- Suction catheters
- ETT various sizes
- ETT stylets
- Syringe for inflating ETT cuff
- Lubricant
- Laryngoscope handle, blades and batteries
- Tape for ETT
- CXR reviewed to confirm ETT position (T2-T3)
- Laryngeal mask airway (if needed)

Breathing and Ventilation

- Oxygen supply – adequate for journey + 2 hours
- Portable ventilator with appropriate settings
- Nasogastric tube inserted and on free drainage
- Appropriate HME (Heat and Moisture Exchanger) or filter attached.
- Ambubag and Mask

Circulation

- IV access x2
- Inotropes
- HR, BP stable
- Intraosseous line or central line ideal if child on inotropes
- IV Cannula, Infusion tubing, Syringes, Alcohol swabs, Gauze, Plaster for emergency IV access

Disability

- Sedation (IVI Morphine + IVI Midazolam)
- Pupils checked
- Glucose stable

Exposure and Temperature Control

- Fractures splinted and secure
- Temperature stable
- Thermometer
- Incubator for infants

Fluids and Nutrition

- Appropriate maintenance fluids prescribed, e.g. NS D5%
- Stress ulcer prophylaxis if needed

Sepsis

- 1st dose antibiotics given
- Cultures taken

Monitoring

- Continuous HR, SpO2 monitoring
- Intermittent noninvasive BP, temperature monitoring

Documentation and Communication

- Referral letter, investigations, x-rays
- GXM samples, forms, blood products, consent forms if relevant
- Receiving centre doctor updated, bed available.
- Parents and family updated.
- Phone numbers of receiving hospital, doctor in charge available.

Lab Results and Radiology

- All relevant lab investigations and x-rays reviewed, and brought along with patient.

Personnel

- Accompanying staff with appropriate skills and experience to handle emergencies during transfer.

References and Acknowledgements

The concept and much of the material in this Handbook was adapted, with permission, from a similar document by the PICU team at Birmingham Children's Hospital, UK.

The following departments and individuals have made significant contributions to the content of this Handbook:

- PICU HRPB Specialists, Nurses, Medical Officers and Pharmacist
- Paediatric Department HRPB
- Pharmacy Department HRPB
- Pathology Department HRPB
- Neurosurgical Department HRPB
- Dr Chew Eng Lai, Consultant Paediatrician and Head of Department, Hospital Langkawi
- Ms Khoo Sze Ni, Pharmacist HRPB

References for the material in this Handbook were obtained from:

- Rogers' Textbook of Paediatric Intensive Care, 5th edition.
- Oxford Handbook of Paediatric Intensive Care,
- Birmingham Children's Hospital PICU Guidelines
- Malaysian Paediatric Protocol 4th Edition
- Advanced Paediatric Life Support 6th Edition
- Vancouver Coastal Health Y-Site Compatibility Table
- Ministry of Health Malaysia COVID Management Guidelines
- Brain Trauma Foundation Guidelines for the Management of Paediatric Severe Traumatic Brain Injury, 3rd edition.



*Good luck and Welcome to
our PICU!*