Pediatric, Neonatal, and PICU Protocols

Last updated: Jan 2022

Please send proposed additions or corrections to ashirk@kijabehospital.org

Please note that this booklet is meant to serve as a supplement to the excellent MoH Pediatric Guidelines. When treating any baby or child, please refer *first* to this booklet as local guidelines reflect local conditions and resources - *then* to the MoH booklet, and if further information is required to the Harriet Lane Handbook for children (found in OPD, nursery, on the pediatric wards and in ICU) and WHO Pocket Book of Hospital Care for Children

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PEDIATRICS ROTATION

Weekly Presentations

Monday 2:30pm: Nursery Presentation
Tuesday 8:30am: Mock Code
Wednesday 2:30pm: Intern Core Lectures
Thursday 2:30pm: Ward Presentation
Friday 8:30 am: Mortality review or ICU presentation

CALL

- Coverage of casualty is by both CO and MO intern. Both must see all patients coming through casualty.
- Newborn unit/deliveries are primarily covered by MO intern.
- OPD and BKKH is primarily covered by CO intern
- Call ends at **8:00AM** - any patient arriving to hospital before 8:00AM is the responsibility of the call team.
- There is always a CO and a consultant on call with you. Consult on ALL admissions, any patient change in status, and any other concerns.

PEDIATRIC TRIAGE

PRIORITY 1 (RED PEWS >3)– NOTIFY PAEDs CO TO CASUALTY. TAKE TO CASUALTY IMMEDIATELY FOR IMMEDIATE REVIEW AND NOTIFY CONSULTANT:		
AIRWAY & BREATHING	1. Head/neck trauma 2. Absent / weak / obstructed breathing 3. Severe respiratory distress / RR >80/ Cyanotic (blue)	1. Cervical collar if head/neck trauma 2. Open airway (chin lift / jaw thrust) 3. Commence bag valve mask if inadequate effort 4. Apply oxygen via face mask if breathing 5. Warm child on resuscitaire
C I R C U L A T I O N	1. No pulse 2. Cold hands/feet with: - Capillary refill >3 seconds - Weak + fast or slow (<60) pulse - Slow skin pinch or sunken eyes	1. Commence CPR if pulseless. 2. Stop active bleeding 3. apply O2 via nasal cannula or facemask. 4. Weigh child (or estimate weight with Broselow tape DO NOT GUESS.) **MUAC: <12.5 / malnutrition?** **Yes:** IV access and IV glucose, 5 ml/kg DNS - 30 min (x3 prn); NO FLUID BOLUSES **No:** IV access; IO if >5min; ***Hypovolemic shock***: 20mL/kg NS bolus x 1-2 ***Septic shock (all cases):*** 5-10/kg BOLUS then 4 ml/kg/hr 1/2D10 1/2NS / D5LR
DISABILITY	Unresponsive / Coma / Convulsing	Manage airway and give oxygen via facemask, consider intubation. Obtain IV access, check RBS
EXPOSURE	Major trauma or burn >10%	IV access x 2, inform pediatric surgeon 1st on call immediately

PEDIATRIC TRIAGE

PRIORITY 2 PEWS 2-3 (see within 10 min & discussed with OPD/MCH consultant)	
Any of the following: - Respiratory distress / SaO2 <90% / RR >60 - Pallor of palms - Malnutrition: severe wasting - Oedema of both feet - Lethargic, irritable, altered alertness - Severe pain (abdomen, genitalia, injury) - Any sick infant under 2 months old - Temperature >39ºC - Poisoning or other trauma - Urgent referral letter	**Start Oxygen as needed** **Start IV as needed** **Call Paeds MO / PECCCO as needed**
PRIORITY 3 (see within 1 hr) All other children with abnormal vital signs, fever or who need medical review.	

Wong-Baker "Faces" Pain Rating Scale

From Wong D.L., Hockenberry-Eaton M., Wilson D., Winkelstein M.L., Schwartz P.: Wong's Essentials of Pediatric Nursing, ed. 6, St. Louis, 2001, p. 1301. Copyrighted by Mosby, Inc. Reprinted by permission.

RESUSCITATION / DETERIORATION

Pediatric patients tend to deteriorate more rapidly than adult patients as they have less ability to compensate for hemodynamic instability.

Important resuscitation pearls:

- **AIRWAY / BREATHING** - Good bag-valve-mask ventilation is imperative and potentially lifesaving.
- **CIRCULATION -** Do not look at the monitor or listen to the heart to determine whether CPR should be commenced - ***any unconscious child without a palpable pulse should have CPR commenced immediately irrespective of monitoring.***
  - ✓ Chest compressions should be commenced at a ratio of 15:2 (infant/child) or 3:1 (newborn) until intubated.
  - ✓ A heart rate on the monitor without a pulse signifies pulseless electrical activity which should be treated with CPR, adrenaline (and reversal of underlying causes until a pulse returns:
  - ✓ Reversible causes
    - Hypoxia
    - Hypovolemia
    - Hypoglycemia
    - Hypo/hyper-kalemia, hypocalcemia
    - Hydrogen Ions (acidosis)
    - Tension Pneumothorax
    - Thrombus (Pulmonary Embolus, Cardiac)
    - Tamponade
    - Toxins

- If **IV access** is not possible within 2 minutes of shock / arrest, an 18gauge (pink) needle or IO if available should be placed in the proximal tibia or distal femur.
- **Adrenaline**: 1mL of 1:1000 solution should be diluted in 9mL saline. The pediatric dose is 0.1 mL/kg IV/IO

WEIGHTS AND DOSES

- Do not give drugs or IV fluids before determining or estimating the weight of the baby/ child.
- Broselow or PAWPER tape
  - **MUAC (mid upper arm circumference) must also be quickly measured -** if MUAC is <13.5 subtract one color category (2 categories if MUAC <11.5) or weight will be overestimated
- Weight maybe estimated from the child's age as:

  Malnourished [age^{yr} x 2] + 4 kg

  Well-nourished [age^{yr} x 2] + 8 kg

WARD MANAGEMENT: DETERIORATING PATIENT

- **Any patient on the pediatric ward who has abnormal vital signs, increasing PEWS score, or PEWS >2, or nursing concern will have call placed to the MO/CO intern**.
  - The patient should be evaluated in person within 15 minutes.
  - If you are unable to respond in person within 15 minutes, you should call the pediatric CO or consultant on call to see the patient.
  - Notify the PECCCO or consultant for ALL PEWS >2 to review the plan.

EVALUATION OF PEDIATRIC PATIENTS

✓ **History** should always include all the following:
- Pregnancy/ birth / developmental history in any infant.
- Most recent weight, if known by the caregiver.
- All other routine history questions.

✓ **Examination** should always include all the following:
- **Weight and length** with z-score or BMI calculated.
- **Head circumference** (percentile should be noted)
- **Mid Upper Arm Circumference** (MUAC) (best >6mo)

6-59 mo	5-9 yr	10-17 yr	
<11.5	<13.5	14.5	Severe acute malnutrition associated with high mortality
11.5-12.5	13.5-14.5	14.5-18.5	Moderate acute malnutrition (consider admission for supplementary food)
12.6-13.5			Mild acute Malnutrition
>13.5			Normal

***translator should always be used if primary language is not Kiswahili or English**

✓ **Z-scores** (see tables on following pages) Every child should have length for age, & weight for length z-score documented to determine if malnutrition is present.

✓ **HIV test** (if malnutrition, chronic illness, suspicion for TB, prolonged fever, and/or maternal illness)

- ✓ **Vital signs**: normal values can be found below.
  - Please recount RR and recheck pulse yourself
  - Abnormal VS requires intervention & notification of a consultant.
  - Parameters for vitals sign alert should be noted in the admitting orders. (Doctor's Order stat & pin to top of orders)

	RESP RATE	SaO2	HR	SYSTOLIC BP
0-3 MONTHS	30-60	>90	100-150	65-85
3-6 MONTHS	30-50	>90	90-150	70-90
6-12 MONTH	25-40	>90	90-150	70-100
1 – 2 YEARS	24-35	>90	80-120	80-105
2 – 5 YEARS	20-30	>90	75-120	85-110
6-12 YEARS	15-25	>90	65-110	90-120
> 12 YEARS	12-18	>90	60-100	100-120

***for Neonate, normal MAP is gestational age (+ 5), older is (age x 1.5+40)**

Age	Systolic Pressure (mm Hg)*	Diastolic Pressure (mm Hg)*	Mean Arterial Pressure (mm Hg)†	Systolic Hypotension (mm Hg)‡
Birth (12 h, <1000 g)	39-59	16-36	28-42§	<40-50
Birth (12 h, 3 kg)	60-76	31-45	48-57	<50
Neonate (96 h)	67-84	35-53	45-60	<60
Infant (1-12 mo)	72-104	37-56	50-62	<70
Toddler (1-2 yr)	86-106	42-63	49-62	<70 + (2 × Age in years)
Preschool (3-5 yr)	89-112	46-72	58-69	<70 + (2 × Age in years)
School age (6-7 yr)	97-115	57-76	66-72	<70 + (2 × Age in years)
Preadolescent (10-12 yr)	102-120	61-80	71-79	<90
Adolescent (12-15 yr)	110-131	64-83	73-84	<90

Data from Gemelli M, et al. Longitudinal study of blood pressure during the 1st year of life. *Eur J Pediatr* 149:318-320, 1990; Versmold H, et al. Aortic blood

Z SCORES FOR WT/LENGTH

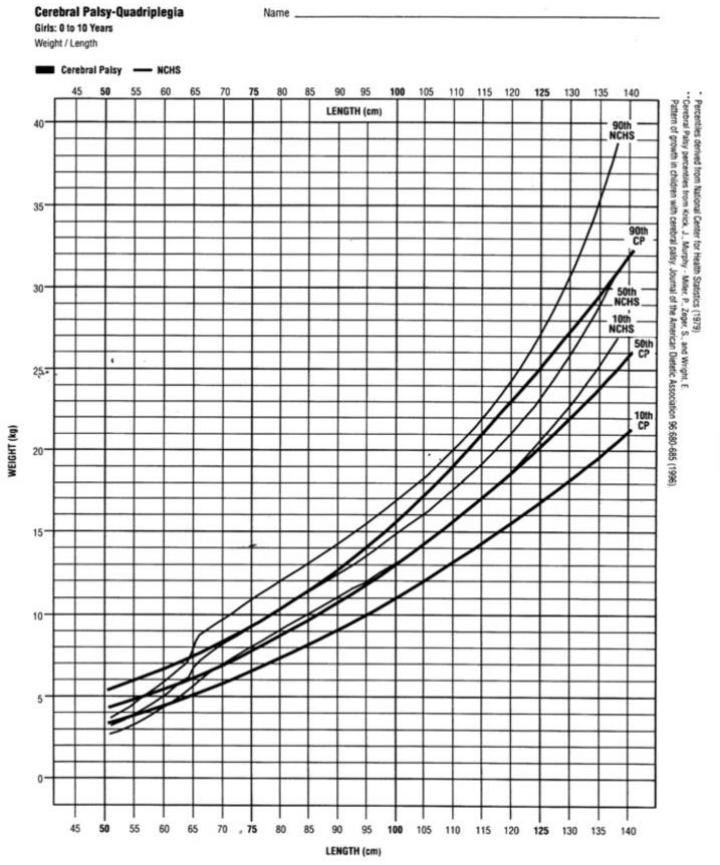
Boys Weight (kg)					Length	Girls Weight (kg)				
-5 SD	-4 SD	-3 SD	-2 SD	-1 SD	(cm)	-1 SD	-2 SD	-3 SD	-4 SD	-5 SD
1.5	1.7	1.9	2.0	2.2	**45**	2.3	2.1	1.9	1.7	1.5
1.7	1.8	2.0	2.2	2.4	**46**	2.4	2.2	2.0	1.9	1.7
1.8	2.0	2.1	2.3	2.5	**47**	2.6	2.4	2.2	2.0	1.8
1.9	2.1	2.3	2.5	2.7	**48**	2.7	2.5	2.3	2.1	1.9
2.0	2.2	2.4	2.6	2.9	**49**	2.9	2.6	2.4	2.2	2.0
2.2	2.4	2.6	2.8	3.0	**50**	3.1	2.8	2.6	2.4	2.1
2.3	2.5	2.7	3.0	3.2	**51**	3.3	3.0	2.8	2.5	2.2
2.5	2.7	2.9	3.2	3.5	**52**	3.5	3.2	2.9	2.7	2.4
2.7	2.9	3.1	3.4	3.7	**53**	3.7	3.4	3.1	2.8	2.5
2.9	3.1	3.3	3.6	3.9	**54**	3.9	3.6	3.3	3.0	2.7
3.0	3.3	3.6	3.8	4.2	**55**	4.2	3.8	3.5	3.2	2.9
3.2	3.5	3.8	4.1	4.4	**56**	4.4	4.0	3.7	3.4	3.1
3.4	3.7	4.0	4.3	4.7	**57**	4.6	4.3	3.9	3.6	3.3
3.6	3.9	4.3	4.6	5.0	**58**	4.9	4.5	4.1	3.8	3.4
3.7	4.1	4.5	4.8	5.3	**59**	5.1	4.7	4.3	3.9	3.5
3.9	4.3	4.7	5.1	5.5	**60**	5.4	4.9	4.5	4.1	3.7
4.1	4.5	4.9	5.3	5.8	**61**	5.6	5.1	4.7	4.3	3.9
4.2	4.7	5.1	5.6	6.0	**62**	5.8	5.3	4.9	4.5	4.0
4.4	4.9	5.3	5.8	6.2	**63**	6.0	5.5	5.1	4.7	4.2
4.7	5.1	5.5	6.0	6.5	**64**	6.3	5.7	5.3	4.8	4.3
4.8	5.3	5.7	6.2	6.7	**65**	6.5	5.9	5.5	5.0	4.5
5.0	5.5	5.9	6.4	6.9	**66**	6.7	6.1	5.6	5.1	4.6
5.1	5.6	6.1	6.6	7.1	**67**	6.9	6.3	5.8	5.3	4.8
5.3	5.8	6.3	6.8	7.3	**68**	7.1	6.5	6.0	5.5	5.0
5.5	6.0	6.5	7.0	7.6	**69**	7.3	6.7	6.1	5.6	5.1
5.6	6.1	6.6	7.2	7.8	**70**	7.5	6.9	6.3	5.8	5.2
5.8	6.3	6.8	7.4	8.0	**71**	7.7	7.0	6.5	5.9	5.3
5.9	6.4	7.0	7.6	8.2	**72**	7.8	7.2	6.6	6.0	5.4
6.0	6.6	7.2	7.7	8.4	**73**	8.0	7.4	6.8	6.2	5.6
6.1	6.7	7.3	7.9	8.6	**74**	8.2	7.5	6.9	6.3	5.7
6.3	6.9	7.5	8.1	8.8	**75**	8.4	7.7	7.1	6.5	5.9
6.4	7.0	7.6	8.3	8.9	**76**	8.5	7.8	7.2	6.6	6.0
6.5	7.2	7.8	8.4	9.1	**77**	8.7	8.0	7.4	6.7	6.1
6.6	7.3	7.9	8.6	9.3	**78**	8.9	8.2	7.5	6.9	6.2
6.7	7.4	8.1	8.7	9.5	**79**	9.1	8.3	7.7	7.0	6.3
6.9	7.6	8.2	8.9	9.6	**80**	9.2	8.5	7.8	7.1	6.4
7.0	7.7	8.4	9.1	9.8	**81**	9.4	8.7	8.0	7.3	6.6
7.2	7.9	8.5	9.2	10.0	**82**	9.6	8.8	8.2	7.5	6.8
7.3	8.0	8.7	9.4	10.2	**83**	9.8	9.0	8.3	7.6	6.9
7.5	8.2	8.9	9.6	10.4	**84**	10.1	9.2	8.5	7.8	7.1
7.7	8.4	9.1	9.8	10.6	**85**	10.3	9.4	8.7	8.0	7.2
7.9	8.6	9.3	10.0	10.8	**86**	10.5	9.7	8.9	8.1	7.3
8.0	8.7	9.5	10.2	11.1	**87**	10.7	9.9	9.1	8.3	7.5
8.1	8.9	9.7	10.5	11.3	**88**	11.0	10.1	9.3	8.5	7.7
8.3	9.1	9.9	10.7	11.5	**89**	11.2	10.3	9.5	8.7	7.9

Combination of Kenyan MOH, WHO, and NCHS charts taken from

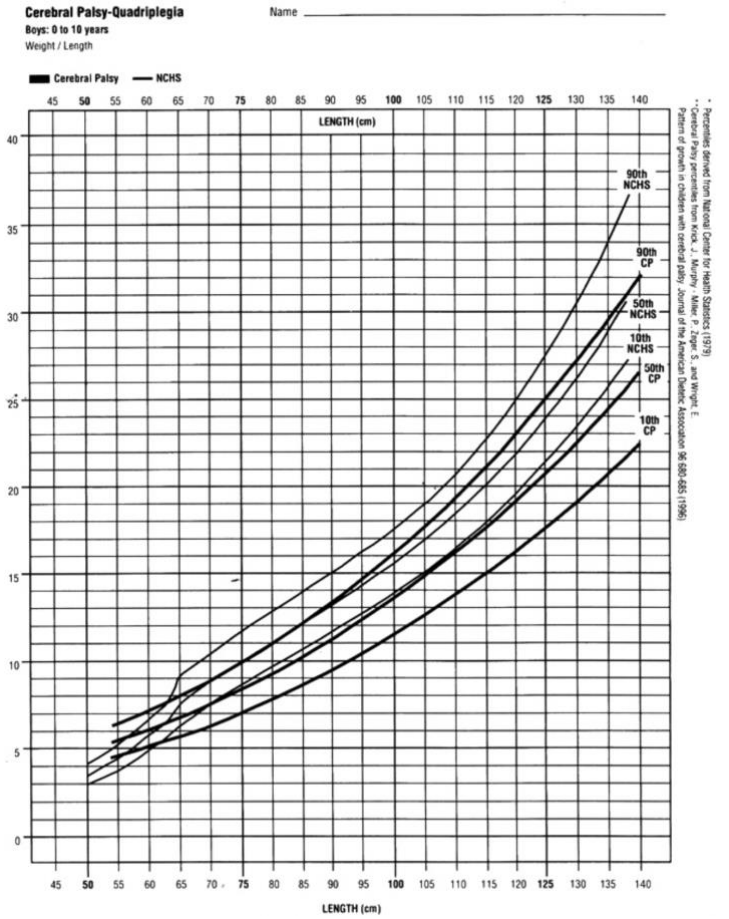
Boys Weight (KG)					length	Girls Weight (KG)				
-5 SD	-4 SD	-3 SD	-2 SD	-1 SD	(cm)	-1 SD	-2 SD	-3 SD	-4 SD	-5 SD
8.5	9.3	10.1	10.9	11.8	**90**	11.4	10.5	9.7	8.8	8.0
8.7	9.5	10.3	11.1	12.0	**91**	11.7	10.7	9.9	9.0	8.2
9.1	9.7	10.5	11.3	12.2	**92**	11.9	10.9	10.1	9.2	8.4
9.0	9.8	10.7	11.5	12.4	**93**	12.1	11.1	10.2	9.4	8.5
9.2	10.0	10.8	11.7	12.6	**94**	12.3	11.3	10.4	9.5	8.6
9.4	10.2	11.0	11.9	12.8	**95**	12.6	11.5	10.6	9.7	8.8
9.5	10.3	11.2	12.1	13.1	**96**	12.8	11.7	10.8	9.9	9.0
9.6	10.5	11.4	12.3	13.3	**97**	13.0	12.0	11.0	10.1	9.2
9.8	10.7	11.6	12.5	13.5	**98**	13.3	12.2	11.2	10.2	9.3
10.0	10.9	11.8	12.7	13.7	**99**	13.5	12.4	11.4	10.4	9.4
10.1	11.0	12.0	12.9	14.0	**100**	13.7	12.6	11.6	10.6	9.6
10.2	11.2	12.2	13.2	14.2	**101**	14.0	12.8	11.8	10.8	9.8
10.4	11.4	12.4	13.4	14.5	**102**	14.3	13.1	12.0	11.0	10.0
10.6	11.6	12.6	13.6	14.8	**103**	14.5	13.3	12.3	11.2	10.1
10.8	11.8	12.8	13.9	15.0	**104**	14.8	13.6	12.5	11.4	10.3
11.0	12.0	13.0	14.1	15.3	**105**	15.1	13.8	12.7	11.6	10.5
11.2	12.2	13.3	14.4	15.6	**106**	15.4	14.1	13.0	11.8	10.7
11.3	12.4	13.5	14.6	15.9	**107**	15.7	14.4	13.2	12.0	10.8
11.5	12.6	13.7	14.9	16.2	**108**	16.0	14.7	13.5	12.3	11.1
11.6	12.8	14.0	15.1	16.5	**109**	16.4	15.0	13.8	12.5	11.2
11.8	13.0	14.2	15.4	16.8	**110**	16.7	15.3	14.0	12.8	11.5
					height					
12.1	13.3	14.5	15.8	17.1	**110.5**	17.1	15.7	14.4	13.1	11.8
12.2	13.4	14.6	15.9	17.3	**111**	17.3	15.8	14.5	13.2	11.9
12.2	13.5	14.8	16.0	17.5	**111.5**	17.5	16.0	14.7	13.3	11.9
12.3	13.6	14.9	16.2	17.6	**112**	17.8	16.2	14.8	13.5	12.1
12.4	13.7	15.0	16.3	17.8	**112.5**	17.9	16.3	15.0	13.6	12.2
12.5	13.8	15.2	16.5	18.0	**113**	18.0	16.5	15.1	13.7	12.3
12.7	14.0	15.3	16.6	18.0	**113.5**	18.2	16.7	15.3	13.9	12.5
12.8	14.1	15.4	16.8	18.3	**114**	18.4	16.8	15.4	14.0	12.6
12.8	14.2	15.6	16.9	18.5	**114.5**	18.6	17.0	15.6	14.1	12.6
12.9	14.3	15.7	17.1	18.6	**115**	18.8	17.2	15.7	14.3	12.8
13.0	14.4	15.8	17.2	18.8	**115.5**	19.0	17.3	15.9	14.4	12.9
13.1	14.6	16.0	17.4	19.0	**116**	19.2	17.5	16.0	14.5	13.0
13.2	14.7	16.1	17.5	19.2	**116.5**	19.4	17.7	16.2	14.7	13.2
13.4	14.8	16.2	17.7	19.3	**117**	19.6	17.8	16.3	14.8	13.3
13.5	14.9	16.4	17.9	19.5	**117.5**	19.8	18.0	16.5	15.0	13.5
13.5	15.0	16.5	18.0	19.7	**118**	20.0	18.2	16.6	15.1	13.6
13.7	15.2	16.7	18.2	19.9	**118.5**	20.1	18.4	16.8	15.2	13.6
13.8	15.3	16.8	18.3	20.0	**119**	20.3	18.5	16.9	15.4	13.8
13.9	15.4	16.9	18.5	20.2	**119.5**	20.5	18.7	17.1	15.5	13.9
14.0	15.5	17.0	18.6	20.4	**120**	20.7	18.9	17.3	15.6	14.0

http://motherchildnutrition.org/malnutrition- management/info/nchs-who-normalized-reference.html

CP WEIGHT/LENGTH (Girls 0-10)



CP WEIGHT/LENGTH(Boys 0-10)



PEDIATRIC TRAUMA

- Major trauma (mechanism, > one injury, burns, head trauma) should be evaluated in CASUALTY.
- **The pediatric surgery team should be informed immediately upon arrival**.
- If there is any delay, call the pediatrician.
- All children with major trauma must be admitted to **pediatric surgery** – not orthopedics or neurosurgery – to ensure a full tertiary survey occurs & appropriate follow-up is completed.

PRIMARY SURVEY

Airway

- Ensure c-spine stabilization with appropriately sized cervical collar (Stabilize with taped linens if no collar)

Breathing

- **Oxygen** should be administered via appropriately sized **mask** for all major trauma.
- **Tension pneumothorax** is a clinical diagnosis (decreased breath sounds with increase resonance to percussion +/- tracheal deviation). Needle thoracostomy should be done without waiting for x-ray if present.

Circulation

- **2 IV lines** should be placed (preferably in large veins such as the antecubital fossa.)
- Obtain an **intraosseous** within 2 minutes for any patient with hypovolemic shock of arrival if IV access is not possible.

Disability

- Glasgow Coma Score (see table) & pupil size should be recorded
- 4 extremities should quickly be evaluated for neurological status (movement, sensation) and findings recorded.

Exposure

- all clothing should be removed so that the entire body can be adequately examined.
- infants/children lose body heat quickly, so ensure linens/blankets and environmental control.

Studies/Xray

- All multi-trauma patients require c-spine, chest, and pelvis x-rays as part of their evaluation.
- Labs guided by Peds Surgery team
- They will be done on transfer to ward or in HDU/ICU. (Portable not available in casualty.)

SECONDARY SURVEY (to do with peds surg)

A full head-to-toe assessment of each child should be done before leaving casualty.

PHYSICAL / SEXUAL ASSAULT

For a child in whom physical assault or neglect is suspected, the pediatric consultant must be advised immediately. For all cases of suspected sexual abuse or assault, immediately **call the pediatric surgery consultant** (pre pubertal) or **OBGYN consultant** (post pubertal) on duty *prior to examination.*

GLASGOW COMA SCALE - CHILDREN

	INFANT <1 YEAR	CHILD 1-4 YEARS	AGE 4+ TO ADULT
		EYES	
4	Open	Open	Open
3	Open to voice	Open to voice	Open to voice
2	Open to pain	Open to pain	Open to pain
1	No response	No response	No response
		VERBAL	
5	Coos, babbles	Oriented, speaks, interacts, social	Oriented and alert
4	Cries but consolable	Confused speech, disoriented, consolable	Disoriented
3	Cries persistently to pain	Inappropriate words, inconsolable	Nonsensical speech
2	Moans to pain	Incomprehensible, agitated	Moans, unintelligible
1	No response	No response	No response
		MOTOR	
6	Normal, sponta-neous movement	Normal, spontaneous movement	Follows commands
5	Withdraws to touch	Localizes pain	Localizes pain
4	Withdraws to pain	Withdraws to pain	Withdraws to pain
3	Decorticate flexion	Decorticate flexion	Decorticate flexion
2	Decerebrate extension	Decerebrate extension	Decerebrate extension
1	No response	No response	No response

BURNS (>30% transferred to KNH)

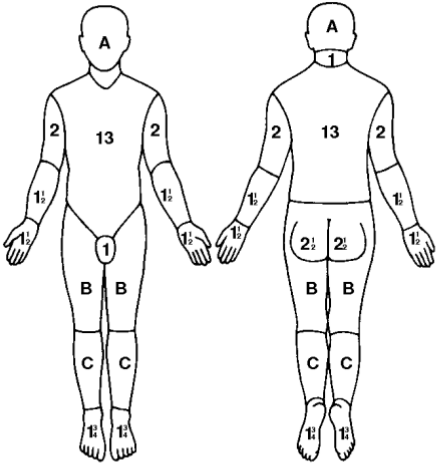
Pediatric Surgery Primary

For burns, the extent of all non-first degree burns should be estimated using the Lund-Browder chart for children:

Parkland formula to replace fluid with RL: (*2016 revision)*

3ml x %BSA x wt kg (½ 1st 8 hrs, ½ next 16hr) + Maintenance (4/2/1 rule)

LUND AND BROWDER CHARTS



Ignore simple erythema.

Superficial

Deep

REGION	%
HAED	
NECK	
ANT. TRUNK	
POST. TRUNK	
RIGHT ARM	
LEFT ARM	
BUTTOCKS	
GENITALIA	
RIGHT LEG	
LEFT LEG	
TOTAL BURN	

RELATIVE PERCENTAGE OF BODY SURFACE AREA AFFECTED BY AGE

AREA	AGE 0	1	5	10	15	ADULT
A = 1/2 OF HEAD	9 1/2	8 1/2	6 1/2	5 1/2	4 1/2	3 1/2
B = 1/2 OF THIGH	2 3/4	3 1/4	4	4 1/2	4 1/2	4 3/4
C = 1/2 OF ONE LOWER LEG	2 1/2	2 1/2	2 3/4	3	3 1/4	3 1/2

PAIN MANAGEMENT

MILD/MODERATE ANALGESIA; PATIENTS <6 MO OLD

DRUG	ROUTE	DOSE	DANGER/ COMMENTS
Paracetamol	PO/PR IV	15 mg/kg q6h or 10 mg/kg q4h 10 mg/kg q8h	Max 60 mg/kg/24h; adult max 4g/24h *IV can cause severe liver injury in normal doses, use cautiously
Ibuprofen	PO	10 mg/kg q6h	NOT in active bleed

MODERATE/SEVERE ANALGESIA IN > 6 MO OLD

DRUG	route	DOSE	ONSET	DURATION	DANGER
Morphine	IV	0.05-0.1 mg/kg/ Dose (up to 0.2) Max 15 mg	5-10 min	Peak 30 min Lasts 2-3 h; repeat q2-4h PRN	**IV only on monitor (not on floor!)**
	PO	0.2-0.5 mg/kg/dose	30-60 min	4-5 h; q4-6 hr PRN	NOT IN <6MO OLD
Fentanyl	IV	1-2 mcg/kg/dose	1-2 min	0.5-1 hr. repeat q2h neo, q1h older	Bradycardia / Chest wall rigidity **ONLY in ICU/HDU**

- ✓ **NALOXONE** 0.001-0.1 mg/kg/dose IV reverses sedation!
  1 ampule = 0.4mg; dilute 1/10 0.1 mg in 9 ml NS = 0.01mg/ml
  Give only as much as is needed for the patient to start breathing.
- ✓ For rigid chest in **Fentanyl** give 1mg/kg succinylcholine

consider calling anesthesia for local blocks

SEDATION for PROCEDURES

DRUG	RTE	DOSE	ONSET	DURATION	DANGER /COMMENTS
Midazolam	IV	0.05-0.1 mg/kg/dose	1-3 min	1hr May repeat q5min	Amnesia / agitation Mild resp depression
	PO PR IN	0.25-0.5 mg/kg/dose 0.4/kg max of 10mg	10-30m	1-2 h	> 6 mo lower doses in older pt
Diazepam	IV	0.05-0.2 mg/kg/dose	1-3 m	rpt q2-4h	Max 2 mg (infant) 5 mg (child) in 8hr
	PO/PR	0.1-0.8 mg/kg/dose	30-60m	2-3 h rpt q6-8h	
Ketamine ** only in ICU, ED, or Theatre*	IV	0.5-1 mg/kg /dose	1 min	1 h	Both sedation/ analgesia ↑HR BP ICP bronchodilation Succinylcholine for laryngospasm
Chloral Hydrate	PO/PR	25-50 mg/kg/24hr		6-8h	Max 500mg/dose

***Consider D10/D25 or dextrogel on gloved finger or gauze during LP and catheterization for neonates**

ADMISSION LOCATION

	VITALS	REQUIREMENTS
Ward	4 hourly or routine(q6h) vitals BP for >/= 12 years O2 requirement <2L/min	No IV narcotics Routine IV fluids
HDU	1-2 hourly vitals required Shock or fluid bolus required in casualty / OPD O2 requirement 2-5 L/min, CPAP, High Flow	IV narcotic requirement hypothermia / Temp instability Frequent RBS needed BP monitoring

Automatic ICU admission by diagnosis

1. Ventilated
2. Pressors
3. DKA with insulin infusion
4. Hypernatremia with Na >180 and/or K > 8
5. -5 / -6 malnutrition

Point System to help with Nurse Staffing Ratios

1. Respiratory
    a. Ventilation (8 points)
    b. Bubble CPAP (4 points)
    c. High Flow Nasal Cannula (4 pt)
    d. Frequent Suctioning (2pt)
    e. Q 1-2 hour nebulization (2 pts)
2. Cardiovascular
    a. Pressors (6 pts)
    b. Q1hr Evaluation of BP (2pts)
    c. Line access (1pt)
    d. 1 point for each syringe pump in use
3. Number of medications
    a. <6 medicines (1 pt)
    b. 7-12 medicines (2 pt)
    c. >12 medicines (3 pts)
4. Frequent re-evaluation
    a. Dressing changes (1pt)
    b. Q1h neuro checks (1pt)
    c. Infusion feeds (1pt)
    d. Phototherapy (1pt)
    e. Lab checks >2x a day (1pt)
    f. Insulin drip with q1 hour RBS (4pts)
    g. Epidural drip (3pts)

PEDIATRIC IVF AT KIJABE HOSPITAL

ORDER WRITTEN	HOW TO MIX	USUAL RATE/AMOUNT	
Routine neonatal fluids (3-28 days of age): 4/5 D10 1/5 NS (add calcium for preterms <34wga)	*For syringe pump:* Mix 48mL 10% Dextrose and 12 mL normal saline in a 60 mL syringe *For burette:* Mix 120mL 10% dex + 30mL NS	See newborn page	
Well nourished ***Routine pediatric fluids (initial):*** 1mo- 1 year ½ D10 ½ NS > 1 year DNS* *adjust according to 48h labs	*To mix for burette ½ D10 ½NS:* Mix 75 mL 10% dextrose and 75 mL NS	*<10kg*	4ml/kg/hr
		10-20kg:	40ml/hr + 2ml/kg/hr per kg over 10kg
		20+ kg:	60ml/hr + 1ml/kg/hr per kg over 20kg
Child in shock/ arrest: NS (normal saline) bolus	0.9% normal saline only via peripheral IV or IO	GE/well nourished: 20ml/kg Well nourished/Septic: 5ml/kg x3 and monitor response Malnourished: D5LR 4ml/kg/hr	
Child with hypoglycemia: D10% bolus	10% dextrose via IV or IO	2.5 ml/kg neonate 5 ml/kg infant/child to correct hypoglycemia, followed by infusion or frequent feeding	

Consider adding KCl on the third day of admission (required 2-4 mmol/kg/day) *if* the child has good urine output and a normal Cr level. (usually 1.5-3 mmol/150 cc solu-set) with regulator (floor or HDU).

SEVERE ACUTE MALNUTRITION

(<-3SD)

INITIAL Location for Care:

- **OUTPATIENT** no complications, good appetite, and proximity to clinic for close follow-up
- **INPATIENT**
  All patients with medical complication, oedema, lack of appetite, or inability for close follow up
  - Admit Location by Z-score (w/l)
    - less than -3SD, -4SD&no oxygen **Ward Admit**
    - less than -4SD w O2 req or <-5/6, **HDU Admit**

INITIAL INVESTIGATIONS (in Casualty/MCH)

- RBS pre-prandial (<2.5 immediate feed or 2 ml/kg D10 IV bolus)
- HIV *(PITC)*
- Na, K, Ca, Hb
- >6 mo: Urinalysis if fever, stool for O&P if diarrhea.
- ***Others to consider based on history***
  - CSF
  - Xray for TB/Rickets if resp symptoms
  - malaria test (MPS) if fever/endemic area
  - Check immunization status for measles vaccine

***Nutrition consult for complicated children, catch up feeds & discharge teaching**

If a child has **CP or Down syndrome**, weight/length should be plotted on a different growth curve
(see pages 15/16) This may not be malnutrition!

SEVERE ACUTE MALNUTRITION (<-3SD)

MEDICATIONS for ALL malnutrition admissions

Name	Dose	Duration
Vitamin A	50,000U < 6m 100,000U 6-12 mo 200,000U > 12 m	X1 (outpatient)
Folic Acid	2.5mg po daily	6 weeks
Zinc Sulfate	< 6 mo 10 mg po daily > 6 mo 20 mg po daily	14 days
Multivitamin	5ml po daily	6 months
Coartem (if endemic or <-5)	< 5 kg 1/2 tab po BD 5-15 kg 1 tab po BD 15-24 kg 2 tabs po BD 25-34 kg 3 tabs po BD	3 days
X-pen then Amoxicillin	50,000 iu/kg IV q6	x 2 days
	40/kg/dose po bd	x 5 days (day 3-7)
Gentamicin	7.5mg/kg/day IV daily	x 5 days
Albendazole	200mg <2 years 400mg >2 years	x 1 after 7 days`
Fe Sulfate	1-2mg/kg/day elemental Fe max 15 mg/day	Start after 7 days Continue for 3 mo

INITIAL DIET FOR -3SD / 6-59 mo

- If appetite fair, **F75** @130mL/kg/d divided q3 and advanced daily as tolerated if no signs of refeeding
- Advance to **F100**@130ml/kg/d when F75 tolerated (avg 2 days)
- After 2 days of F100@130ml/kg/day, start catch up feeds.
- If admission is for another reason, and malnutrition is complicating, then **catchup feeds** can be started on admission {IF fair appetite and/or MAM (< -2SD)}

SAM (=/<- 4SD) or Kwashiorkor

FEEDING REGIME: 6mo to 59 mo

	F75/F100	Resomal	Labs
Day 1	60ml/kg F75 (40kcal)	40ml/kg	Na, K, Ca, Cr, CBC, TSH
Day 2	80ml/kg F75	20ml/kg	
Day 3	100ml/kg F75	None	Ph, Na, K
Day 4 (out of HDU)	120ml/kg F75	None	*prn based on clinical and prior labs
Day 5	130ml/kg F75	None	
Day 6&7	130ml/kg F100		
Day 8	Catch Up feeds		

*based on anorexia nervosa refeeding protocols & Kijabe case series

Because of higher risk of refeeding, add these supplements inn addition to all above <-3 supplements for all >/= -4 SD pts:

	Drug Name	Dose	Duration
Ph	Phosphate Sandoz 1 tab = 16mmol	3 mmol/kg/day (1mmol/kg po tds)	x5 days or until 130 ml/kg
Mg	Magnesium Sulfate Use IV solution 500mg/ml	50 mg/kg po OD (0.1ml/kg) 25/kg/dose IV q6	x5 days or until 130 ml/kg x24 hr if hypocalcemic
K	Potassium Chloride 600mg tab = 8mmol	KCl 4 mmol/kg/day (1mmol/kg po QID)	Only if K < 3

SIGNS OF REFEEDING: Tachycardia, trend of increasing heart rate, any increase in oxygen requirement or decrease in O2 saturations, anemia, hypokalemia (<2.5), weakness, hyperventilation

SEVERE ACUTE MALNUTRITION

< 6mo or >6 months and <4kgs

INPATIENT

- < - 3 SD W/L
- Bilateral Pitting Edema
- Too weak to suckle or feed regardless of W/L

For Breastfeeding Babies:

- Encourage breastfeeding.
- If breastfeeding is not adequate, supplement with EBM / dilute F100 (preferred because it helps in catch up growth) / infant formula
- EDEMA PRESENT: use F75 until edema subsides then switch to diluted F100
- Feeds given at 130ml/kg/d using supplementary suckling technique.
- NB: Feeds not increased when infant starts gaining weight.

For Babies who are not Breast Fed:

- Stabilization phase- F100 dilute or F75 (in case of edema) at 130ml/kg/d q3
- Transition phase- formula or F100 dilute at 150-170ml/kg/d or increase the quantities given in stabilization by 1/3.
- Rehabilitation phase- formula or F100 at 200ml/kg/d or twice the volume given in stabilization phase.

DILUTE F100 RECONSTITUTION IS 1SCOOP IN 32MLS OF WATER

SEVERE ACUTE MALNUTRITION

Management of SAM in older children

- Children older than 6 years should not get 130mls/kg/d of F75 and/or F100 as this can lead to them getting more calories/kg than required leading to potential refeeding syndrome.
- Use this table to guide in feeds calculations according to age:

AGE	**MAX DAILY ENERGY REQUIREMENT**	**DAILY VOLUME REQUIRED for Full Feeds**	
	Kcal/kg	**F75 ml/kg**	**F100ml/kg**
7-10	75	100	72
11-14	60	84	60
15-18	50	67	48

FOR CHILDREN >/= -4

	F75/F100	**Resomal**	**Labs**
Day 1	40ml/kg F75 (40kcal)	40ml/kg	Na, K, Ca, Cr, CBC, TSH
Day 2	60ml/kg F75	20ml/kg	
Day 3	80ml/kg F75	None	Ph, Na, K
Day 4 (out of HDU)	See above F75	None	*prn based on clinical and prior labs
Day 5		None	
Day 6&7	See above F100		
Day 8	Catch Up feeds		

RICKETS

Ca++ deficiency may be as frequent in rickets as Vitamin D deficiency in our region

Diagnosis at Kijabe (Rickets)

- Clinical based on physical findings – palpable or visible rosary especially prominent OR flayed radial metaphyses on wrist x-ray.

Treatment at Kijabe (Rickets)[1]

Med	Dose	Duration	Notes
Vitamin D injection	>6 MO 300,000 IU <6 MO 150,000 IU	X 1 every 3 months	
Elemental Calcium	**Children** 50mg/kg/day **Neonates** 50-150mg/kg/day	6mo	*Calculate ZedCal dose based on weight
Vitamin D	400 IU daily	6mo	All prems and breastfed babies
ZedCal (Calcium/Vit D): Elemental Ca 150mg and D3 400iu & Zinc Sulfate 2mg & Magnesium hydroxide 25 mg / 5ml)			

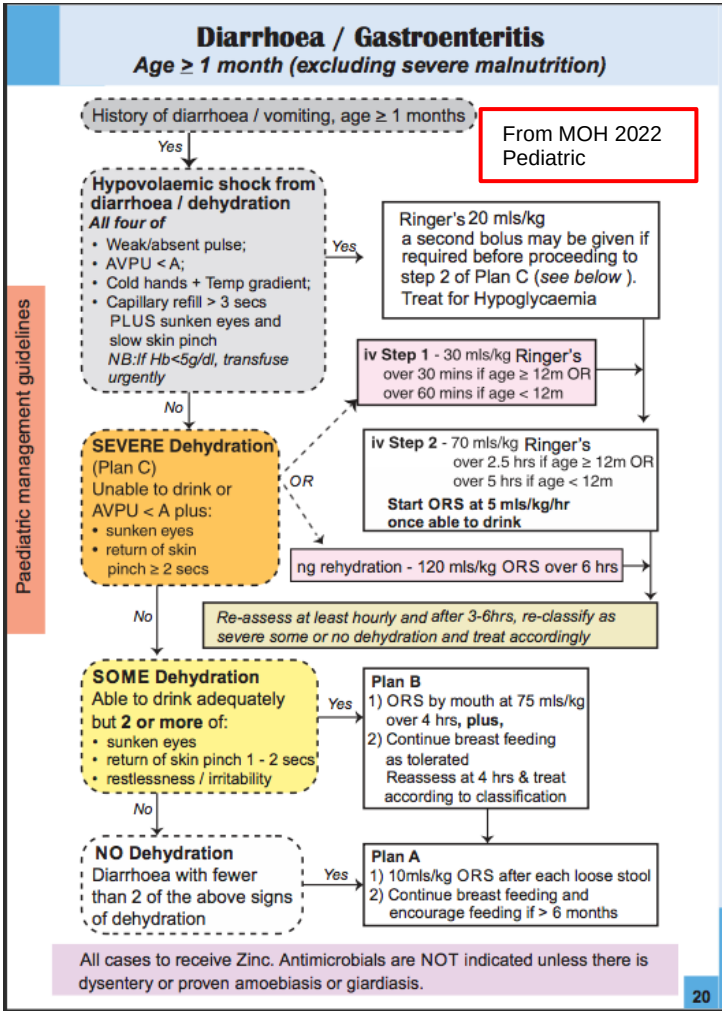
<u>Family Education</u>: Family should know to completely avoid mixed cereal ujis ("Afya Bora", "Toto Afya" etc. – millet and sorghum and some sorghum are chief phytate problems and can exacerbate rickets

GASTROENTERITIS AND DEHYDRATION: Well Nourished

Not every child with gastroenteritis requires IV fluids.

Attempt OPD/Casualty rehydration first with following prescriptions:

Treatment	Dose	Notes
Ondansetron	0.15mg/kg sl/po (round to nearest 1mg. Max 4mg)	*Not in 1st 5 days of refeeding -risk of torsades *Promethazine/ Metaclopramide have risk of sleepiness/dystonia
Oral Rehydration Salts	1 packet in 1L clean/boiled water	See doses on next page Consider NG tube for < 2 years of age
Zinc Sulfate	< 6 mo 10 mg po daily > 6 mo 20 mg po daily	If any diarrhea
Metronidazole	35-50 mg/kg/day po tds	Only with amebiasis by stool studies


Diarrhoea / Gastroenteritis
Age ≥ 1 month (excluding severe malnutrition)
From MOH 2022 Pediatric
Paediatric management guidelines
History of diarrhoea / vomiting, age ≥ 1 months
Yes
Hypovolaemic shock from diarrhoea / dehydration
All four of
• Weak/absent pulse;
• AVPU < A;
• Cold hands + Temp gradient;
• Capillary refill > 3 secs PLUS sunken eyes and slow skin pinch
NB:If Hb<5g/dl, transfuse urgently
Yes
Ringer's 20 mls/kg
a second bolus may be given if required before proceeding to step 2 of Plan C (see below).
Treat for Hypoglycaemia
iv Step 1 - 30 mls/kg Ringer's
over 30 mins if age ≥ 12m OR
over 60 mins if age < 12m
No
SEVERE Dehydration
(Plan C)
Unable to drink or AVPU < A plus:
• sunken eyes
• return of skin pinch ≥ 2 secs
OR
iv Step 2 - 70 mls/kg Ringer's
over 2.5 hrs if age ≥ 12m OR
over 5 hrs if age < 12m
Start ORS at 5 mls/kg/hr once able to drink
ng rehydration - 120 mls/kg ORS over 6 hrs
No
Re-assess at least hourly and after 3-6hrs, re-classify as severe some or no dehydration and treat accordingly
SOME Dehydration
Able to drink adequately but 2 or more of:
• sunken eyes
• return of skin pinch 1 - 2 secs
• restlessness / irritability
Yes
Plan B
1) ORS by mouth at 75 mls/kg over 4 hrs, plus,
2) Continue breast feeding as tolerated
Reassess at 4 hrs & treat according to classification
No
NO Dehydration
Diarrhoea with fewer than 2 of the above signs of dehydration
Yes
Plan A
1) 10mls/kg ORS after each loose stool
2) Continue breast feeding and encourage feeding if > 6 months
All cases to receive Zinc. Antimicrobials are NOT indicated unless there is dysentery or proven amoebiasis or giardiasis.
20

GASTROENTERITIS MALNOURISHED

Fluid management
in severe malnutrition with diarrhoea

MOH 2022 Pediatric Protocols

Shock: AVPU<A, *plus* absent, or weak pulse plus prolonged capillary refilling (>3s) *plus* cold periphery with temperature gradient **20 mls/kg in 2 hrs of Ringer's lactate with 5% dextrose** - add 50 mls 50% dextrose to 450 mls Ringer's

If severe anaemia start urgent blood transfusion not Ringer's.

If not in shock or after treating shock

Paediatric management guidelines

- If unable to give oral / ngt fluid because of very poor medical condition use / continue with iv fluids at maintenance regimen of 4mls/kg/hr
- **If able to introduce oral or ng fluids / feeds:**
  - **For 2 hours:** Give ReSoMal at 10mls/kg/hour
  - **Then:** Give ReSoMal at 7.5ml/kg over 1 hour then introduce first feed with F75 and alternate ReSoMal with F75 each hour at 7.5mls/kg/hr for 10 hours - can increase or decrease hourly fluid as tolerated between 5 - 10 mls/kg/hr.
- At 12 hours switch to 3 hourly oral / ng feeds with F75 (*next page*)

Weight (kg)	Fluids for shock complicating malnutrition		Oral / ngt *first 12 hours*	Maintenance
	20mls/kg over 2 hrs		7.5mls/kg/hr	4mls/kg/hr
	Ringer's in 5% Dextrose		ReSoMal*/ F75 (*10mls/kg first 2hrs)	Ringer's in 5% Dextrose
	IV		Oral / ng	IV
	Shock (over 2hrs)	**Drops/min** adult iv set (20 drops = 1ml)	**7.5mls/kg/hr** for up to 10 hours	mls/ hour
4.00	80	*14*	30	15
5.00	100	*17*	37	20
6.00	120	*20*	45	25
7.00	140	*24*	52	30
8.00	160	*27*	60	30
9.00	180	*30*	67	35
10.00	200	*34*	75	40
11.00	220	*37*	82	44
12.00	240	*40*	90	46
13.00	260	*44*	97	48
14.00	280	*47*	115	50
15.00	300	*50*	122	52

TB IN CHILDREN

Diagnosis (Counsel. Counsel. Counsel.)

Diagnosis in kids is mostly clinical using these criteria:

Presence of 2 or more of the following symptoms

- ✓ **Cough > 2weeks**
- ✓ **Poor weight gain (or weight loss)**
- ✓ **Persistent fever and/or night sweats > 2 weeks**
- ✓ **Fatigue, reduced playfulness, less active**

PLUS

2 OR more of the following:

- ✓ **Positive contact history** (defined as living in the same household as, or in frequent contact with (e.g. child minder, school staff) an adult or adolescent with PTB)
- ✓ **Respiratory signs**
- ✓ **CXR suggestive of PTB (where available)**
- ✓ **Positive Mantoux test** (not available; unreliable in malnutrition, disseminated TB, and HIV)

Then PTB is likely, and treatment is justified.

Note About Gene Xpert:
Sensitivity is about 50% for one sample, 65% for two samples. Please send two samples of induced sputum, but remember even 2 negatives with a good clinical history does not exclude TB. Kids are pauci-bacillary.

TB MEDICATIONS

1. First calculate individual ideal dose per kg of each drug :

Drug	Daily Dose - mg/kg (max)
Rifampicin (R)	10-20 (600 mg)
Isoniazid (H)	10-15 (300 mg)
Pyrazinamide (Z)	25-40 (2000 mg)
Ethambutol* (E)	15– 25 (1200 mg)

2. Guidelines here for Pediatric TB medications are provided free of charge as dispersible tablets

Intensive Phase:

<table>
<tr><th>Patient weight (kg)</th><th>RHZ (75/50/150)</th><th>E (100)</th><th>How to reconstitute</th></tr>
<tr><td><2</td><td colspan="2">5ml</td><td rowspan="3">Dissolve 1 RHZ tab in 20mL clean water, when dissolved add 1 crushed Ethambutol tab. Use this solution to give ml as indicated left</td></tr>
<tr><td>2-2.9</td><td colspan="2">10ml</td></tr>
<tr><td>3-3.9</td><td colspan="2">15ml</td></tr>
<tr><td>4-7.9</td><td>1</td><td>1</td><td rowspan="4">Dissolve the number of tablet(s) in 20ml of clean water and give all the solution to the child</td></tr>
<tr><td>8-11.9</td><td>2</td><td>2</td></tr>
<tr><td>12-15.9</td><td>3</td><td>3</td></tr>
<tr><td>16-24.9</td><td>4</td><td>4</td></tr>
<tr><td>25-39.9</td><td colspan="2" rowspan="3">Use RHZE 150/75/400/275</td><td>2 tabs</td></tr>
<tr><td>40-54.9</td><td>3 tabs</td></tr>
<tr><td>>55</td><td>4 tabs</td></tr>
</table>

*Based on Kenyan National Guideline 2019

TB MEDICATIONS

Continuation phase:

Patient weight (kg)	RH (75/50)	How to reconstitute
<2	5ml	Dissolve **1 RH tablet in 20mL** safe drinking water. Use this solution to give mL as indicated left.
2-2.9	10ml	
3-3.9	15ml	
4-7.9	1	Dissolve the number of tablet(s) indicated of RH in 20ml clean water, **give all the solution** to the child.
8-11.9	2	
12-15.9	3	
16-24.9	4	
25-39.9	**Use RH 150/75**	2 tabs
40-54.9		3 tabs
>55		4 tabs

3. Finally, add Pyridoxine for all children on TB treatment

Weight	Dose (mg)	25mg tabs	50mg tabs
<5	6.25	½ tab 3x wk	N/A
5-7.9 kg	12.5	½ tab daily	N/A
8-14.9 kg	25	1 tab daily	½ tab daily
>15 kg	50	2 tabs daily	1 tab daily

TB MEDICATIONS (Duration)

Treatment

All children diagnosed with **pulmonary tuberculosis** severe enough to warrant hospitalization (respiratory distress, severe malnutrition, miliary TB) should be commenced on a intensive 4-drug regimen (RHZE) for 2 months, followed by a 4 month continuation phase of RH.

TB meningitis or bone/joint should be treated with 2 months RHZE / 10 months RH

Isolate coughing children <u>greater than 5 years</u> of age or patient with caregiver who is symptomatic with cough.

TB Meningitis: For TB meningitis in children <14 years, prednisolone should be added with omeprazole:

- Prednisolone 2 mg/kg/day (or equivalent dose dexamethasone: 0.6 mg/kg/24 h) for 4 weeks, then
- a reducing course over 4 weeks (taper by 1 mg/kg/day per week)
- Screening after diagnosis of TB meningitis
    - Give follow up for hearing screen
    - Need to be followed up in POPC

Other Indications for steroids in TB: pericardial effusion, meningitis, severe LN burden with compression, severe miliary TB.

BRONCHIOLITIS

- Infants <1 year of age
- Exam
    - URTI symptoms
    - Crackles and rhonchi, tachypnea
    - No palpable liver edge
- Treatment
    - Oxygen for hypoxia
    - Nasal suctioning with saline drops
    - IV fluids or NG if feeding is impaired.

↘ *NOT **AUTOMATIC** TREATMENTS*

- ↘ *Bronchodilators* *(only if recurrent, atopic, or strong family hx)*
- ↘ *Hypertonic saline (only in HDU)*
- ↘ *Nebulized adrenaline*
- ↘ *Antibiotics (unless UTI)*
- ↘ *Steroids*
- ↘ Chest Xray ONLY in consultation with consultant

ORDERS

- ✓ IVF fluids or OG feeds with EBM with tachypnea > 60 breaths/minute
- ✓ O2 for hypoxia less than 90%
- ✓ Scheduled wall suctioning with 0.5ml nasal saline per nostril q6h
- ✓ Attempt cohorting to avoid hospital acquired bronchiolitis in other patients

ASTHMA

- History
  - > 12 months of age
  - recurrent wheezing illnesses with response to bronchodilators
- Exam
  - Tachypnea
  - Wheezing
  - Prolonged expiratory time
  - Silent chest if severe
- Consider HDU/ ICU admission for <u>any child requiring more than 2L/min oxygen</u> or 2 hourly salbutamol.

MILD Exacerbation	
SaO2 > 90% on room air Shortness of breath Wheeze or prolonged expiratory phase ASSESS Q2 HOURS	**If ventolin inhaler available give**: 6-10 puffs of inhaler every 20 minutes up to 3 doses with spacer ** each puff requires 4-6 breaths before giving next puff.* **1 puff = 0.1mg* **If inhaler not available:** Nebulized salbutamol single dose: 0.15mg/kg dose or - 2.5mg (<5 years old) - 5 mg (>5years old) Prednisone 1 mg/kg PO. Reassess after 1 hour, if better, may be discharged home with 5-day course of prednisolone and inhaled salbutamol.

MODERATE Asthma Exacerbation	
SaO2 <90% on room air	Nebulized **salbutamol** Q 20 min x3 (0.15/kg/dose, round to closest 2.5mg)
Respiratory distress	**Prednisone** 2 mg/kg po stat
Wheeze	Schedule **ipratropium** 250 mcg (4puffs) every 4 hours & **salbutamol** every 4 hours
ASSESS Q1 HOUR	*If oxygen required or persistent distress 1 hour after salbutamol, admit to ward (<2 L/min req or q4) or HDU (>2L/min req or <q4hr).*
SEVERE Exacerbation	
SaO2 <90% on room air	O2 & nebulized **salbutamol** back-to-back
Barely audible breath sounds	Start with 0.15 mg/kg and equivalent amount NS (round to nearest 2.5mg) if need continuous neb, 0.3-0.5mg/kg/hour
Palpable pulsus paradoxus	Obtain IV, start maintenance IVF.
Cyanosis	**Prednisone** 2 mg/kg po **OR** if not tolerating, **Dexamethasone** 0.6mg/kg IV q24h
ASSESS AT END OF EVERY NEB (Q15-30)	**MgSO4** 50mg/kg IV over 1 hour **Adrenaline** 0.01 ml/kg (1:1000) IM for rapid deterioration.
Get chest xray as soon as arrive in HDU	Consider high flow and aminophylline infusion if still deteriorating despite the above.

NEONATAL SEPSIS & FEVER (<60 days)

History:

- Temperature >38 degrees
- Subjective fever at home with irritability or any other abnormal vital signs

Investigations (outpatient)

- Blood cx
- CBC
- Lumbar puncture (Cell count, glucose, microprotein and culture if cells >5)
- Sterile UA with urine culture
- Electrolytes and Cr if dehydration or weight loss
- *Discuss CRP if any part of work-up fails or > 30 days and URTI symptoms*

Initial MEDICATION:

- Ampicillin or X pen **AND** Gentamicin
- Increase dose for Meningitis (see Harriet Lane)

Admission

- Initial IVF if baby not feeding well
- Check Cr every 4 days on Gent or Amikacin
- Discharge if no meningitis (based on cell count/CSF glucose) and cultures negative

FEVER &NEUTROPENIA: ONCOLOGY

Kijabe Hospital does chemotherapy for children with conditions such as Wilm's tumor, neuroblastoma, rhabdomyosarcoma, and Burkitt's lymphoma.

Chemotherapy patients, or newly diagnosed oncology admissions, should be assumed to be immunocompromised if presenting with fever or other signs consistent with sepsis.

LAB INVESTIGATIONS

- CBC with differential, and hold blood for peripheral blood film if required
- Urine Culture
- Blood Culture

ANTIBIOTICS (given within 30 minutes of presentation)

- First line ceftriaxone in first presentation or from home > 2 weeks
- First line antibiotic choice for all oncology patient currently on chemo is piperacillin-tazobactam IV because of GNR resistance
- **Add** amikacin IV in ANC <500

ADMISSION

- Oncology consultant should be called on presentation for every oncology patient for further advice on admission and treatment
- Neutropenia necessitates AUTOMATIC admission
- See MTRH protocol for inpatient antibiotic tx.

True SEPTIC SHOCK at Kijabe Hospital: *first 2 hours*

Well Nourished

- 5-10/kg bolus x1 of **LR or NS** over 15min with close monitoring of vitals & exam while giving.
- Further boluses determined by response to therapy.
- If shock persists after 20cc/kg, consider pressor support with epinephrine (0.1mcg/kg/min) or norepinephrine (0.1mcg/kg/min) if no cardiac dysfunction.
- May start epi infusion in Casualty if any delay in admission and titrate up every 15 minutes.

Malnourished *(< -3 SD weight for length) be VERY CAREFUL with fluid*.

- If altered mental status, coma - start with 10-15 ml/kg of D5LR (if not available D5NS) over 1-2 hours with careful monitoring.

- If shock but alert, no bolus and gentle hydration with 4/ml/kg/hr DNS or D5LR (stop IVF when shock resolved)

ANTIBIOTICS: > 6 months: Ceftriaxone/Amikacin initially then focus for source/history adding meningitic or anaerobic cover

DIABETIC KETOACIDOSIS

Diagnosis

- **History**
  - Polyuria, polydipsia, weight loss, vomiting, abdominal pain
- **Examination**
  - *Always weigh OR estimate from Broselow tape.*
  - New diagnosis, estimate degree of dehydration based on VBG.(BSPED Guidelines 2020)
  - Assess level of consciousness
- **INITIAL INVESTIGATIONS from casualty / OPD**
  - RBS – glucose >11mmol/L may indicate DM
  - Na, K, Cr
  - Venous blood gas
    - Calculate with initial anion gap >18
    - pH <7.10 **OR** HCO3 < 7, treat with insulin infusion
  - Urinalysis and culture if any abdominal pain.

CATEGORIZATION (pick the worst)

	pH	HCO3	MANAGEMENT
MILD (5% dehy)	7.25-7.30	12-17	May not require IV insulin or IVF
MOD (7% dehy)	7.10-7.25	7-12	Will probably require insulin infusion and HDU / ICU admission
SEVERE (10% dehy)	<7.10	<7	Requires ICU admission, insulin infusion and IVF

Treatment DKA– CASUALTY / OPD

- **Airway:** NG tube if vomiting & impaired GCS
- **Breathing:** Oxygen 100% by face mask if signs of shock (poor peripheral perfusion).
- **Circulation:** If shocked give 10ml/kg of 0.9% Saline over 10-20 minutes and repeat until circulation is restored. (if *>20ml/kg call pediatric consultant)*
- **Dextrose:** check q1 hour

Fluids

- **Resuscitation:** If shock, give 10ml/kg of 0.9% Saline over 10-20minutes up to 30ml/kg.
- **Fluid management**
  - **FLUID:**
    - **RBS >15 : 0.9% Saline with KCl**
    - **RBS <15**, add 5% Dextrose to the IV fluids to keep blood glucose 8-12mmol/L**.**
    - Dextrose may be added to the IV fluids as hourly checks up to 12.5%
  - **Rate**: (Maintenance + deficit) over 48hrs
    - In mild/moderate DKA - use 5-7% dehydration
    - In severe DKA - use 10% dehydration.
    - If IV fluids given elsewhere and casualty bolus, should be included in the deficit calculations
  - **ORAL**: In severe dehydration and acidosis only allow sips of water or ice to suck (include in fluid balance)

The initial focus should be fluid resuscitation which will lower serum glucose level in the first 60-90 min.

DKA–ELECTROLYTE MANAGEMENT

- **Sodium**
  - If **hypernatremia** is present (corrected Na >150mmol/L) begin with 0.9% Saline and correction of fluid and electrolyte deficit should be over 48-72 hours.
    - *Corrected Na = measured Na + 2 x [(glucose – 5.5) ÷ 5.5]*
    - Rapid fall in serum sodium will predispose to cerebral edema – (goal < 10 mmol/L/24h).
- **Potassium**
  - Insulin administration and the correction of acidosis will drive potassium back into the cells, decreasing serum levels**.**
  - **Therefore, potassium replacement is essential to safe management.**

K level (mmol/L	KCL/ 150ml burette	Lab frequency	Insulin y/n
< 2.5	6-9 mmol	Q2h	N
2.5-3.5	6-9 mmol	Q4h	Y
3.5-5	4-6 mmol	Q6h	Y
>5	None	Q4h	Y

TREATMENT DKA – INSULIN

- **Insulin**
  - Insulin is required to
    - push glucose intracellularly AND
    - correct the acidosis.

  - *Insulin therapy should not be started until*
    - ✓ *the circulating volume has been restored,*
    - ✓ *the serum potassium is known AND*
    - ✓ *potassium replacement has commenced.*

  - **Insulin Dose**:
    - **<u>0.1units/kg/hr</u>** (50 units soluble insulin diluted in 50mls of 0.9% Saline, 1unit = 1ml) .
    - A lower insulin dosage of **<u>0.05u/kg/hr</u>** may be considered in children
      - <5yrs of age (more sensitive to insulin) OR
      - children with known diabetes who have a lower blood glucose due to partial insulin treatment prior to presentation.

  - **After resuscitation, the desired rate of fall in blood glucose is 4-5 mmol/hour**

  - The insulin infusion should not be stopped or reduced below **<u>0.05u/kg/hr</u>** until the anion gap has resolved and the HCO3 is >15.

DIABETES GLUCOSE and FLUID ADJUSTMENT

Transfer to ORAL Fluids and SUBCUTANEOUS Insulin:

- **Oral fluids**
  - In severe dehydration and acidosis only allow sips of water or ice to suck (include in fluid balance).
  - Oral fluids should only be offered after substantial clinical improvement and cessation of vomiting (mild acidosis and ketosis may still be present).
  - When oral fluids are tolerated the IV fluids should be reduced.
- **Insulin Infusion with Feeding**
  - The insulin infusion can be increased to cover oral carbohydrate intake prior to the commencement of subcutaneous (SC) insulin.
  - The basal insulin infusion rate is usually doubled for 30 minutes for snacks and 60 minutes for meals.
  - **Transfer to SC insulin and the pediatric ward can be made when the acidosis has resolved and oral intake is tolerated.**

TREATMENT DIABETES– PEDIATRIC WARD

- How to start SQ Insulin: (new dx, transfer from ICU).
- Insulin 0.8 units/kg/day. (0.8 x wt in kg)
  - 2/3 of this dose in a.m. as Mixtard 70/30
  - 1/3 of this dose in the p.m. as Mixtard 70/30
- RBS timing
    - 6am (before breakfast)
    - 12pm (before lunch)
    - 6pm (before dinner)
    - Midnight.
- **Remember: the 6pm insulin dose controls the midnight and 6am RBS level.** Thus, each morning the pediatric consultant should look at the midnight and 6am RBS on rounds and decide 6pm insulin dose will be.
  Similarly, the 6am insulin dose controls the noon and 6pm RBS.
  Thus the noon & 6pm RBS should be reported to the on-call pediatric consultant at 6pm for a decision as to the next morning's 6am dose of insulin.

- ***Sliding scales should rarely be used in children -***
  do not use without a consultant's input.
  If used, a rule of thumb that may be helpful is the following:
  Take the child's estimated total daily insulin dose.
  For a newly diagnosed 30 kg child, this will be 30 x 0.8 = 24 units per day.
  Divide 80 by the daily dose: 80 / 24 = **3.3**

This number is how much 1 unit of regular insulin will lower the child's blood sugar by.
Tight control in a new diabetic is difficult, so goal RBS should be 6-10.

So a sliding scale for this child would be:

Blood sugar level	**Action**
< 4	Give sugar containing beverage if conscious; Give 2-5mL/kg D10 IV if altered conscious state
4 - 7	Nil
7-10	Nil
11- 13	Give 1 unit regular insulin SC
13-16	Give 2 units regular insulin SC
17-19	Give 3 units regular insulin SC
>19	Give 4 units regular insulin SC

STATUS EPILEPTICUS IN KIJABE

Check RBS , if below 2.5 give glucose bolus of D10 2-5ml/kg
100% Oxygen. Secure Airway. Treat fever. Check Na/Ca.
Treat aggressively with AEDs.

NEONATES:

- Give Phenobarbital 10mg/kg IV q10min up to max of 40mg/kg.
- NEXT: Phenytoin 20/kg IV x 1
- NEXT: Levetiracetam 40mg/kg NG up to 70 mg/kg (5 min onset)
- Consider pyridoxine if refractory to phenytoin.

***CHILDREN*:**

- **Diazepam** 0.2 mg/kg IV over 1-2 min or 0.5 mg/kg PR (max 10 mg)
- Rapid onset, but more hypotension and respiratory depression

OR

- **Midazolam** 0.2 mg/kg/dose IV/IM/buccal – (max 7 mg)
- May REPEAT above Benzodiazepines q 5-10 minutes up to 3x

IF STILL SEIZING…….

- **Phenytoin** load 10-20 mg/kg **over 20-30 minutes** (low BP, especially with fast administration) – onset 5-10 minutes, may give additional 5-10 mg/kg if still seizing

IF STILL SEIZING……..

- **Phenobarbital** load 10-20 mg/kg over 10-15 minutes- onset 15-30 minutes (high risk for respiratory depression and hypotension). May repeat 5-10mg/kg if seizure continues

IF STILL SEIZING. . .

- **Levetiracetam** 40 mg/kg ng load on empty stomach (5 min onset)

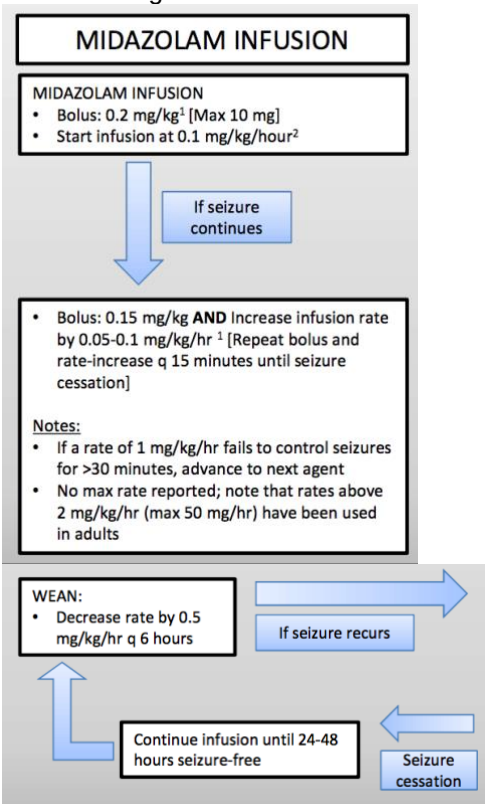
IF STILL SEIZING. . .

- **Midazolam** load 0.2 mg/kg then infuse 2-6 mcg/kg/min

PERSISTENT STATUS EPILEPTICUS:

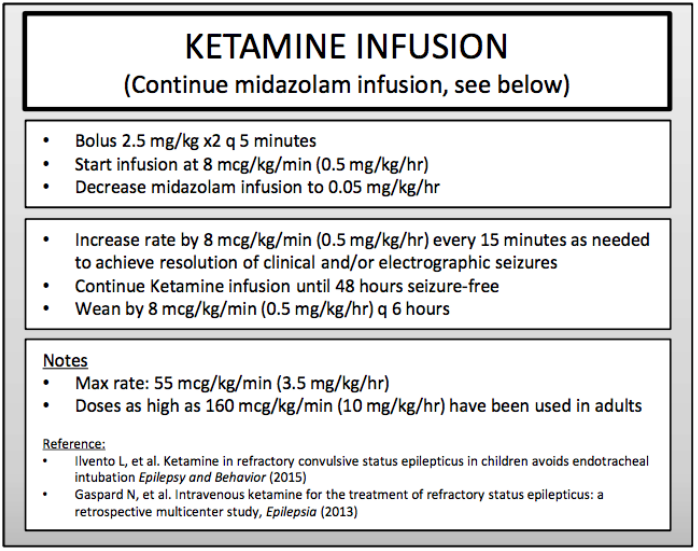
Midazolam infusion

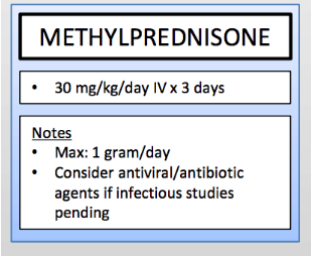
If above protocol does not abort status epilepticus, consider the following alternatives.



PERSISTENT STATUS EPILEPTICUS

Ketamine Infusion





If suspicion of autoimmune or inflammatory process, or refractory x 2 days, consider methylprednisone

Reference:
https://emed.unm.edu/common/documents/pediatric-seizure.pdf

PERSISTENT STATUS EPILEPTICUS
Propofol Infusion

PROPOFOL INFUSION

- Bolus: 3 mg/kg
- Start infusion at 50 mcg/kg/min (3 mg/kg/hr)
- Stop midazolam infusion

- Increase rate by 8 mcg/kg/min (0.5 mg/kg/hr) every 15 minutes as needed to achieve burst suppression (goal IBI 10 seconds)
- Once burst suppression is achieved →continue infusion for 24 hours → wean to 50% max rate for 6-12 hours → wean to 25% max rate for 6-12 hours → stop

❑ Monitor ABG, LFTs, CK q 6 x24 hours, then q12

Notes
- Max duration: 48 hours
- Max dose: 300 mcg/kg/min (18 mg/kg/hr)
- **Contraindications:** ketogenic diet, metabolic disorder, egg allergy

Reference:

- Phelps S, Pediatric Injectable Drugs, 2013
- Rossetti AO, et al. Propofol treatment of refractory status epilepticus: a study of 31 episodes, *Epilepsia* (2004)
- Van Gestel JP, et al. Propofol and thiopental for refractory status epilepticus in children, *Neurology* (2005)

Reference: https://emed.unm.edu/common/documents/pediatric-seizure.pdf

FLOOR AND OUTPATIENT CONTROL OF SEIZURES

Neonate

- Start with Phenobarbital 3-5 mg/kg daily
- Wean: allow to grow out with Weight gain

Drug	Mechanism of Action	GTC	Focal	Myoclonic	Absence	COST
Phenytoin	Block Sodium Channel	++	++			1 tab 100mg 11 KES 250mg/5ml IV 350 KES
Carbamazepine	Sodium Channel	++	++			200mg tab 3 KES 100mg/5ml (100ml) 782 KES
Valproate	Block sodium channels and increase GABA levels	++	++	++	++	200mg tab 11KES 300 mg tab 31 KES 200mg/5ml 1300KES
Phenobarbital	GABA receptor – increase synaptic inhibition	+	+			30mg 2 KES 120mg/2ml IV 621 KES
Clonazepam	Enhance GABA neuro inhibitory activity	+	+	++	+	
Levetiracetam	Decrease GABA turnover	++	++	+	+ (25%)	250mg po 68 KES
Ethosuximide	Inhibits NADPH linked aldehyde reductase				++	

Child

1. Start with drug appropriate to their type of seizure
2. Dose and titrate according to Harriet Lane
3. If second drug needed, use one with different mechanism of action and titrate up accordingly

* If stopping a medicine, always wean in stepwise fashion over weeks.

* Levetiracetam (Keppra) should only be prescribed after discussion with a consultant.

SNAKE ENVENOMATION IN KIJABE

Snakebite is uncommon in Kijabe, but local species include:

- Hemotoxic - puff adders, Kenya horned viper, Gaboon vipers, saw scaled vipers, boomslang
- Neurotoxic - spitting cobras
- Neuro/Cardiotoxic – mambas

There is an antivenom available in Kenya called “Fav Africa” from Sanofi. It treats envenomation by all of the above snakes *(except for Boomslang which requires SAIMR Boomslang antivenom)*.

The cost is about Ksh 10,000 per 10ml amp, and initial dosing for all ages is 20 ml (remember, the antivenom dose treats a certain amount of snake venom, which is independent of body weight).

Only one vial is kept in Kijabe pharmacy for emergencies, so as one vial is given others will need to be ordered.

Contact Elizabeth (pharmacy manager) as soon as you use the dose, so she can order the next dose to be brought by G4S .

When antivenom is available, administer per manufacturer’s directions. A test dose will need to be given before the full 2 vials, as allergic reaction is possible.

SNAKE ENVENOMATION IN KIJABE
(continued)

If suspicious of envenomation and antivenom is required, ensure the following steps are also taken:

1. Immobilize the affected extremity at or below the level of the heart. Do **not** use a tourniquet, but use elastic bandages to the entire limb to reduce lymphatic drainage.
2. Admit the child to pediatric HDU for frequent monitoring.
3. Place reference marks for measuring circumference of affected extremity to envenomation site. Measure every 15 min and trace leading edge of swelling with skin markers.
4. If hemotoxic envenomation likely (puff adders, Kenya horned viper, Gaboon vipers, saw scaled vipers), send CBC, PT/INR, PTT.
5. Remove rings and constrictive items
6. Obtain IV access in unaffected limb (2 sites are possible)
7. Vital signs every hour until control of envenomation achieved
8. For severe pain, give morphine 0.1 mg/kg IV every 2 hours PRN
9. For mild to moderate pain use paracetamol
10. For nausea, consider ondansetron ~0.15 mg/kg SL (round to nearest 2mg)

NEONATOLOGY

TERM NEWBORNS OF CONCERN

- **Risk of Sepsis (>1 risk factors consider rule out)**
  - PROM > 18 hours
  - Peri-partum maternal fever
  - Chorioamnionitis
  - Preterm with spontaneous labor
  - **Do not admit**, no culture done, but do danger signs counseling with mom and schedule 48-72 hour fu at MCH/preferred facility
- **Risk of Hypoglycemia (not admitted if RBS normal)**
  - Weight > 4.2kg
  - Infant of a diabetic mother, IUGR/SGA
  - Orders: 1hr RBS, q 2 hour RBS x 2
- **Risk of Jaundice**(**not admitted if low risk bili**)
  - Rhesus negative moms
  - Orders as outpatient: DCT and Blood Group, Cord blood bili, 6 hour bili, 24 hr bili
- **Concern for hypernatremia (not admitted if <150)**
  - Weight loss in newborn >7.5%
  - Orders: Na, K, Cr as OUTPATIENT
  - Na <150, no admission, add NAN until milk comes
  - If Na >150, then maintenance IVF + EBM
- **HIV exposed**
  - OB team should consult CCC team for counseling and medications
- **Hepatitis B Positive Mom**
  - OB team may consult peds team for admin/dosing
  - Use Red Book to advise: HBIG (0.5 ml) and Hep B vaccine at birth (0.5 ml) separate sites, same time

NEONATAL ADMISSIONS

Senior Most Person on call present for birth of:

1. Cord prolapse
2. Anticipated Shoulder dystocia
3. Emergency GA CS (Cat 3 CST, fetal brady, late decels)
4. Deliveries below 31 weeks

TERM

RULE OUT SEPSIS (start antibiotics)

- Any neonatal fever/hypothermia (>38 and <35.8 rectal)
- Sodium > 160
- Significant resuscitation (prolonged bagging)
- Prolonged O2 requirement at birth (>4 hours) + Cxray
- > 1 maternal risk factors (see above)
- **Orders**:
  - Blood culture (BCx only if DOL 1)
  - CBC
  - UA, UCx
  - CSF (discuss failed tap with consultant)
    - <72 hours: if fever + 1 more
    - >72 hours: all need CSF

OTHERS (see instructions below)

- All babies with RBS < 2.0
- Na > 150
- Hyperbilirubinemia babies per following Pages
- Feeding difficulty
- Convulsions
- Altered mental status (decreased activity)

PRETERM ADMISSIONS

We resuscitate preterms 26^0 wga & above born with a HR >50.

If no dates available, if >500 and eyelids not fused, consider resuscitation.

Consultant should be present at all deliveries below 31 weeks.

PREDELIVERY.

All moms and dads should be counselled on preterm complications prior to delivery:

- RDS, NEC, IVH, & expected length of stay
- Surfactant and UVC placement should be consented and signed

PRETERM ADMISSION ORDERS

- Surfactant for any baby <1000 gm/ <29 wga within the first hour (up to 3 times in first 72 hours.)
- Place on CPAP immediately in delivery room after initial resuscitation
- If <1300gm, place UVC and check placement by x-ray (should be in IVC as it enters right atrium immediately above diaphragm)
- Incubator care with appropriate humidification
- < 1000 gm: **RBS q2hr** and weigh all diapers
- Minimal handling
- Saline drops every hour and suctioning every shift for CPAP babies to clear nose
- NG placed for trophic feeds starting as soon as mom has colostrum/milk (within 36 hours)
- TPN for preterms discussed below along with advancement of feeds
- **Meds**: Amp or Xpen, Gent, Aminophylline
- **Labs**: Blood Culture

PRETERM ADMISSIONS: BALLARDS

Neuromuscular Maturity

Score	−1	0	1	2	3	4	5
Posture							
Square window (wrist)	 >90°	 90°	 60°	 45°	 30°	 0°	
Arm recoil		 180°	 140–180°	 110–140°	 90–110°	 <90°	
Popliteal angle	180°	 160°	 140°	 120°	 100°	 90°	 <90°
Scarf sign							
Heel to ear							

Physical Maturity

Skin	Sticky, friable, transparent	Gelatinous, red, translucent	Smooth, pink; visible veins	Superficial peeling and/or rash; few veins	Cracking, pale areas; rare veins	Parchment, deep cracking; no vessels	Leathery, cracked, wrinkled
Lanugo	None	Sparse	Abundant	Thinning	Bald areas	Mostly bald	
Plantar surface	Heel-toe 40–50 mm: −1 <40 mm: −2	>50 mm, no crease	Faint red marks	Anterior transverse crease only	Creases anterior 2/3	Creases over entire sole	
Breast	Imperceptible	Barely perceptible	Flat areola, no bud	Stippled areola, 1–2 mm bud	Raised areola, 3–4 mm bud	Full areola, 5–10 mm bud	
Eye/Ear	Lids fused loosely: −1 tightly: −2	Lids open; pinna flat; stays folded	Slightly curved pinna; soft; slow recoil	Well curved pinna; soft but ready recoil	Formed and firm, instant recoil	Thick cartilage, ear stiff	
Genitals (male)	Scrotum flat, smooth	Scrotum empty, faint rugae	Testes in upper canal, rare rugae	Testes descending, few rugae	Testes down, good rugae	Testes pendulous, deep rugae	
Genitals (female)	Clitoris prominent, labia flat	Clitoris prominent, small labia minora	Clitoris prominent, enlarging minora	Majora and minora equally prominent	Majora large, minora small	Majora cover clitoris and minora	

Maturity Rating

Score	Weeks
−10	20
−5	22
0	24
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

https://www.merckmanuals.com/professional/pediatrics/perinatal-problems/gestational-age

COMMONLY USED COMPLICATED MEDS for preterms

GENTAMICIN			
Post Conceptual Age (wk)	Postnatal Age (Days)	Dose (mg/kg/dose)	Interval (hr)
</= 29[a]	0-7	5	48
	8-28	4	36
	>28	4	24
30-34	0-7	4.5	36
	>7	4	24
>35	ALL	4	24[b]

a - or significant asphyxia, PDA, indomethacin, poor cardiac output, reduced renal function
b – use q35 hr interval for HIE babies with cooling

AMIKACIN			
Post Conceptual Age (wk)	Postnatal Age (Days)	Dose (mg/kg/dose)	Interval (hr)
</= 29[a]	0-7	18	48
	8-28	15	36
	>28	15	24
30-34	0-7	18	36
	>7	15	24
>35	ALL	16	24[b]

a - or significant asphyxia, PDA, indomethacin, poor cardiac output, reduced renal function
b – use q35 hr interval for HIE babies with cooling

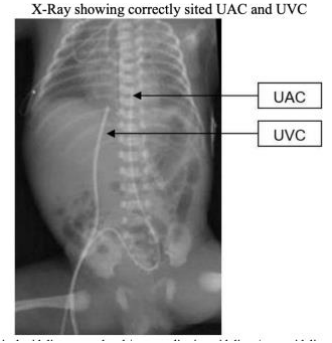
All dosing from Harriet Lane Handbook ©2021

UVC PLACEMENT

Orders: Obtain small minor set, 2 4 Fr NG tubes, 11 blade, 2 sterile goals, sterile drape, iodine

UVC Length: 1.5 x Birth weight^{kg} + 5 + length of stump

1. Drape the baby and prep the cord, allow to dry completely
2. Flush the NG tube and fill with saline to prevent air embolism
3. Tie bottom of the umbilical stump to prevent bleeding
4. Use scalpel to cut 1-1.5 cm from the base of the cord
5. Identify the vein (single, thin walled)
6. Stabilize cord & insert catheter into vein to proper length
7. Some resistance may be felt at the umbilical ring just below the level of the skin; apply gentle pressure until the catheter passes through.
8. Aspirate blood to confirm position & then flush to prevent clot
9. Obtain x-ray to confirm position before securing with suture



https://london-nts.nhs.uk/wp-content/uploads/2020/11/Umbilical-Catheter-Insertion-NTS-Guideline-2020.pdf

FLUIDS, ELECTROLYTES & NUTRITION

- Expected weight loss:
  - up to 7.5% in large preterms and terms
  - 10-15% in VLBW (<1500g) infants.

- Weigh infant daily or alt days if **UNSTABLE** on CPAP
- Should regain birth weight by 2 weeks of age

IV Fluids

	Day 1	**Daily increase**	**Maximum (total fluids IVF +feeds)**	**Fluid Type**
Term (>37 wks GA)	60ml/kg/d	20ml/kg/d	~150 ml/kg/d	Day 1 D10 Day 3+ 4/5 D10 1/5 NS
Preterm (<37 wks GA)	80ml/kg/d	20ml/kg/d	~180-200ml/kg/d	Day 1 D10 Day 3+ 4/5 D10 1/5 NS
Extreme preterm (<1000gm)	100ml/kg/d	20ml/kg/d	~180-200ml/kg/d	Day 1 D5 Day 2 TPN

IV component should rarely exceed **150ml/kg/d** due to risk of PDA

Exceptions

- Hypernatremia with no milk (to180)
- TPN because of custom GIR and electrolytes

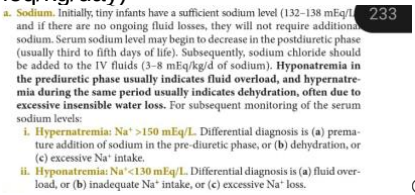
NEONATAL Electrolyte Requirements

Glucose

- *Want RBS > 2.5*
- *Glucose infusion rate adequate with above 3.5 ml/kg/day*

Sodium (daily checks in the first week starting day 3)

- Withhold until day 3 of life
- Term Typical daily need 3 meq/kg/d
- Preterm daily need 3-5 meq/kg/d
- For ELBW, start at 5 meq/kg/d (up to 10 meq/kg/day)



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a. **Sodium.** Initially, tiny infants have a sufficient sodium level (132–138 mEq/L) and if there are no ongoing fluid losses, they will not require additional sodium. Serum sodium level may begin to decrease in the postdiuretic phase (usually third to fifth days of life). Subsequently, sodium chloride should be added to the IV fluids (3–8 mEq/kg/d of sodium). **Hyponatremia in the prediuretic phase usually indicates fluid overload, and hypernatremia during the same period usually indicates dehydration, often due to excessive insensible water loss.** For subsequent monitoring of the serum sodium levels:

i. **Hypernatremia: Na^+ >150 mEq/L.** Differential diagnosis is (**a**) premature addition of sodium in the pre-diuretic phase, or (**b**) dehydration, or (**c**) excessive Na^+ intake.

ii. **Hyponatremia: Na^+<130 mEq/L.** Differential diagnosis is (**a**) fluid overload, or (**b**) inadequate Na^+ intake, or (**c**) excessive Na^+ loss.

©Gomella

Potassium

- Rarely added to IVF for safety concerns.
- Typical daily need 1-3meq/kg/day if prolonged NPO

Calcium

- Majority of calcium is transferred in the third trimester,
  preterm infants (<34 weeks) are therefore at risk for neonatal rickets even normal serum levels
- On day 3 of life for <34 weeks, add 200 mg/kg/day divided into total IV fluid infusion given and continue until patient on 100cc/kg/day feeds.
  (Note Ca Gluconate is in **mg** not **meq**.)
- Add oral calcium/vitamin D when we switch to full feeds.

NEONATAL NUTRITION

Feeding requirement guidelines

BW	Initial feed volume	Daily increase	Frequency
<1250g	5-15 ml/kg/d	20 ml/kg/d	Q2h
1250-1500g	10-15 ml/kg/d	20 ml/kg/d	Q2h
>1500g	20ml/kg/d	20 ml/kg/d	Q3h

* consider increasing volume more frequently than once a day if tolerating

Caloric needs

	<37 weeks gestation	>37 weeks gestation
Kcal	115-130 kcal/kg/d	100-120 kcal/kg/d
Protein	3-4g/kg/d	2.5-3g/kg/d
Gain	15-20 g/kg/d	25-30g/d

There is often some daily variability in weight gain, so calculate a which should be approximately 1-2% of body weight per day.

TO CALCULATE BABIES CALORIES:

	Dose	Calories
D10W	0.1 g dextrose/ml	0.34 kcal/ml
4/5D10 1/5NS	0.08g dextrose/ml	0.27 kcal/ml
Breast Milk		0.67 kcal/ml (20kcal/30 ml)
Preterm Formula		0.8 kcal/ml (24kcal/30ml)
Fortified Breast Milk : Consider in VLBW (<1500gm) once baby reaches150 ml/kg/d of enteral feeds		
PreNan/Nutriprem	¼ scoop per 20 ml	6 kcal/ ¼ scoop
FM85	1 scoop per 20 ml	3.4 kcal/ scoop
Lactodex	1 sachet per 20 ml	8 kcal/satchet

NUTRITIONAL SUPPLEMENTS for neonates born <37 weeks gestation or <2 kg BW

All oral supplements are usually continued until the baby is 1 year old.

SUPPLEMENT	Timing	Dose
Vitamin K	on admission x 1 if <14 days old	> 1.5 KG: 1mg IM < 1.5 KG: 0.5mg IM
Calcium and Vit D (ZedCal)	When achieve 100ml/kg/day feeds	2.5 ml daily (75mg Ca and 200IU VitD)
Folate	When achieve 150ml/kg/d feeds	2.5mg/week
Iron 2-6 mg/kg/d elemental iron	2 weeks of age AND feeds of >130ml/kg/day	**FerroB** (5.2mg Fe/ml) **FerrousSO4 (**4mg iron/ml) 0.5-1 ml/day (calculate)
Multivitamin (pick by what is in stock)	Full feeds of 150ml/kg/day	**Mixavit 0.6 ml/day** **Abidec 1 ml/day** **Lasomin-Z 0.5ml/day** **Multivitamin 2.5ml/day**

- **Mixavit Infant drops:** Vit A 5000iu; Vit D 400iu; B1 1.5iu; B2 1.2mg; B6 0.5mg; Vit C 50mg; Nicotinamide 10mg
- **Regular multivitamin** 5ml contains Vit A 2500iu; Vit D 250iu; B1 1mg; B2 0.5mg; B6 0.5mg; B12 2mcg; d-panthenol 0.5mg; niacinamide 5mg
- **Abidec Multivitamin Drops**: 1ml = 1333 IU retinol, 400 IU ergocalciferol solution, 0.4 mg thiamine hydrochloride, 0.8 mg riboflavin, 0.8 mg pyridoxine hydrochloride, 8 mg nicotinamide, and 40 mg ascorbic acid
- **Lasomin-Z**: 0.5ml/day. 1ml contains Vit B1 1mg;Vit B2 0.5mg; nicotinamide 10mg; Vitamin A 2500iu; ascorbic acid 40mg; Zinc 13.3mg; Vitamin E 2.5iu; Vit d3 200iu; Dexpantenol 15mg; lysine 10mg

NEONATAL HYPOGLYCEMIA

- **RISK FACTORS**
  - LGA, SGA
  - Infant of Diabetic Mother
  - < 37 wks or >42 wks
  - 5 minute APGAR </=5
  - Temperature < 36 degrees on admission,
  - Sepsis
- **ORDERS (see below for abnormal)**
  - If asymptomatic, RBS @ 1hr
  - If first sugar abnormal (<2.4) see below
  - Feed early (as soon as possible after birth) and frequently (every 2-3 hours).
  - When blood sugar is checked, it should be preprandial

- **SYMPTOMS OF HYPOGLYCEMIA**
  - lethargy, poor feeding, irritability, emesis, tachycardia, jitteriness, cyanosis, seizures, respiratory distress, apnea, temp instability, tachypnea, pallor.
  - CHECK BLOOD GLUCOSE STAT if there are SYMPTOMS

TREATMENT: NEONATAL HYPOGLYCEMIA

Glucose	Action
**** If symptoms of hypoglycemia are present at any time, action should be taken irrespective of measure blood sugar level***	
> 2.5 mmol/L (asymptomatic)	Breastfeed / syringe feed Check PRN if symptoms occur
2 – 2.5mmol/L before feeds	**FEED IMMEDIATELY** EBM or 10cc of D10 orally if mom not available IF no symptoms & baby active and vigorous **THEN, Re-check blood glucose q1h** until RBS > 2.5 preprandial x 2, then prn If blood glucose < 2.5 **after** feed, start IVF
<2mmol/L with or without symptoms	Administer **2.5ml/kg** IV D10 Feed immediately if awake & able to breastfeed. If unable to breast-feed be sure bolus is followed by glucose infusion at a rate of 6-8 mg/kg/min = 3.6-4.8 ml/kg/hr of D10 (**use 4 ml/kg/hr as quick estimate**). Re-check blood glucose in 20 to 30 minutes.
Persistent hypoglycemia despite D10 infusion with GIR 6-12 mg/kg/min	1. increase rate by up to 40/kg/day. 2. Then increase concentration (up to D12.5% via peripheral line) or will need central line **Monitor GIR and do not increase more than 2mg/kg/min in order to prevent insulin surge and rebound hypoglycemia.* 1. To wean, decrease by GIR 1-2 or 1-2mL/hr, with each q2-3 hour pre-prandial glucose check. If RBS below 2.5, go back to previous rate.

NEONATAL HYPOGLYCEMIA

If above measures fail:

1. Consider Glucagon if IDDM or LGA
2. Consider Hydrocortisone if concern for adrenal insufficiency.
3. Consider work up for sepsis with antibiotics always.
4. Draw insulin and cortisol.

Formulas to make stronger dextrose concentrations:

Add the volume of 50% dextrose to D10 to make total 100ml		
Desired conc.	**Volume of D10**	**Volume of D50**
D12%	95ml	5ml
D14%	90ml	10ml
D16%	85ml	15ml
D18%	80ml	20ml
D20%	75ml	25ml
Add the volume of 50% dextrose to 0.9%NS to make 100ml		
Desired conc.	**Volume of NS**	**Volume of D50**
7.5%	85ml	15ml
10%	80ml	20ml
12%	76ml	24ml
14%	72ml	28ml
16%	68ml	32ml
18%	64ml	36ml
20%	60ml	40ml

NEONATAL HYPERGLYCEMIA

- **If RBS >20mmol/L** (call senior most on call)
  - ✓ treat any underlying cause
  - ✓ reduce glucose infusion rate no lower than 4 mg/kg/min
  - ✓ consider starting insulin (if hyperglycemia persists despite previous 2 interventions)
  - ✓ High RISK: High hypernatremics and ELBW

- For insulin therapy, start at 0.05units/kg/hr
  - ➢ Do not include insulin drip to total fluid volume intake
  - ➢ Check RBS in 1 hour from initiation, after a dose change, and discontinuation of insulin

- Glucose monitoring during insulin infusion:

If RBS is at…	*When to recheck…*
>15mmol/L	Repeat in 1 hr
>15mmol/L on repeat check	Increase insulin dose by 0.01unit/kg/hr
13-15mmol/L	Repeat in 1 hr
10-12 mmol/L on repeat check	Decrease insulin dose by 0.01unit/kg/hr
< 10 mmol/L	Discontinue insulin drip and repeat in 1 hr x 3

- In VLBW, hyperglycemia is associated with IVH, NEC, and late onset sepsis.

- **Glucose infusion rate** (GIR) (mg/kg/min) = [rate (ml/hr) x % dextrose x 0.166] ÷ wt (kg)

NEONATAL HYPERNATREMIC DEHYDRATION

Term babies with over 20% weight loss carries a significant risk of cerebral edema if levels drop more than 10 mmol/L per 24 hours,

- **EXAMINE** for signs of infection, dehydration, congenital anomaly, and shock.
- **Place on MONITOR** (?widened QRS, peak t-waves)
- **ACCESS** – OBTAIN IV ACCESS
  - If skin pinch > 2 sec and CRT >3 sec, give 0.9% NS bolus 10ml/kg
  - Second 10/kg 0.9% NS bolus if signs of shock have not improved in 30 min
  - Do not give more than 20/kg in total
- **ORDER STAT LABS**
  - Na, K, Cr, RBS
  - CBC and Blood Culture
  - UA and Urine cx (leave NG for UOP measurement if >15%)
  - Bilirubin if Jaundice
  - VBG if shock
- **MEDICATIONS** (all **renally dosed** based on GFR)
  - **Antibiotics**
    - **Ampicillin** & **Cefotaxime** IV until Cr known
    - OR **Cefotaxime** + **Piperacillin tazobactam** if plt <50 for CSF & gram negative coverage
  - **Aminophylline** 1mg/kg IV bid x 5 days to improve renal afferent circulation if Cr >77

NEONATAL HYPERNATREMIC DEHYDRATION

FLUID RESUSCITATION

1. **Calculate % weight loss**
   - Birth Weight – Current weight = deficit
   - Deficit (gm) ÷ Birth weight = % weight loss
2. **Estimated Na based on Percentage Weight Loss**
   Expected Na = {1.3 x (%wt loss)} + 144

3. **Calculate Maintenance[pg54] + Deficit for rate**
   - If > 5 days: {150/kg ÷ 24} (+) {Deficit ÷ (hrs below)}

4. Double check to ensure not over 180ml/kg/day IVF and 200 ml/kg/day total

Na estimate or actual	**IV fluid type**	**Deficit over (hrs)**	**Lab draws**
>170	D5NS	96	Q12 hr Na Q24 hr Cr/K
155-170	1/2D10 1/2NS	72	Q 24 hr Na/K/Cr
<155	4/5D10 1/5 NS	48	Prn wt loss

No matter total replacement calculated,
DO NOT exceed 180ml/kg/day IVF or 200 ml/kg/day in total fluids- more than this risks cardiac overload.
Better to max at 200ml/kg/d over more days!

NEONATAL HYPERNATREMIC DEHYDRATION

ADMIT LOCATION

- ICU: Na >180
- HDU: Na 161-179 and abnormal cr
- Floor: Na 150-160 with normal K/Cr/Mental Status

FEEDS

- If no bloody aspirates on NG insertion, the first 20 ml/kg/day should be given as NG feeds (EBM or formula)
- Increase daily as tolerated to full feeds (watch for refeeding if >7 days old)

Additional Orders

- ✓ Cranial Ultrasound within 24 hours if Na >170
- ✓ Check RBS and see Neonatal Hyperglycemia protocol for RBS>20 mmol/l
- ✓ **Hyperkalemia** should be treated according to standard protocols found in the Harriet Lane HB.
- ✓ If Cr >150, maintain NG tube as foley catheter to monitor strict urine output
- ✓ If no urine output at 24 hours, refer to KNH with call to Nephrologist or MP Shah if insurance or civil servant

TOTAL PARENTERAL NUTRITION (TPN)

- **TPN Indications:**
  - premature babies (<30wga, <1300gm) who are at risk for extrauterine growth restriction (EUGR)
  - surgical needs such as gastroschisis, atresias, and ileus where enteral nutrition will be compromised for extended period time

- **TPN complications**
  - Sepsis
  - central venous catheter complications (line placement must be confirmed before starting TPN)
  - cholestatic liver disease
  - hyperlipidemia.

- **Components of TPN at Kijabe**
  - Amino Acids (protein) - Aminosteril 8%, Vaminolact 6%
  - Dextrose (carbohydrates) - Use Dextrose 50% (D50%)
  - Trace Elements - Peditrace
  - Soluble Vitamins - Soluvit
  - Electrolytes (Na, Cl, K, Ca, Ph, Mg) - normal saline, KCL, calcium gluconate, magnesium sulfide
  - Sterile water
  - Lipids (fat) - Intralipid 20%

- **Calorie goals for optimal nutrition for babies**:
  - Babies who are solely on TPN only require 80-100 non-protein kCal/kg/d.
  - For those on a mix of enteral feeds and TPN, calories should be closer to 120 kCal/kg/d**.**

TOTAL PARENTERAL NUTRITION: START

Protein Aminosteril 8% (NEEDS TO BE COVERED)

- **Preterm Neonate:**
  - start with 1-1.5 g/kg/day
  - advance 0.5-1 g/kg each day as tolerated to goal
  - goal = 3.5-4 g/kg/day
- **Term Neonates, infant:**
  - start at 1-1.5 g/kg/day & advance 0.5-1 g/kg/day to goal
  - goal = 3 g/kg/day
- **Child & adolescents** (consider Kabiven 19 starting at 25/kg)
  - start at 1-1.5 g/kg/day & advance 0.5-1 g/kg/day to goal
  - goal = 2-3 g/kg/day
- **Cautions**
  - More in protein losing enteropathy
  - Stop in renal failure if BUN >30mmol/L

FAT Intralipid 20% (NEEDS TO BE COVERED)

- **Preterm Neonates: (20-30% of kcal)**
  - start with 0.5-1 g/kg/day
  - advance 0.5 g/kg/day
  - goal = 3 g/kg/day
  - Monitor triglyceride levels daily if <1 kg, unstable sepsis, steroids - keep below 2.5 mmol/L
- **Term neonates, infant and child:**
  - start with 1 g/kg/day
  - advance by 0.5-1 g/kg/day as tolerated
  - goal = 3 g/kg/day
  - check TG when at goal, keep below 2.5 mmol/L
- **Cautions**
  - Infants on phototherapy for jaundice - limit lipids to 0.5-1 g/kg/day (increased risk of kernicterus)
  - PNALD (TPN associated liver disease)
    - Infants on long-term TPN may develop PNALD due to inflammation & cholestasis from IV lipids
    - Consider when conjugated bilirubin is ≥ 25 mmol/L
    - Therapy is limiting intralipid to 1 g/kg/day
    - Some VLBW infants with PNALD may require 2 g/kg/day for growth

TOTAL PARENTERAL NUTRITION:START

Carbohydrate D50% (60% 0f Kcal)

- **Preterm and Term Neonates:**
  - start with a GIR of 4-6 mg/kg/min
  - advance 1-2 mg/kg/min daily as tolerated by RBS checks (or 2.5% dextrose)
  - goal GIR = 11-12 mg/kg/min
  - monitor RBS trends and urine ketones (if hyperglycemia)
  - need minimum of D5% in TPN to avoid ketosis
- **Infant and Child:**
  - assess tolerance to current dextrose and advance 1-2 mg/kg/min (or 5%) daily as tolerated
- **GIR calculation**
  - $\frac{\text{IV rate (mL/hr) x Dextrose concentration (\%) x 0.167}}{\text{weight (kg)}}$
- **Cautions**
  - Advance in small increments in head trauma and adolescents
  - With fast advance: fatty liver, AST, ALT

GIR Maximum Rates

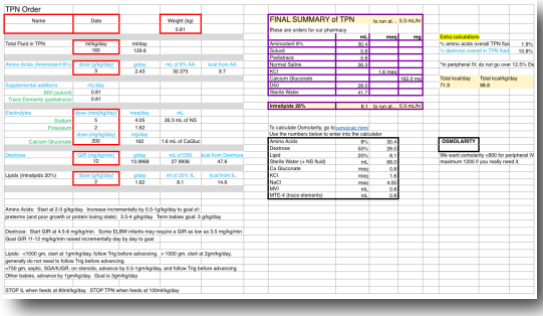
AGE	GIR Maximum (Mg/kg/min)
Preterm neonate	12-15
Term neonate	14
1 mo to 1 yr	12
1 year to 7 years	10
>12 years	7

ELECTROLYTES (add day 3 of life and adjust based on labs)

- Preterm Neonates
  - Sodium (normal saline) = 5-12 meq/kg/day after day 2
  - Potassium (KCL) = 0-2 meq/kg/day
  - Calcium (calcium gluconate) = 200 mg/kg/day
  - **Adjust based on lab data**
- Term Neonates:
  - Sodium (normal saline) = 2-4 meq/kg/day
  - Potassium (KCL) = 0-2 meq/kg/day
  - Adjust based on lab data

Total Parenteral Nutrition (TPN): Write (use highest weight)

Order once daily before 3pm, picked up by nurse at 5pm



1. **Peditrace**:
   - Order: 1 bottle, infusion, 10 days, 1 vial
   - Under both “Pharmacy Notes” and “Patient Notes” type: “for TPN - see Aminosteril Order”
2. **Soluvit**:
   - Order: 1 bottle, infusion, 10 days, 1 vial
   - Under both “Pharmacy Notes” and “Patient Notes” type: “for TPN - see Aminosteril Order”
3. **Electrolytes**:
   - Order: 1 bottle, infusion, 10 days, 1 vial
   - Under both “Pharmacy Notes” and “Patient Notes” type: “for TPN - see Aminosteril Order”
   - Inform nursing electrolytes are for the TPN and not to give separately
   - Do not add phosphorous to TPN, it will precipitate

STOPPING TPN

- Stop lipids when tolerating 80 ml/kg/day EBM
- Stop TPN when tolerating 100 ml/kg/day

NEWBORN RESPIRATORY MANAGEMENT

Apnea of Prematurity Treatment

- **Patient**: <34 weeks GA and/or <1500gm.
- **Aminophylline** (IV until tolerating feeds)
  - Admission: 8 mg/kg IV loading dose
  - Maintenance: 2.5mg/kg/dose BD
- **Complications**
  - Tachycardia
  - Arrhythmia
- **Discontinuation**
  - 34 wks AND no apneas for 5-7 days. (may require up to 37 weeks)

Oxygen saturations and altitude

- Kijabe is located at an altitude of almost 2250 meters. Neonates born at or above 2100 meters exhibit "normal" oxygen saturation levels between 91% to 96% rather than the expected 97% found at sea level. These reference values for varying altitudes can guide clinicians to avoid hypoxemia or hyperoxia.

Ravert P, Detwiler TL & Dickinson JK. Mean oxygen saturation in well neonates at altitudes between 4498 and 8150 feet. Advances in Neonatal Care 2011 Dec;11(6):412-7

NASAL CANNULA AND FIO2 in NEONATES

Flow	1kg	2 kg	3kg	4kg	Child
0.25 L/min		31%	27%	26%	21%
0.5 L/min	61%	41%	34%	31%	22%
1 L/min	100%	61%	47%	41%	25%
2L/min	100%	100%	74%	61%	29%
3L/min	100%	100%	100%	80%	33%

This table adapted from equations (3) and (4) in: Benaron DA & Benitz WE "Maximizing the Stability of Oxygen Delivered Via Nasal Cannula" Arch. Pediatr. Adolesc Med 148: 294-300, March 1994

- The lowest possible FiO2 should be given to premature babies to maintain SaO2 of 90-93%.
- Smaller babies reach a FiO2 of 100% with very little flow.
- Thus if 1L/min of 100% O2 has been reached for a 1kg baby, there is no reason to increase flow rate, but consider transitioning the baby with respiratory distress to nasal bubble CPAP or ventilator support if not a candidate for CPAP.
- Face mask/NRB should never be given with <5 L of flow and should be used as a bridge, not final solution for oxygenation.

Silverman- Anderson Score			
Feature	Score 0	Score 1	Score 2
Chest Movement	Equal	Respiratory Lag	Seesaw Respiration
Intercostal Retraction	None	Minimal	Marked
Xiphoid Retraction	None	Minimal	Marked
Nasal Flaring	None	Minimal	Marked
Expiratory Grunt	None	Audible with Stethoscope	Audible

*Score of >6 initiate CPAP as you prepare for transfer for mechanical ventilation (For instruction on how to set up CPAP, refer to CPAP training/equipment manuals)

BUBBLE CPAP

- Early nasal prong bubble CPAP administration is as effective as prophylactic surfactant, thus prophylactic CPAP should be considered for infants as risk for RDS (NEJM 2010;362:1970-9.)
- **Consider CPAP for**:
    - respiratory distress syndrome / BPD
    - atelectasis on CXR,
    - apnea/bradycardia of prematurity
    - meconium aspiration without PPHN
    - tracheomalacia
    - respiratory support after extubation.
- **Contraindications**:
    - congenital diaphragmatic hernia
    - tracheo-esophageal fistula
    - cleft palate
    - choanal atresia
    - omphalocele, gastroschisis
- **Cautions**: (disease causing decreased pulmonary blood flow or increased expiratory resistance – lower PEEP 2-4cm)
    - meconium aspiration with pulmonary hypertension,
    - Tetralogy of Fallot
    - Bronchiolitis
- **Nasal prong sizes** should be: (do not cut, long prongs prevent septal injury!)

< 700 gms	Size 0
700 – 1000 gms	Size 1
1000 – 2000 gms	Size 2
2000 – 3000 gms	Size 3
3000 – 4000 gms	Size 4
> 4000 gms	Size 5

BUBBLE CPAP: SETUP

Flow - 5-10L/min

PEEP – usually 5cm/H_2O (tube is 5cm below the surface of the water), if > 8, consider ventilator

Most patients will start at the same settings*:

	Concentrator Flow	Oxygen Flow	Total Flow
Neonate	3 L/min	3 L/min	6 L/min
Child	4 L/min	4 L/min	6 L/min

Set the wall flow regulator

2 → *check* the Oxygen Flow → **3** set the Total Flow

1. Choose the Total Flow Rate (L/min) to deliver to the patient.
2. Choose the Fraction of Inspired Oxygen (FiO_2) Level to deliver to the patient.
3. The table value where the Total Flow Rate and FiO_2 Level meet is the Suggested O_2 Flow Rate*.

An **Example Setting** is shown in the table to the right:

A patient requires a Total Flow Rate of 8 L/min and an FiO_2 Level of 60%. Therefore, the Suggested O_2 Flow Rate is 5 L/min.

Set from wall

OXYGEN BLENDING TABLE

FiO_2 Level	Total Flow Rate (L/min)					
	5	6	7	8	9	10
	Suggested O_2 Flow Rate (L/min)					
20% O_2	0	0	0	0	0	0
30% O_2	1	1.5	2	2	2.5	2.5
40% O_2	2	2.5	3	3.5	4	4.5
50% O_2	3	3.5	4	4.5	5	5.5
60% O_2	3.5	4	4.5	5*	5.5	6.5
70% O_2	3.5	4.5	5	6	6.5	7.5
80% O_2	4	5	5.5	6.5	7	8.5
90% O_2	4.5	5.5	6	7	8	9

*Note that the Suggested O_2 Flow Rate may need to be increased at higher altitudes to meet FiO_2 Level requirements.

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PUMANI CPAP: SETUP

FiO2

Oxygen flow set at wall and reviewed on machine.
as low as possible to maintain SaO2 >90%

Wean PEEP based on Silverman Anderson score

SURFACTANT THERAPY

- Our pharmacy ***surfactant***, costs between 20,000-40,000 KSH per 4-6mL (depending on supplier) and is **not** covered by NHIF.
- Risks and Benefits
  - Pneumothorax and Pulmonary hemorrhage are main complications
  - Carefully explain to the parents before administration (ideally prior to delivery of the baby where possible)
- Cost
  - Specific consent for the cost of the medication should be obtained & documented
  - If the family cannot afford surfactant, but the clinician feels that it may be a life-saving drug, consider accessing the Kijabe Hospital "Needy Children's Fund" to pay for a vial for the parents.

CONSIDER SURFACTANT for:

- **Neonate <29 weeks:** PROPHYLACTIC. If born at less than 29 weeks and vigorous at delivery give within1 hour (delivery room or immediately on arrival to nursery)
- **Neonate 29-30wga**
  - If antenatal steroids have not been given to mom
  - If infant requires significant resusc in the delivery room
  - OR If the infant continues to have O2 requirement >40%
- **<36 wks**: if has respiratory distress **AND** O2 requirement >40% **AND** a chest x-ray consistent with RDS.
- **Term Neonate**: at risk of RDS, who is deteriorating to the point of requiring intubation and ventilation

SURFACTANT ADMINISTRATION

Dose: 100mg/kg, given via ETT in 2-3 equal aliquots.

1. Optimize oxygenation while the Surfactant is warmed to room temperature (~5min holding in the hand, or 20 min on countertop).
2. The full dose should be drawn into a syringe.
3. If available, attach 4F feeding tube to the syringe and prime. For small size ETT (<=2.5) that will not allow passage of 4F feeding tube, the surfactant may be administered directly into the ETT followed by bagging to distribute the dose.
4. Intubate.
5. Ensure the feeding tube (if used) is fed down the ETT to just proximal to the ETT tip.
6. Instill each aliquot over 2-3 seconds while supine
7. Allow 1-2 minutes recovery time between aliquots, ensuring the SaO2 is adequate before next dose.
8. Extubate after administration.
9. Ideally, the baby should not be suctioned for at least the next 2 hours (preferably 4-6 hours).
10. Always get chest xray after first dose before giving second to evaluate for pneumothorax, etc.

Up to 3 doses may be given in the first 72 hours of life. Its efficacy after 2 doses and 3 days is controversial.

Only give 2nd dose if good response to the first dose.

The baby's FiO2 requirement, if measured, should be at least 10% higher than after the first dose of surfactant.

PERSISTANT PULMONARY HYPERTENSION OF THE NEWBORN (PPHN)

Definition: Persistence of normal fetal in utero circulation pattern of elevated pulmonary pressures and thus minimal lung blood flow, with shunting of blood right to left across the ductus arteriosus or foramen ovale due to failure of drop in pulmonary resistance after birth.

Risk: Meconium Aspiration Syndrome, Asphyxia, Term Surfactant Deficiency

Diagnosis of PPHN

- Infant with at risk condition and labile oxygenation.
- Pre (right hand) and post-ductal (lower extremity) saturation difference >10% (not always)
- Echocardiogram

Treatment Goal – prevent or reverse shunt

1. **Decrease pulmonary pressures**
   - **Oxygen**- anticipate PPHN in at risk patients and aggressively improve oxygenation with O2, CPAP, ventilation. Until blood gases are available aim for 100% saturation in these patients
   - **Sildenafil** 1-2 mg/kg via NG every 6 hour
2. **Prevent acidosis**
   - Goal is normal pH, not alkalosis.
   - Can use hyperventilation or NaHCO3 1meq/kg IV
3. **Sedation**
   - Fentanyl infusion once intubated 1-3 mcg/mg/hr (can add Midazolam but target MAP 50-60
4. **Paralysis**
   - Rocuronium if intubated & needed for discordant movement
5. **Treat underlying cause (antibiotics, surfactant**?)
6. **Increase systemic pressures** (>pulmonary pressures)
   - **Norepinephrine** infusion to target goal MAP in 50-60s
     - Begin low (0.05 mcg/kg/min) and titrate upwards based on clinical response (to 0.2 mcg/kg/min).
   - **Vasopressin** if refractory (vasoconstrict peripheral but not systemic circulation)

.....

PERSISTENT PULMONARY HYPERTENSION

WEANING from SUPPORT

- Patients with PPHN are extremely labile for the first 3 to 4 days. Wean interventions slowly in reverse order in which they were started.
- Wean oxygen by intentional steps, not by saturations – an infant can suddenly drop from 100 to 50% saturated with a small change in oxygen delivered
- Patients often have therapy of choice – some respond better to oxygen, or higher mean BP, or sedation – observe what works best for an individual infant.

MATERNAL HIV (consult CCC; not admitted)

- HIV positive mothers should be on HAART
- Do not do mixed feeding (including fortification)
- All babies born of HIV positive mothers should have PCR sent at birth and again at 6 weeks of age
- Both AZT and NVP should be started at birth for 6 weeks, then NVP until 6 weeks after complete cessation of breastfeeding (see MoH guidelines)

Age/Weight	Dosing NVP	Dosing AZT
<2kg	2mg/kg/dose OD	4mg/kg/dose BD
2-<2.5kg	10mg (1ml) OD	10mg (1ml) BD
>2.5kg	15mg (1.5ml) OD	15 mg (1.5ml) bd

NEONATAL SEPSIS

Neonatal Rule Out Sepsis (Symptomatic)

PRESENTATION

Symptoms and signs of sepsis in an infant may be very non-specific and require a high index of suspicion.

SIGNS and SYMPTOMS

Early Onset Sepsis (1st 24 hours)

- Respiratory changes – apnea, tachypnea, new onset distress, O2 requirement >4hours
- Any baby requiring significant resuscitation at birth
- Meconium aspiration syndrome (O2 requirement)
- Preterm without maternal factors
- Sodium >160
- Consider with >1 risk factors for Risk of sepsis

Late Onset Sepsis (>3 days)

- Temp instability, temp >38 or hypothermia < 36 rectal
- Lethargy/irritability
- Tachycardia in the absence of fever
- Perfusion changes – mottling, pallor, cool extremities
- Vomiting and abdominal distension

** If any of these symptoms/signs are present, a sepsis workup should be strongly considered, even in the absence of fever.*

NEONATAL FEVER & SEPSIS

Definition: rectal temperature 38ºC

Neonates may manifest fever as the only sign of underlying infection.

SEPSIS WORK UP febrile inpatient neonate:

- CBC
- Blood cx
- UA, urine cx if > 24 hours
  - Urine collection: in/out catheter or suprapubic bladder aspiration.
  - *High rate of false negative UA in this age group, thus urine culture should be used as the gold standard*.
  - (+) Nitrites but not (+) LE are consider a positive UA.
- Lumbar Puncture automatic if >72 hours
  - Discuss LP for <72 hours

ANTIBIOTICS

- (ampicillin OR xpen) AND gentamicin
- within one hour of feer

If in shock, give antibiotics quickly and consider delaying complete workup until clinically stable. Use boluses and pressors as needed.

URINARY TRACT INFECTION (most common SBI)

- UTI typically presents in the second week after birth in term infants and later in preterm infants.
- Although UTI is unusual during the first 3 days after birth, we test all symptomatic infants >24 hours of age.

NEONATAL SEPSIS: DISPOSITION

DISPOSITION

- If the baby is afebrile and feeding well, and blood/urine/CSF cultures are negative at 48 hours, THEN patient can be discharged home.

Positive Culture	Duration of Treatment
Urine Culture	7 days if pansensitive 10 days if multidrug resistant
Blood Culture	10 days of treatment
+ CSF (> 5 cells)	14 days Gram + or – culture 21days Gram -

*LP should be repeated if not improved after 48 hours or if culture positive at day 10 to confirm the infection has cleared.

Serious Bacterial infection (SBI) and FEVER: Studies

- The incidence of (SBI) is higher in infants less than three months of age, particularly those under 28 days, than at any other time in childhood.
- Two studies performed after the introduction of vaccination against HIB found a 13% incidence of SBI in febrile neonates under 29 days of age.
- A Kenyan study of 552 positive blood cultures revealed the most common pathogens in infants with bacteremia included:
- <7 days of age: *E coli* 13%, *Acinetobacter* 10%, *Klebsiella* 10%, *S. aureus* 9%, Group B Strep 7%;
- >7 days of age: Group A strep 13%, *S. pneumo* 11%, S *aureus* 11%, Group B strep 10%, *Kleb* 9%, *Acinetobacter* 9%.
-

KIJABE ANTIBIOGRAM 2021

Table 2: AIC Kijabe Hospital Antibiogram

AIC Kijabe Hospital Antibiogram, February 2016 through September 2020	Organism	Number of patients	Amikacin	Amox-Clav Acid	Aztreonam	Cefazolin	Cefepime	Cefotaxime	Cefoxitin	Ceftazidime	Ceftriaxone	Cefuroxime	Chloramphenicol	Ciprofloxacin	Clindamycin	Cloxacillin	Gentamicin	Meropenem	Nitrofurantoin	Pip-Tazobactam	Trimeth/Sulfa	Vancomycin
Gram Negative	*Acinetobacter baumannii*	50	72			46					33	29		51			65	57		44	31	
	Enterobacter cloacae	63	82			56					35	31		63	60		46	90	54	63	25	
	Escherichia coli	721	88	57	49		52	49	81	48	49	47	78	55			70	96	85	75	19	
	Klebsiella oxytoca	153	91	38	34		35	35	78	31	33	30	56	60			49	94	60	57	28	
	Klebsiella pneumoniae	312	87	32	22		28	22	85	22	24	21	62	62			35	94	45	47	22	
	Pseudomonas aeruginosa	39	82			70			65					76			87	82		74		
	Serratia fonticola	31	97	54			52		75	52	29	29		30				97	84	65	30	
Gram Positive	*Staphylococcus aureus*	110				87							90				66	91			32	70
	Staphylococcus, coagulase negative	1534				70							87		57	69					27	80

This is aggregated culture data from blood, urine, and CSF for the years 2016 to 2020. The minimum of 30 isolates were used to create the antibiogram. Numbers expressed as percent sensitive.

NEONATAL HYPERBILIRUBINEMIA

EVALUATION

- Any clinical jaundice needs:
  - Total bilirubin / Direct bilirubin
  - Place under lights if suspect severe jaundice

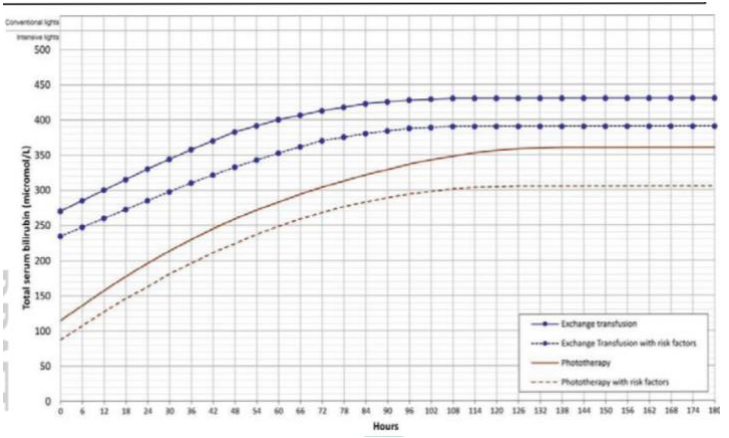
- Severe jaundice OR Rhesus -, OR O then obtain:
  - Cord blood at delivery if possible
  - Blood group
  - Hgb level
  - DCT if suspicion/maternal and obstetric hx

- Concern for jaundice that is not physiologic, may need septic work-up and other studies:
  - baby with exchange level bilirubins,
  - rising bilirubin >5 days of life,
  - direct bilirubin more than 20% of total bilirubin,
  - history of fever or other sepsis risk factors.

PHOTOTHERAPY

Indications in TERM babies

For babies with a gestational age of 38 wga+, the nomogram below should be used:
(use red dotted line assuming G6PD with 20% prevalance)

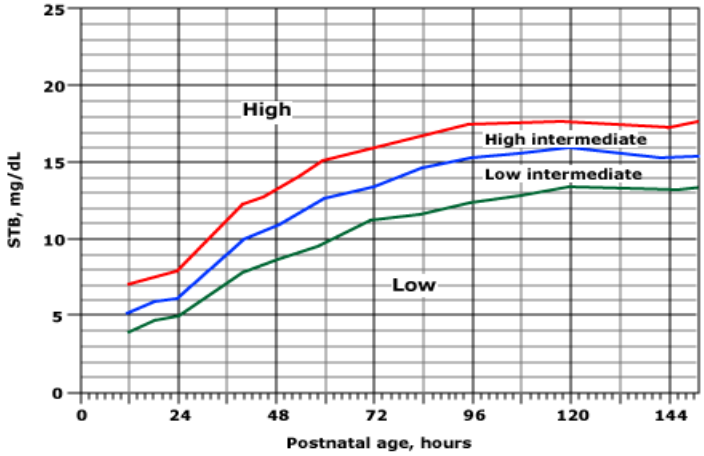


To start phototherapy:

1. Ensure good eye protection with goggles.
2. Skin must be exposed for phototherapy to be effective – fold nappy, the rest of the body naked.
3. Continue feeds.
4. Ensure the distance between the baby and the
   lights 30cm (and no more than 45cm)
5. Turn child from time to time supine to prone

GUIDELINE FOR RISK OF NEEDING INTERVENTION FOR JAUNDICE

If the current bilirubin level does not meet criteria for phototherapy, the bilirubin level should be rechecked according to the following nomogram:

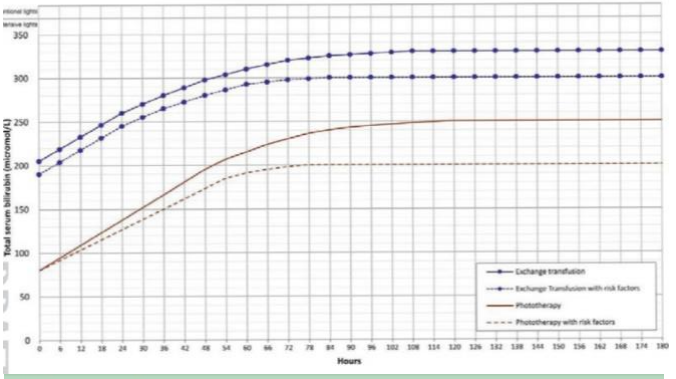


<u>High risk</u>: recheck T-bili in 6-12 hours
<u>High intermediate risk</u>: recheck T-bili in 24 hours
<u>Low intermediate risk</u>: recheck T-bili in 24-48hour
<u>Low risk</u>: recheck T-bili as needed

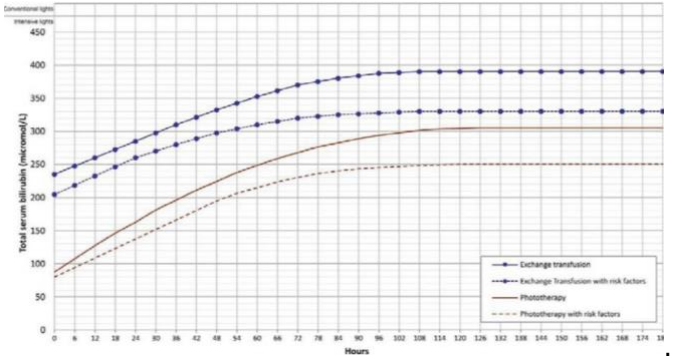
***all charts below from Kenyan Pediatric Protocol 2022

PHOTOTHERAPY CHARTS PRETERM BABIES

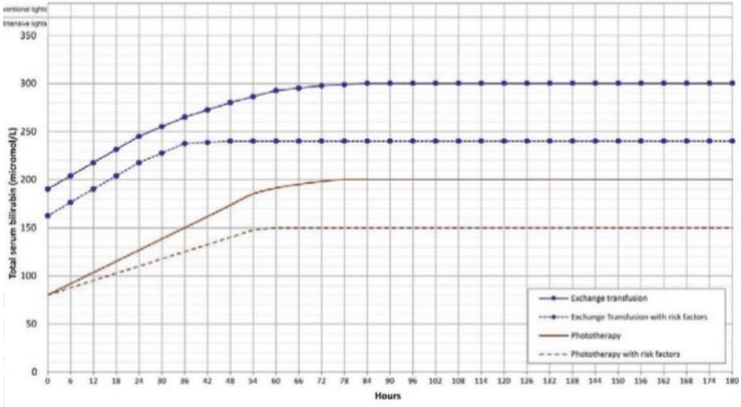
< 35 weeks gestational age, >2kg at birth



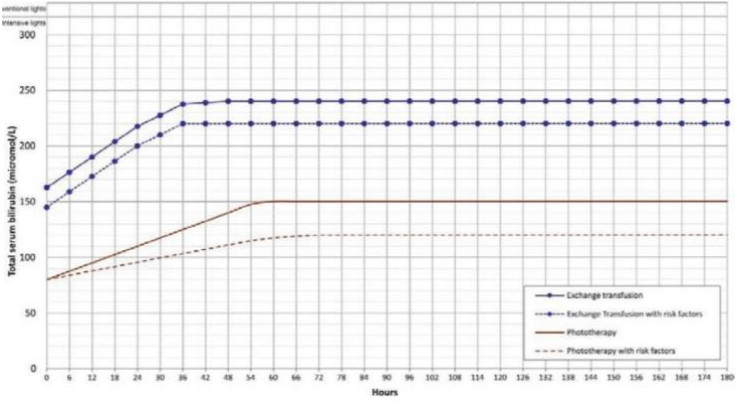
35-37 weeks gestational age



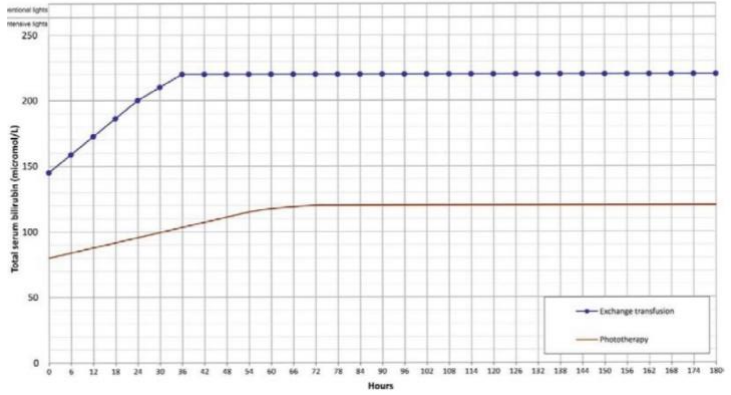
< 35 wga, 1500 – 1999gm at birth



< 35 wga, 1000 – 1499 gram at birth



< 35 wga, <1000 gram at birth

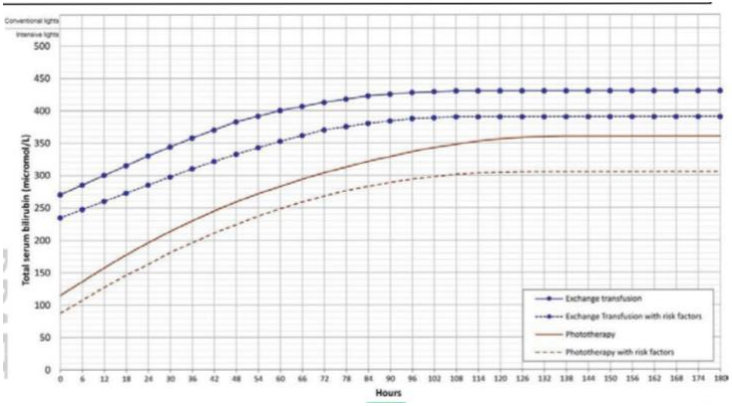


LABS FOR HYPERBILIRUBINEMIA

Clinical Situation	Lab Monitoring
Near exchange Rise > 80 in 24 hours Low Hb (hemolysis)	6 hour after photo started then q12h
After stopping intervention	Recheck in 12-24 hours
Under phototherapy	Daily AM (q24h)
*initial draw should be total/direct. After that direct only need every 72 hours if initial direct is normal.	

IVIG / EXCHANGE TRANSFUSION

- Immediate intervention with exchange transfusion is recommended if:
  - Infant shows signs of severe acute bilirubin encephalopathy OR
  - Bilirubin is >513
  - OR according to the blue dotted lines on the table below



For babies with a gestational age <35 weeks, IVIG / exchange transfusion should be done at the discretion of the pediatric consultant, and will usually be done for any baby exhibiting kernicterus and according to MOH tables.

INTENSIVE phototherapy guidelines :

*for over and near exchange or rapidly rising bilirubin

1. Hyperhydrate. (1.25-1.5 M feeds + fluids)
2. Give EBM via syringe/NG while patient is under phototherapy to minimize time without therapy.
3. If available add bili-blanket and reflective surface
4. During this time, do not remove patient from photo.

IVIG – dosing and procedure

In Kijabe, in cases of ABO/Rh incompatibility, IVIG has been found to be as effective as exchange transfusion.

- Inform the parents of the cost of IVIG – around 20,000 KSH for 2.5gram vial or 37,000 for 5gm vial. (Inform not covered by NHIF)
- **IVIG dose**: 500-1000 mg/kg/dose over 6-8 hrs (easiest to round to nearest 2.5g or 5g as comes in 5g vials)
  - Begin at 0.01 mL/kg/min (*0.6ml/kg/hr*), double rate every 15–30 min, max. of 0.08 mL/kg/min (*4.8 mL/kg/hr*).
  - Monitor continuously for adverse effects (tachypnea, tachycardia, hypotension). If adverse reactions occur, stop infusion until side effects subside, and may restart at rate that was previously tolerated

Exchange Transfusion - Supplies

- BLOOD (160 ml/kg total)
  - If Rh incompatibility use Rh negative but ABO compatible with baby
  - If ABO incompatibility use Group O but Rh compatible with baby
  - Use Whole blood < 7 days old
- You will need:
  - 2 sterile gowns, 4 pairs sterile gloves
  - Small minor set
  - an umbilical catheter - use 5 Fr **single** lumen umbilical venous catheter or 5 Fr NGT
  - 11 blade
  - 3-5 x5cc syringes (to flush line)
  - an 18g needle (to draw flush)
  - a 3-4.0 nylon stitch (to suture catheter in place);
  - 2 three way stop cocks, and
  - one tegaderm

Exchange Transfusion – Procedure

Exchange 2 times the blood volume whole blood (~160ml/kg total).

1. Place baby on resuscitaire and immobilize.
2. Place baby on continuous monitoring
3. Place an NGT and evacuate stomach contents
4. Continue IVF through PIV throughout exhchange.
5. Place umbilical catheter. If unable to obtain an umbilical line, procedure can be performed via femoral line.
6. Exchange slowly (2-3ml/kg/min) in 15-20ml aliquots
7. Give calcium gluconate 100 mg/kg IV midway through the exchange transfusion. (citrate in whole blood binds calcium)
8. After the procedure, order total bili, direct bili, CBC with diff, Cr and Ca.
9. Patient can feed 4 hours after procedure.

PERINATAL ASPHYXIA

Perinatal asphyxia is:

- Evidence of metabolic acidosis with cord gass pH <7
- OR early onset of neonatal encephalopathy in the absence of other etiologies (infection, trauma etc).
- OR Apgar score of </=5 at greater than 5 minutes of life.

If patient has 5 minute APGAR </= 5 or severe acidosis on cord gas, mechanical ventilation does not improve outcome and should not be initiated in our setting.

Thompson Score

Table 3: Thompson score

Sign	0	1	2	3
Tone	Normal	Hyper	Hypo	Flaccid
Level of consciousness	Normal	Hyperalert/stare	Lethargic	Comatose
Fits	None	<3 per day	>2 per day	
Posture	Normal	Fisting, cycling	Stron distal flexion	Decerebrate
Moro	Normal	Partial	Absent	
Grasp	Normal	Poor	Absent	
Suck	Normal	Poor	Absent, bites	
Respiration	Normal	Hyperventilation	Brief apnea	IPPV (apnea)
Fontanel	Normal	Full not tense	Tense	

IPPV – Intermittent positive pressure ventilation

The **HIE score** (**Thompson score**) is a clinical tool comprising of a set of clinical signs associated with CNS dysfunction. It is used to assess status of a child following birth asphyxia [10–13]. ... Infants with **score** 1–10 are considered to have mild **HIE**, 11–14 have moderate **HIE** and 15–22 are considered to have severe **HIE**

PERINATAL ASPHYXIA continued

Sanart Classification

- Stage I – hyper alert, uninhibited Moro lasting <24h
- Stage II – obtunded, hypotonic, decreased spontaneous movement
- Stage III – stupor, flaccid, seizures, hypertonic.

MANAGEMENT

1. **Passive Cooling** to 35^{o}. Do NOT actively rewarm
2. **Labs**
   a. RBS
   b. blood culture
   c. CBC at birth
   d. Na, Cr, and SGOT at 48 hours
3. **Medications**
   a. Consider Phenobarbital 15 mg/kg IV load if Mod/Severe then 3-5 mg/kg/day po q12
   a. For persistent seizures, additional phenobarbital boluses may be required up to a cumulative maximum of 40mg/kg.
   b. For breakthrough seizures on phenobarbital, give Keppra 10mg/kg po q12
4. **Feeding:** hold feeds for 24 hours because of risk of intestinal ischemia and subsequent NEC.
5. **Aminophylline:** in case of significant apnea, considering loading and maintenance dose of aminophylline

HEARING SCREENING

Screening should happen on
every baby that is born in Kijabe.

For outborn babies, ENT department at Kijabe will perform otoacoustic emission screening hearing tests on at-risk babies. These include:

- BW <1500grams
- Gentamicin/Amikacin course >72 hours
- Meningitis
- Anoxic brain injury
- Craniofacial abnormalities
- Babies who have received exchange transfusion or IVIG
- Suspected or documented TORCH infection

A running list of babies requiring screening should be posted in the nursery to facilitate the team finding at-risk neonates.

PATENT DUCTUS ARTERIOSUS (PDA)

Diagnosis:

- If clinically you think you have a hemodynamic relevant PDA (watch if no clinical adverse effects)
- Murmur @ 2nd intercostal space left sternal border
- Bounding (pronounced) pulses; palmar pulses
- Oxygen requirement > 25-30%;
- Oxygen saturations that are more fluctuant than usual (e.g. 1 minute 100%, the other minute 75 %)
- ECHO

TREATMENT

- Paracetamol 15 mg/kg/dose po q6h for 3-5 days
    - Treat if symptomatic - best done within the first 7 days of life

Le J, Gales MA, Gales BJ. **Acetaminophen for patent ductus arteriosus**. *Ann Pharmacother*. 2015 Feb;49(2):241-6.

- If treating PDA, also consider fluid restriction until the PDA is closed
    - no more than 150 ml/kg/day of total intake
    - If growing well, then restrict even down to 120 ml/kg/day. Consider fortifiers.

RE-TREATMENT

- If after a full course the PDA has not closed and is clinically relevant, second course of PCM or Brufen (10mg/kg day 1, 5 mg/kg day 2/3)
- If a significant PDA is confirmed then surgical PDA ligation is needed.
- Consider transfusion to maintain Hb of 15gm/dl

CRITICAL CARE PROTOCOLS

RESPIRATORY CARE

	Central Line	Chest Tube	Foley	NG	Suction	ETT at gum	LMA size
1 -6 mo	4-5	10-12	6	8	8	9-10 cm	1-1.5
1 yr	4-5	16-20	8	10	8	12 cm	1-2
2 yrs	5	18-20	8	10	8	14 cm	2
4 yrs	5	18-22	10	12	10	15 cm	2-3
6 yrs	5	20-22	10	12	10	15 cm	3
8 yrs	5-7	20-24	12	14	10	18 cm	3-4
10 yrs	7	24-34	12	16	12	18 cm	4-5
12 yrs	7	24-34	12	16	12	20 cm	5
Adult	7	24-34	14-18	18	12-14	20-22 cm	5

ETT size: (age in yrs/4) + 4 **ETT Distance to gum: ½ age + 12 *or* 3X ETT Size**

Cuffed ETT for all significant resp disease – may need to subtract ½ size

CPAP

- If the baby is has a reasonable respiratory effort with CPAP and has a relatively low oxygen requirement, then it is safer to use CPAP than intubation (unless the baby has multiple apneas on CPAP).
- Babies managed on CPAP rarely have issues with low CO2.
- If a baby's respiratory effort becomes significantly labored with severe thoracic retractions despite CPAP, then intubation may be needed. Consider surfactant as adjunct in Neonates
- Contraindications: CDH, recent intestinal surgery.

HIGH FLOW NASAL CANNULA

HNFC has been shown to:

- Reduce work of breathing
- Provides low-level positive pressure (PEEP) and aids in lung recruitment
- Exact amount of PEEP is variable (2-5 cm H2O) and depends on flow rates, nasal cannula fit to nares, and whether mouth is open or closed
- Provides CO2 “washout” of physiologic dead space
- Warmth and humidity keep secretions moist, improve mucociliary clearance, and inhibit inflammatory reactions and nasopulmonary bronchoconstriction reflexes triggered by cold and dry air

Start HFNC at maximal flows per weight and with correct nasal cannula size.

	Patient weight (kg)					
	3-4 kg	5-6 kg	7-8 kg	9-10 kg	11-14 kg	15-20 kg
Max HFNC flow (L/min)	5L	10L	14L	18L	20L	25L
Nasal cannula size* (with maximal deliverable flows)	Infant (0.5-20L)	Infant (0.5-20L)	Infant (0.5-20L) or Pediatric (0.5-25L)	Infant (0.5-20L) or Pediatric (0.5-25L)	Pediatric (0.5-25L)	Pediatric (0.5-25L)
Patient circuit	RT330 Optiflow Tubing Kit					
Humidifier set-up	Invasive mode – 37 degrees Celsius					

HIGH FLOW NASAL CANNULA

High Flow Nasal Cannula Order Sheet

- ☑ Maximum oxygen flow rate is _____ LPM
- ☑ Vital signs every 2 hours (HR, RR, O2 Sats, Oxygen Flow Rate)
- ☑ Check water level every 2 hours (assure at the line)
- ☑ Keep Oxygen Saturations >90%
- ☑ NPO (discuss with physician to initiate NG feeds after 6 hours)
- ☑ After 4 hours, may wean HFNC by 1 LPM every 2 hours if:
  - ☐ Oxygen sats >90% for 4 hours
  - ☐ Improving respiratory distress
  - ☐ Patient is not lethargic
  - ☐ Respiratory Rate is normal for age

HFNC Initial and Maximal Flow Rates

FiO2 to keep SpO2 > 90%

- 6 lpm for 3 – 4 kg
- 10 lpm for 5 – 6 kg
- 14 lpm for 7 – 8 kg
- 18 lpm for 9 – 10 kg
- 20 lpm for 11 – 14 kg
- 25 lpm for 15 – 20 kg
- 30 lpm for 21 – 30kg
- 30 lpm for 31 - 40 kg
- 35 lpm for 41 – 50 kg
- 40 lpm for 51 – 60 kg
- 45 lpm for 61 – 70 kg

Danger Signs (Call Physician):

- O2 saturations < 90%
- Severe respiratory distress (grunting, very severe chest in-drawing)
- Lethargy or reduced level of consciousness
- Convulsions
- Respiratory Rate:
  - 2–11 months: ≥ 50 breaths/min
  - 1–5 years: ≥ 40 breaths/min
  - 6-14 years: ≥ 30 breaths/min
- Heart Rate:
  - 2–11 months: ≥ 180 beats/min
  - 1–5 years: ≥ 160 beats/min
  - 6-14 years: ≥ 140 beats/min

*Wean by 1 LPM every 2 hours if above criteria met!

INTUBATION : SIZES and SUPPLIES

For neonates, ETT size can be estimated by dividing the gestational age in weeks by 10, and taped at a depth of 6 + weight (kg).
The following table may be a more precise guide:

Gestational age	Weight (gm)	Laryngoscope	ETT size	Depth at lip (cm)
23-24	500-600	Miller 00 *	2.5	5.5
25-26	700-800			6
27-29	900-1000			6.5
30-32	1100-1400	Miller 0 *	3.0	7
33-34	1500-1800			7.5
35-37	1900-2400		3.5	8
38-40	2500-3100	Miller 1		8.5
41-43	3200-4200		4.0	9
6mo to 2y		Miller 1		3x Tube diameter
2year to teen		Miller 2	(Age+16)/4	
Adults		Miller 3		

Infants <1000 gm usually only intubated to give surfactant but are not ventilated.

For older children, ETT size can be calculated using the following formula:

$$\textbf{ETT} = \frac{\textbf{Age in years}}{4} + 4$$

Depth of insertion at the lip for oral intubation can be estimated at:

3 x ETT size (cm)

Measure Cuff pressures every shift if cuffed.

INTUBATION SEQUENCE DRUGS

PRE-INTUBATION: Preoxygenate with 100% oxygen for 3 minutes.
Have available: Good IV, suction, oral airway, alternative ETT and blade sizes, proper LMA. *Have NS available for hypotension with PPV. (asthma, dehydration, etc.)*

STANDARD RAPID SEQUENCE – *CONSULTANT MUST BE PRESENT*

Atropine 0.02 mg/kg IV (min. 0.1 mg; max: child 1 mg)(<1yr c succ)

Ketamine 1-2 mg/kg IV
Succinylcholine 1-2 mg/kg IV
Midazolam 0.1-0.2 mg/kg IV (after intubation)

STANDARD SEQUENCE

Atropine 0.02 mg/kg IV (min. 0.1mg; max: child 1 mg) (<1 year)
Fentanyl 3-6 mcg/kg IV **OR** Morphine 0.1 mg/kg IV
Midazolam 0.1-0.2 mg/kg IV
Rocuronium 1-2 mg/kg IV

ASTHMA **(Think fluid bolus first)**

Atropine 0.02 mg/kg IV (min 0.1 mg; max: child 1 mg) (<1year)
Ketamine 1-2 mg/kg IV
Succinylcholine 1-2 mg/kg IV

HEMODYNAMIC INSTABILITY **(Think fluid bolus!)**

Atropine 0.02 mg/kg IV (min0.1 mg; max: child 1 mg) (<1year)
Ketamine 1-2 mg/kg IV
Rocuronium 1-2 mg/kg IV

HEAD INJURY

Atropine <1yr 0.02 mg/kg IV (min. 0.1 mg; max: child 1 mg)
Or Lignocaine 1mg/kg IV or to the cords
Phenobarbital 20 mg/kg IV (If Normotensive)
OR Ketamine 1-2 mg/kg (If Hypotensive)
Rocuronium 1-2 mg/kg IV (only if normotensive)

Ketamine, Morphine, Midaz can all be given IM if no IV.
Atropine may be given via ETT.

VENTILATOR MANAGEMENT

INITIAL VENTILATOR SETTINGS

1. **FiO2 to meet desired saturation goals**
2. **Rate 20-40**
3. **PIP to ensure TV of 6-8/kg**
4. **PEEP 5-10**
5. **I:E 1:2**

ENDOTRACHEAL TUBE CARE

- ETT should be suctioned regularly. .
- Pediatric HME filters trap an infants' own vapors during expiration which then humidify the following inspiration preventing drying of secretions. Change every 1-2 days or if visibly soiled

BLOOD GAS MONITORING

- Blood gases are available in Kijabe and should be measured once the baby is stable on the ventilator.
- **The desired range for arterial CO2 in a premature or term baby is 40-60 mmHg, never less than 35**
- Obtain a gas before sedating for tachypnea to see if tachypnea is approproiate

VENTILATION SUMMARY TABLE

	Healthy lung:	Sick lung:
PEEP (Oxygenation)		
Child	5	6-12
Neonate	4	6-8
PIP (ventilation)		
Child	10	15-30
Neonate	17	18-27
Respiratory Rate • I:E ratio should be 1:2 to start • E time should never be less than 0.5 seconds • Should over breathe by 5-15 to control ventilation		
Teenager	15	20
Child	20-30	25-30
Term Neonate	20-30	30-40
Preterm Neo	40	40-60
Tidal Volume		
Child	6-8cc/kg	6-8cc/kg
Neonate	4-6 cc/kg	4-8 cc/kg
FiO2 start and 100% and wean quickly to goal sats of:		
Child	Sats 90-95%	
Preterm	Sats 88-90%	

Lung compliance (stiffness of the lung) can change within a few hours in the same baby, so spontaneous respiratory rate, tidal volume, and chest rise should be monitored frequently to see if rate or PIP need to be altered.

EXTUBATION CRITERIA

Considerations for Extubation: Improved lung disease?

S ecretions / Sedation / Spontaneous Vt (>5ml/kg) – minimal suction frequency? Patient awake enough to breath and protect airway?

O xygenation FiO_2 <35%

A irway - Maintainable? Leak?, Consider steroids 12 hours prior if mechanical ventilation >48° or after multiple airway intubations

P ressures - PIP <25, PEEP < 5

Predictors of Extubation Failure

Variable	*Low risk <10%*	*High Risk >25%*
$Tv_{spontaneous}$	>6.5 ml/kg	<3.5 ml/kg
FIO_2	<0.30	>0.40
PIP	<25cmH20	>30cmH20

ANALGESIA & SEDATION: NARCOTICS

FENTANYL PRN and INFUSION

INDICATIONS FOR USE: Used for sedation in ventilation and post trauma pain control and neonates

AVAILABLE AS: AMP 100mcg/2ml (50mcg/1ml)

USUAL DOSE: Neonate & younger infant 1-5 mcg/kg/hr (tolerance may develop)

Minimum rate is 0.5 ml/hr (0.5mcg/kg/hr)
Maximum rate is 5 ml/hr (5mcg/kg/hr) for neonate & 3ml/hr (3mcg/kg/hr) for child

FENTANYL 1-3 MCG/KG/HR

$$50 \times \frac{1\ \text{mcg/kg/hr}}{1\ \text{ml/hr}} \times \text{Wt (kg)} = \frac{\text{mcg drug}}{50\text{ml fluid}}$$

Neonate and younger infant:

Sedation/analgesia: 1–4 mcg/kg/dose IV Q2–4 hr PRN

Continuous IV infusion: 1–5 mcg/kg/hr; tolerance may develop

Older infant and child:

Sedation/analgesia: 1–2 mcg/kg/dose IV/IM Q30–60 min PRN

Continuous IV infusion: 1 mcg/kg/hr; titrate to effect; usual infusion range 1–3 mcg/kg/hr

To prepare infusion, use the following formula:

$$50 \times \frac{\text{Desired dose (mcg/kg/hr)}}{\text{Desired infusion rate (mL/hr)}} \times \text{Wt (kg)} = \frac{\text{mcg Fentanyl}}{\text{50 mL fluid}}$$

NARCOTICS: Morphine

Morphine

- Should be strongly considered for any intubated trauma patient, who by the nature of their injuries will have pain.
- Signs of pain in a sedated patient include tachycardia, hypertension, dilated pupils and agitation (although these may be also signs of airway obstruction so monitor airway patency closely).
- IV boluses: May be required initially in doses of 0.05-0.1mg.kg IV in order to gain initial pain control, but repeated boluses may cause hypotension and myocardial depression.

** For non-intubated patients, consider ordering morphine every 3-4 hours PRN. For anyone with long bone fracture in the first 48 hours of hospitalization, converting to oral morphine/paracetamol as tolerated.*

** Also consider regional anesthesia where appropriate rather than systemic opiates (such as a fascia iliaca block for femur fracture).*

ANALGESIA AND SEDATION

BENZODIAZEPINE: MIDAZOLAM

INDICATIONS FOR USE: sedation in ventilation/status epilepticus
AVAILABLE AS: AMP 5mg/5ml (1mg/1ml)
DOCTORS ORDER: Clinician should order in mcg/kg/min
USUAL DOSE: Neonate <32 wk gestation 0.5 mcg/kg/min
>32 wk gestation 1 mcg/kg/min
Infant and child 1-2 mcg/kg/min

MIDAZOLAM 1-2 MCG/KG/MIN

$$6 \times \frac{1 \text{ mcg/kg/min}}{1 \text{ ml/hr}} \times \text{Wt (kg)} = \frac{\text{mg drug}}{100 \text{ ml}}$$

- Note that benzodiazepines do not have a sedative effect on all children – around 1/6 may have a paradoxical reaction with agitation which is independent of dose.
- IV boluses: May be required to facilitate rapid sequence intubation. Doses range from 0.1 mg/kg for mild sedation to 0.3 mg/kg IV for deep sedation, but note that hypotension is a dose-dependent

BENZO and NARCOTIC WITHDRAWAL PROTOCOLS

NEED:

- Any neonate, infant or child who has been on an opioid infusion or regular dosing for 5 days or more
- Any neonate, infant or child who has been given 3 doses or more per day of diazepam or required continuous infusions of benzodiazepines for 5 days or more

SIGNS OF BENZO and OPIOID WITHDRAWAL

NEUROLOGIC IRRITABILITY	GASTROINTESTINAL ABNORMALITIES	AUTONOMIC SYSTEM
• Poor sleep pattern • Tremors • Muscle spasms • Irritability • Hallucinations • Dilated pupils • Seizures	• Diarrhea • Vomiting • Abdominal pain • Uncoordinated suck/swallow • Gagging	• Sweating • Fever • Yawning • Hiccups • Goosebumps/ chills • Increased secretions • Tachycardia • Tachypnea • Hypertension

To evaluate for Withdrawal, use tool on the next page. Score >3 indicates withdrawal.

• Start WAT-1 scoring from the **first day of weaning** in patients who have received opioids +/or benzodiazepines by infusion or regular dosing for prolonged periods (e.g., > 5 days). Continue twice daily scoring until 72 hours after the last dose.

WITHDRAWAL ASSESSMENT TOOL

	Date:													
	Time:													
Information from patient record, previous 12 hours														
Any loose /watery stools	No = 0 Yes = 1													
Any vomiting/wretching/gagging	No = 0 Yes = 1													
Temperature > 37.8°C	No = 0 Yes = 1													
2 minute pre-stimulus observation														
State	SBS[1] ≤ 0 or asleep/awake/calm = 0 SBS[1] ≥ +1 or awake/distressed = 1													
Tremor	None/mild = 0 Moderate/severe = 1													
Any sweating	No = 0 Yes = 1													
Uncoordinated/repetitive movement	None/mild = 0 Moderate/severe = 1													
Yawning or sneezing	None or 1 = 0 ≥2 = 1													
1 minute stimulus observation														
Startle to touch	None/mild = 0 Moderate/severe = 1													
Muscle tone	Normal = 0 Increased = 1													
Post-stimulus recovery														
Time to gain calm state (SBS[1] ≤ 0)	< 2min = 0 2 - 5min = 1 > 5 min = 2													
Total Score (0-12)														

CALCULATION FOR Narcotics TAPER

Conversion of IV morphine to enteral morphine:

The bioavailability of oral morphine is 33%. When converting morphine IV to enteral multiply the IV dose by 3.

1) Calculate the total daily dose of morphine IV in 24 hours
2) Multiply daily dose by 3 for total daily dose of enteral morphine in 24 hr
3) Divide into Q4h or Q6h dosing

___mg/24hr of morphine IV x 3 =
___mg/24hr of enteral morphine (divide into Q4-Q6h)

Conversion of IV fentanyl to IV morphine

- Fentanyl is more potent then morphine. In acute pain the conversion of morphine to fentanyl is 1:100. In the chronic situation (ie those patients who requiring weaning) the conversion is thought to be 1: 25-50.
- When changing between opioids the tolerance between opioids is not thought to be the same so hence the dosage of the new opioid should be reduced by 25-50%

1) Calculate the total daily dose of IV fentanyl
2) Convert to milligrams by dividing by 1000
3) Multiply total daily dose of fentanyl in milligrams by 25 to give total daily dose of IV morphine in milligrams.
4) Divide this into q4h – q6h dosing.

___mcg/24hr of fentanyl IV divide 1000 x 25 =
___mg/24hr of IV morphine (divide into Q4-Q6h)

Conversion of IV fentanyl to enteral morphine

___mcg/24hr of fentanyl IV divide 1000 x 25 x 3 =
___mg/24hr of enteral morphine (divide into Q4-Q6H)

Maximum Doses: IV morphine = 7.5mg /dose
Enteral morphine = 15mg/dose

CALCULATION OF DOSES FOR Benzodiazepine TAPER

Conversion of IV Midazolam to IV or PO Diazepam:

1) Calculate the total daily IV midazolam
2) Divide total daily dose by 3 to give total daily dose of IV or enteral diazepam
3) Divide total daily dose of diazepam by 4 to get Q6h dosing
4) Start diazepam and decrease IV midazolam by 50% with 1st dose IV or enteral diazepam.

____mg/24 hr of iv midazolam divide by 3 =
____mg/24hr of diazepam (div 6hr)

- Cease IV midazolam infusion with 2nd dose IV or enteral diazepam Conversion of IV diazepam to enteral diazepam
- Use a 1: 1 conversion of IV diazepam to enteral diazepam

Maximum Doses: IV/Enteral Diazepam = 10mg
Withdrawal Protocols adapted from: https://www.sickkids.ca/clinical-practice-guidelines/clinical-practice-guidelines/Export/CLINH303/Main%20Document.pdf Accessed June 15, 2020 with gratitude.

WAT-1 from Franck LS, Harris SK, Soetenga DJ, Amling JK, Curley MA. The Withdrawal Assessment Tool-1 (WAT-1): an assessment instrument for monitoring opioid and benzodiazepine withdrawal symptoms in pediatric patients. *Pediatr Crit Care Med*. 2008;9(6):573-580. doi:10.1097/PCC.0b013e31818c8328

INOTROPES/PRESSORS

Note: Give adequate volume resuscitation first. Vasopressors/ inotropes will only work if a patient is not hypovolemic. In unstable patients pressors may be started while volume is being given.

Children for whom pressors are considered to be of likely benefit must have appropriate sized blood pressure cuffs for q15 min measurement of MAP.

All drugs dosed in mcg/kg/minute should be mixed according to the rule of 6's found in front cover of the Harriet Lane. Our infusion pumps run 50cc syringes, so divide your final number in half to get the amount in 50cc

Table 4. Summary of Vasoactive Agents With Relative Receptor Affinities, Dosing, and Suggested Indications for Specific Pathology Use

	α_1	β_1	β_2	Dosing	Indication(s)
Phenylephrine	+++	-	-	0.1-5 mcg/kg/min	Vasodilatory, procedural
Norepinephrine	+++	++	-	0.05-0.5 mcg/kg/min*	septic and cardiogenic
Dopamine	-	-	-	1-3 mcg/kg/min	cardiogenic, septic, and neurogenic
	+	++	-	5-10 mcg/kg/min	
	+++	++	-	10-20 mcg/kg/min	
Epinephrine	+++	++	++	0.05-0.5 mcg/kg/min*	cardiogenic, septic, and anaphylactic
Dobutamine	+	+++	++	2.5-20 mcg/kg/min	cardiogenic & septic
Vasopressin	N/A; ↑ intracelluar Ca^2+			0.04 U/min	septic and cardiac (high cardiac output)

Key: "+" = degree of receptor effect through activation; "-" = no effect on receptor subtype; CO = cardiac output.

*There is a theoretical maximum dosing concentration, but this has not been clearly established.[45,53]

SHOCK AND APPROPRIATE PRESSORS

Type of Shock	HR	Pre load	Cardiac Contrac	Sys VR	Treatment
Hypovolemic	↑	↓↓	+/-	↑	High Flow O2 Evaluate perfusion after 30 mL/kg total volume bolused, then consider pressors
Septic (early, warm)	↑	↓↓	+/-	↓	High-flow O2 Fluids / Antibiotics Pressors (Norepinephrine epinephrine)
Septic (late, cold)	↑	↓↓	↓	↑	High-flow O2/ fluids Antibiotics Pressors (epinephrine, norepinephrine, vasopressin)
Anaphylactic	↑	↓↓	↓	↓	High-flow oxygen Epinephrine (IM) Fluid resuscitation
Neurogenic	↑	↓↓	+/-	↓↓	Fluid resuscitation Pressors (norepinephrine)
Cardiogenic	↑	↑	↓↓	↑	High-flow oxygen Fluid resuscitation (5–10 mL/kg) CHF management (CPAP/BiPAP, diuretics, ACE inhibitors) Inotropes (milrinone, dobutamine)

NOREPINEPHRINE IV Infusion

INDICATIONS FOR USE: Used for Cardiac and circulatory Failure. Stimulates Beta 1 and Beta 2 and Alpha receptors.
AVAILABLE AS: AMP 1mg/ml for 1:1000 solutions
DOCTORS ORDER: Order in mcg/kg/min with MAX/MIN MAPS
USUAL DOSE: 0.05-2 mcg/kg/min

TO PREPARE FOR USE:

1. Calculate milligrams of Norepinephrine in 100ml of NS to run at 0.1mcg/kg/min= 1ml/hr
2. Divide milligrams obtained in above equation by 2 to calculate the milligrams/50ml syringe.
3. Draw up appropriate mg of drug and add to NS to equal 50 ml total (eg if 1mg, then draw up 1ml of and add to 49 ml of NS)

Minimum rate is 0.1 ml/hr (0.01mcg/kg/min) and maximum rate is 20ml/hr (0.5mcg/kg/min)

NOREPINEPHRINE 0.05-2 MCG/KG/MIN

$$6 \times \frac{0.1 \text{ mcg/kg/min}}{1 \text{ ml/hr}} \times \text{Wt (kg)} = \frac{\text{mg drug}}{100 \text{ ml}}$$

EPINEPHRINE IV Infusion

INDICATIONS FOR USE: Used for Cardiac and circulatory Failure. Stimulates Beta 1 and Beta 2 and Alpha receptors.
AVAILABLE AS: AMP 1mg/ml for 1:1000 solutions
DOCTORS ORDER: Doc should order in mcg/kg/min with Max/Min MAPS

Usual Dose 0.01-1 mcg/kg/min

TO PREPARE FOR USE:

- Calculate milligrams of Epinephrine in 100ml of NS to run at 0.1mcg/kg/min= 1ml/hr
- Divide milligrams obtained in above equation by 2 to calculate the milligrams/50ml syringe.
- Draw up appropriate mg of drug and add to NS to equal 50 ml total (eg if 1mg, then draw up 1ml of and add to 49 ml of NS)

Minimum rate is 0.1 ml/hr (0.01mcg/kg/min) and maximum rate is 10ml/hr (1mcg/kg/min)

EPINEPHRINE 0.1-1 MCG/KG/MIN
0.01-0.5

$$6 \times \frac{0.1 \text{ mcg/kg/min}}{1 \text{ ml/hr}} \times \text{Wt (kg)} = \frac{\text{mg drug}}{100 \text{ ml}}$$

DOPAMINE IV infusion

INDICATIONS FOR USE: Used as an inotropic agent in the treatment of neonatal shock . Stimulates alpha 1, Beta 1 and Beta 2 receptors.
AVAILABLE AS: AMP 200mg/5ml solution (40mg/1ml)
DOCTORS ORDER: Doc should order in mcg/kg/min (e.g. 5mcg/kg/min to increase cardiac output)
USUAL DOSE: 2-20 mcg/kg/min

- Minimuma rate 0.5 ml/hr. Maximum rate 4 ml/hr
-

DOPAMINE 2-20 MCG/KG/MIN

$$6 \times \frac{5 \text{ mcg/kg/min}}{1 \text{ ml/hr}} \times \text{Wt (kg)} = \frac{\text{mg drug}}{100 \text{ ml}}$$

DOBUTAMINE IV Infusion

INDICATIONS FOR USE:
Used as an inotropic agent in the treatment of cardiac decomposition. Stimulates Beta 1 and Beta 2 receptors.
AVAILABLE AS: AMP 50mg/1ml solution
DOCTORS ORDER: Doc should order in mcg/kg/min with Max/min MAPS
USUAL DOSE: 2-20 mcg/kg/min
TO PREPARE FOR USE:
Draw up appropriate mg of drug and add to NS to equal 50 ml total (eg if 100mg, then draw up 2ml of dobutamine and add to 48 ml of NS)

DOBUTAMINE 2-20 MCG/KG/MIN
2.5-15

$$6 \times \frac{5 \text{ mcg/kg/min}}{1 \text{ ml/hr}} \times \text{Wt (kg)} = \frac{\text{mg drug}}{100 \text{ ml}}$$

Minimum rate should be 0.5ml/hr (2.5 mcg/kg/min) and max rate should be 4ml/hr (20mcg/kg/min)

VASOPRESSIN IV infusion

INDICATIONS FOR USE: Use for septic shock resistant to epinephrine/norepinephrine in volume optimized patients with normal cardiac function as adjunct

AVAILABLE AS: AMP 20 U/2ml (10 U/1ml)

DOCTORS ORDER: Doc should order in mcg/kg/hr (eg. 1mcg/kg/hr to attain adequate sedation)

USUAL DOSE: Neonate and younger infant 0.00017-0.008 U/Kg/min via continuous IV infusion in combination with other pressors ; Adult 0.01-0.04 U/min via continuous IV infusion

TO CALCULATE DRIP RATE: You need to know:

- DR's order e.g. 0.01 units/kg/hour
- Final concentration of drug e.g. 2units/ml
- Use the formula below to calculate mls/hr (pump rate)

TO PREPARE FOR USE:

$$50 \times \frac{\text{0.01 Units/kg/hr}}{\text{1ml/hr}} \times \text{wt (kg)} = \text{units drug / 50ml}$$

Minimum rate is 0.5 ml/hr (0.005units/kg/hr) and maximum rate is 4 ml/hr (0.04units/kg/hr)

INFUSION SUMMARY

1. **Dopamine**: 6 x [(5mcg/kg/min) / (1ml/hr)] x wt (kg) = mg/100 ml
2. **Dobutamine**: 6 x [(5mcg/kg/min) / (1ml/hr)] x wt (kg) = mg/100 ml
3. **Epinephrine**: 6 x [(0.1mcg/kg/min) / (1ml/hr)] x wt(kg) = mg/100ml
4. **Norepinephr**: 6 x [(0.1mcg/kg/min) / (1ml/hr)] x wt(kg) = mg/100ml
5. **Vasopressin**: 50 x [(0.01 units/kg/hr) / (1ml/hr)] x wt(kg) = unit/50ml
6. **Midazolam**: 6 x [(1mcg/kg/min) / (1ml/hr x wt(kg) = mg/100ml
7. **Fentanyl**: 50 x [(1 mcg/kg/hr) / (1ml/hr)] x wt(kg) = mcg/50ml
8. **Insulin**: Mix 50units/50ml. 1 ml/hr = 1unit/hr.

	Constant		Weight (KG)	Concentration	Range ml/hr
Dopamine	6 x	(5mcg/kg/min) (1ml/hr)	X Wt (kg)	X Mg/100ml	0.5-4ml/hr
Dobutamine	6 x	(5mcg/kg/min) (1ml/hr)		X Mg/100ml	0.5-4ml/hr
Epinephrine	6 x	(0.1mcg/kg/min) (1ml/hr)		X Mg/100ml	0.1-10 ml/hr
Norepinephrine	6 x	(0.1mcg/kg/min) (1ml/hr)		X Mg/100ml	0.1-20ml/hr
Vasopressin	50 x	(0.01 Units/kg/hr) (1ml/hr)		X Unit/50ml	0.5-4ml/hr
Midazolam	6 x	(1mg/kg/min) (1ml/hr)		X Mg/100ml	0.5-2ml/hr
Fentanyl	50 x	(1 mcg/kg/hr) (1ml/hr)		X Mcg/50ml	0.5-5ml/hr
Insulin		50 units in 50 ml	----------	1unit/1ml	Per weight/RBS

ELECTROLYTE CORRECTION SUMMARY

Adrenal Crisis

Hydrocortisone: 50-100 mg/m^2 IV bolus, followed by infusion in D5NS of 50-100 mg/m^2/day OR divide q4-6hr bolus dosing (Physiologic replacement 8-12 mg/m^2/day)
Dexamethasone: (initial bolus dose) – 4 mg/m^2 IV

HYPERKALEMIA Correction (EKG PEAKED T WAVES, WIDE QRS, Sine wave)

1) **Ca gluconate** 100 mg/kg (1 cc/kg) IV over 2-5 min. Adults: 500 mg to 3 mg.
2) **Sodium Bicarbonate** 1-2 meq/kg IV over 5-10 minutes (**flush IV if Ca given**!)
3) **D10** (5 mL//kg) IVmixed with **regular insulin** 0.1 U/kg
4) **Salbutamol –** 2.5-5 mg nebulized
5) **Kayexalate** 1 g/kg in 4 cc of 10% glucose PR (infants) or 10% sorbitol (child)

HYPONATREMIA Correction

For neurologic symptoms or serum Na less than 120 mEq/L – 6 mL/kg of **3% NaCl** IV over one hour will increase serum sodium by 5 mEq/L (goal 125)- see electrolyte correction sect
SIADH: (Euvolemia, Hi Urine osm, Low Serum osm, low UOP) – fluid restriction
Cerebral Salt Wasting (Hypovolemia) – Rehydration, correct Na (see below), consider florinef * consider using medcalc.org to calculate correction over 2 days

HYPOGLYCEMIA

Glucose 0.5 to 1 g/kg IV over 5 min: D10 (2.5 ml/kg Neonate; 5 mL/kg Child)
Glucose infusion rate (mg/kg/min) =[rate (ml/hr) x % dextrose x 0.166]÷wt(kg)

ELECTROLYTE ABNORMALITIES

Bicarb 0.5 – 2 mEq/kg over 5-10 min [Base Deficit x wt (kg) x 0.3] = mEq dose)

Hypocalcemia: **Ca gluconate** 50-100 mg/kg IV (0.5-1 cc/kg)- better for PIV– max dose 2g. Infuse over 30-60 min. Push if urgent. Monitor ECG for bradycardia!

Hypomag. *(presumed)* 25-50 mg/kg **MgSo4** IV over 2-4 hours x 3 doses

Hypokalemia 0.5-1 mEq/kg **KCl** IV over 1-2 hours ***(must be on monitor!);*** *in IVF*

Hyponatremia (goal Na –actual Na) x 0.6 x wt (kg) = mEq Na to be given.
3 % Saline (513mEq/L)OR 1 cc = 0.5 mEq Na.
Normal Saline (154 mEq/L OR 1 cc = 0.15 mEq Na)
Max rate increase ½ - 1 meq/L rise per hour. (medcalc.org)

Hypernatremia (Na >170 DNS, Na 155-170 ½ D10 1/2NS, Neonate: maintenance + deficit in neonate over 48-97 hours); child use medcalc.org to calculate rate.

COVID-19

SUSPECTED COVID PATIENTS:

- Respiratory Symptoms
- (Cough, respiratory distress, O2 requirement) +/- Fever

COHORTING and ISOLATION

- Suspected and confirmed COVID pediatric patients will still be cared for in Pediatric ward.
- Pediatric Patients will be cohorted together in designated room and one family member will be allowed to stay with them

OUTPATIENT TREATMENT: Stable patients with fever, cough, mild tachypnea for age, and pharyngeal erythema without malnutrition or comorbidities will be sent home without antibiotics if COVID antigen is positive.

INPATIENT TREATMENT

- Patients with cough, persistent tachypnea, and/or indrawing **AND** oxygen requirement or dehydration remain the most likely patients with COVID-19 to need admission
- If patient has signs of respiratory distress (O2 requirement, increased work of breathing, significant tachypnea with inability to feed) then they are admitted to BKCC and given Dexamethasone & supportive care.

TESTING: All admitted patients with suspicion should be tested

COMMON DRUGS: ANTIMICROBIALS

Benzyl penicillin/ penicillin G/ crystapen/ Xpen

Indication : First line antibiotics

Weight	PNA	Dose (mg/kg/day)	Interval
	<7days	50,000 - 100,000 iu	BD
<1kg	8-14	50,000-100,000iu	BD
	15-28	75,000-100,000iu	TDS
>1kg	>7 days	75,000-150,000iu	TDS
Meningitis –GBS			
<7days		250,000-400,000iu	TDS
8-28 days		450,000-500,000iu	Q4-Q6hrly
Infant/child		100,000-400,000IU	Q4-Q6hrly
Max dose		24 million units in 24 hrs	

Cefazolin

Indication -GPC antibiotics if positive and sensitive

PNA	Weight	Dose(mg/kg/day)	Interval
<7		50	BD
>7	<2kg	50	BD
	>2kg	75	TDS
Infant	Mild infxn	25-50	TDS-QID
	Severe infxn	100	TDS-QID
Max dose		6g/24hrs	

RC	GFR	Dose	Interval
80%	35-54	100%	Q8hrly
	11-34	50%	12hrly
	<10	50%	Q18-24hrly

-caution in renal failure
-no CSF penetration
-false positive urine for reducing substances and coombs test

ANTIMICROBIALS

Drug	Dose/ indications	Caution/ dose in Renal failure

AMIKACIN

Indications : Cystic fibrosis, Second line antibiotics

PCA	PNA	Dose	Interval(hrly)
29	0-7	18	48
	8-28	15	36
	>28	15	24
30-34	0-7	18	36
	>7	15	24
>35	All	15	24
Infant/child		15-22.5mg/day	Divided TDS
Max dose		1.5g/dose /30mg/kg cystic fibrosis	

RC	GFR	Dose	interval
95%	<60	Per serum levels	Q18-24hrly

-Can cause nephrotoxicity and ototoxicity
-therapeutic levels 20-30mg/l trough level 5-10mg/l, peak 20-30mg/l
-CNS penetration poor post infancy period
-drug interaction with loop diuretics – potentiates ototoxicity

AZITHROMYCIN **Oral only in KH**

Indications Atypical PNA, COVID
10mg/kg/day OD x 3/7
Or
10mg/kg STAT then 5mg/kg/day x4/7

-impaired hepatic function, use with GFR <10 limited data,
-prolonged QT interval, bradycardia, arrhythmias hypokalemia

Amoxicillin

neonate	20-30mg/kg/day BD	
Child	Standard dose	-20-50mg/kg/day BD –TDS
	High dose	80-90mg/kg/day BD-TDS

RC	GFR	Dose	interval
60%	10-30	20mg/kg	Q12hrly
	<10	20mg/kg	Q24hrly

Amoxy-clav- dosage dependent on amoxyl component

Indications Otitis media PNA
Non high dose infection 25-45 mg/day divided BD –TDS
High dose in otitis 90mg/kg/day BD-TDS

RC	GFR	Dose	interval
60%	10-30	20mg/kg	Q12hrly
	<10	20mg/kg	Q24hrly

CI in patients with history of cholestatic jaundice

Ampicillin

Indication : First line antibiotics

PNA	Weight	Dose (mg/kg/day)	Interval
<7days	<2kg	100	BD
	>2kg	150	TDS
>7days	<1.2kg	100	BD
	1.2-2kg	150	TDS
	>2kg	200	QID
Infant		100-200	TDS –QID
Meningitis		200-400	Q4–Q6hrly
Max dose		12g/24hrs	

RC	GFR	Dose	interval
90%	10-30	100%	Q8hrly
	<10	100%	Q12hrly

Cefotaxime

Indication : first line in renal failure

weight	PNA	Dose (mg/kg/day)	Interval
all	<7days	100	BD
<1 kg	8-14 days	100	BD
	15-28	150	TDS
>1kg	8-28 days	150	TDS
Meningitis	< 7 days >2kgs	100-150	TDS-QID
	>7 days, >2kgs	150-200	TDS-QID
Infant		100-200	TDS –QID
Meningitis		225-300	TDS _QID
Max dose		12g/24hrs	

RC	GFR	Dose	interval
60%	30-50	100%	Q8-12hrly
	10-29	100%	12hrly
	<10	100%	Q24hrly

- good CNS penetration
-similar to other cephalosporin

Ceftazidime

Indication : first line in renal failure

weight	PNA	Dose (mg/kg/day)	Interval
all	<7days	100	BD
<1 kg	8-14 days	100	BD
	15-28	150	TDS
>1kg	8-28 days	150	TDS
Meningitis	< 7 days	100-150	TDS-QID
	>7 days,	150	TDS-QID
Infant		100-150	TDS
Max dose		12g/24hrs	

RC	GFR	Dose	Interval
80-90%	30-50	100%	Q12hrly
	10-30	100%	Q24hrly
	<10	50%	Q24hrly

penicillin allergy
-renal impairment
-good CSF coverage
-false pos urine for reducing substances and coombs

Ceftriaxone

Indication: -first line in meningitis and PNA out of neonatal period
50-75mg/kg/day OD-BD
Meningitis 100mg/kg/day divide BD

- cause biliary sludge in neonates

Cefotaxime

Indication : first line in renal failure

weight	PNA	Dose (mg/kg/day)	Interval
all	<7days	100	BD
<1 kg	8-14 days	100	BD
	15-28	150	TDS
>1kg	8-28 days	150	TDS
Meningitis	< 7 days >2kgs	100-150	TDS-QID
	>7 days, >2kgs	150-200	TDS-QID
Infant		100-200	TDS –QID
Meningitis		225-300	TDS _QID
Max dose		12g/24hrs	

RC	GFR	Dose	interval
60%	30-50	100%	Q8-12hrly
	10-29	100%	12hrly
	<10	100%	Q24hrly

- good CNS penetration
-similar to other cephalosporin

Ceftazidime

Indication : first line in renal failure

weight	PNA	Dose (mg/kg/day)	Interval
all	<7days	100	BD
<1 kg	8-14 days	100	BD
	15-28	150	TDS
>1kg	8-28 days	150	TDS
Meningitis	< 7 days	100-150	TDS-QID
	>7 days,	150	TDS-QID
Infant		100-150	TDS
Max dose		12g/24hrs	

RC	GFR	Dose	Interval
80-90%	30-50	100%	Q12hrly
	10-30	100%	Q24hrly
	<10	50%	Q24hrly

penicillin allergy
-renal impairment
-good CSF coverage
-false pos urine for reducing substances and coombs

Ceftriaxone

Indication: -first line in meningitis & PNA out of neonatal period
50-75mg/kg/day OD-BD
Meningitis 100mg/kg/day divide BD

- cause biliary sludge in neonates

Ciprofloxacin

Indication: complicated UTI and severe infections

severe infections	PO	30-40mg/kg/day BD	
	IV	10mg/kg/day BD	
Mild/moderate infxn	PO	20mg/kg/day BD	
Complicated UTI or pyelonephritis	PO	20-40mg/kg/day BD	
	IV	18-30mg/kg/day BD	

RC	GFR	Dose	Interval
30-50%	10-29	100%	Q18hrly
	<10	100%	Q24hrly

-Caution with systemic steroids
- Don't give via feeding tubes tends to adhere to the tube

Gentamycin

Indications : Cystic fibrosis, Second line antibiotics

PCA	PNA	Dose	Interval(hrly)
<29	0-7	5	48
	8-28	4	36
	>28	4	24
30-34	0-7	4.5	36
	>7	4	24
>35	All	4	24
Infant/child		7.5mg/kg/day	Divided TDS

RC	GFR	Dose	Interval
100%	<10	standard	Per serum levels

Use cautiously in renal failure without level
Recheck of creat in 5 days of use

Fluconazole

Indications- Fungal infections

PCA	PNA	Dose (mg/kg/day)	Interval
> 29 wks	0-14	Load – 12-25mg/dose Maintenance – 6-12mg/kg/dose	48hrly
	14		24hrly
30 wks	0-7		48hrly
	< 7days		24hrly

Child IV/PO

Indication	Loading	Maintenance OD
Oropharyngeal candidiasis	6mg/kg	3mg/kg
Esophageal candidiasis	12mg/kg	6mg/kg
Invasive systemic candidiasis	12mg/kg	6-12mg/kg
Max dose	12mg/kg/24hrs	

RC	GFR	Dose	Interval
80%	10-50	50%	Q24hrly
	<10	50%	Q4hrly

Avoid in drugs with concomitant QT prolongation and drugs metabolized by CYP450 or in liver failure

Meropenem

Indication: 3rd generation antibiotic

Non CNS dosage

Weight	PNA	Dose (mg/kg/**dose**)	Interval
<2kgs	>14days	20	BD
	15-28	20	TDS
	29-60	30	TDS
>2kgs	<14days	20	TDS
	>1.2kg	30	TDS
Meningitis		40	TDS
Max dose		Max 2g/dose	

RC	GFR	Dose	interval
70%	26-50	100%	Q12hrly
	10-25	50%	12hrly
	<10	50%	Q24hrly

In CNS disease it might cause seizures

Metronidazole

Indication; amoebasis, anaerobic infection

Anaerobic infections po/iv formulations
Load 15mg/kg x 1 below are the maintenance doses

PMA	Dose (mg/kg/**dose**)	Interval
24-25 wks	7.5mg/kg/dose	OD
26-27wks	10mg/kg/dose	Q24hrly
28-33wks	7.5mg/kg/dose	BD
34-40wks	7.5mg/kg/dose	TDS
>40wks	7.5mg/kg/dose	Q6hrly

Infant /child/ Adolescent	po iv	30-50mg/kg/day 22.5-40mg/kg/day	TDS TDS
Amoebasis	Child	35-50mg/kg/day	TDS x 10 days
Giardiasis	Child	15mg/kg/day	Tds 5-7 days
Max dose		PO 2250mg IV 1500mg	

RC	GFR	Dose	Interval
15%	No data		
			May increase phenytoin toxicity

Piptazo

Indication : 3rd line antibiotic

weight	PNA	PMA	Dose (mg/kg/dose)	Interval
<2kg	<7days	all	100	TDS
	8-28 d	<30 wks	100	TDS
		>30 wks	80	QID
	29-60 d		80	QID
>2kg	<60days		80	QID
Severe infections		>2mon	80	Q4-Q6hrly
		2-9mon	80	TDS- QID
		>9mon	100	Q6-Q8hrly
Max dose			16g/24hrs	

RC	GFR	Dose	Interval
75%	30-50	50-75%	Q6hrly
	>30%	50-75%	Q8hrly
	IHD	50%	Q12hrly

Valacycovir

Indication: Herpes family

To mimic 20mg/kg/dose 4-5times a day

6-19kg	250mg TDS
20-31kg	500mg TDS
>32kg	750mg TDS

Vancomycin

Indications : 4th line antibiotics bacteremia and meningitis

PCA	PNA	Dose	Interval(hrly)
29	0-14	Bacteremia 10mg/kg/dose	18
	>14		12
30-36	0-14	Meningitis 15mg/kg/dose	12
	>14		18
37-44	0-7		12
	>7		8
>45	All		6

Infant/child

Age	General dosing	CNS/endocarditis/MRSA
1mon – 12 yrs	15mg/kg/dose Q6	20mg/kg/dose Q6
Adolescent	15mg/kg/dose QID-TDS	20mg/kg/dose QID_TDS
Max dose	1.5mg/dose /30mg/kg cystic fibrosis	

RC	GFR	Dose	interval
80-90%	<50% IHD/PD	Standard	Per serum levels

Ototoxicity and nephrotoxicity esp with concurrent aminoglycoside use

COMMON DRUGS: GI and AMINOPHYLLINE

Ondansentron

Vomiting, post chemo, post op vomiting
Normal dosage 0.15mg/kg/dose max dose 0.3mg/kg or 4mg if below 15kg

EKG monitoring in patients with electrolyte anomalies ,CHF and bradyarrythmias

Omeprazole

esophagitis , GERD or ulcers
Start 1mg/kg/day max dose 20mg/day
Reported effective range 0.2-3.5mg/kg/day

3-<5kg	2.5mg	OD
5-<10kg	5mg	OD
10-<20kg	10mg	OD
>20kg	20mg	OD

Aminophylline

Neonatal apnea off label in renal failure

Apneas : load 5-8mg/kg/dose maintenance 5mg/kg/day BD

Renal failure 2mg/kg/day BD

Asthma load 6mg/kg for maintenance drip confirm with harriet lane

ANTIPYRETICS

Ibuprofen	**Indication for pain and PDA closure** 10mg/kg/dose Q6-Q12hrly max dose 40mg/kg/day	Avoid in renal failure Avoid in bleeding problems or GI bleeds
Paracetamol	**Indication PDA closure , fever and pain** 15mg/kg/dose Q4-Q6 max dose 60-75mg/kg/day	Avoid in hepatic failure

COMMON MEDS: ANTISEIZURE MEDS

Antiseizures						
Diazepam	Sedative	Child	0.04mg/kg/dose Q2-Q4 IM/IV 0.12mg-0.8mg/kg PO Q6-Q8hrly			-may cause hypotension and resp depression, for drug interaction confirm with harriet lane
	Status Epilepticus	neonate	0.3-0.75mg/kg/dose IV	15-30mins 2-3 doses	Max total dose 2mg total	
		Child	0.2-0.5mg /kg/dose	15-30mins 2-3 doses		
Levirataracetam/keppra	**Load** 40mg/kg/dose					caution with renal impairment personality change in longterm use
	Maintenance					
	1-5mo	Start 7mg/kg/dayBD increase 7mg.kg/dose 2weekly		average daily dose 21mg/kg/day		
	6mo - 3yrs	Start 10mg/kg/dose BD increase 10mg/kg/dose 2 weekly		average daily dose - 25mg/kg/day		
	4-15yrs	Start 10mg/kg/dose BD increase 10mg/kg/dose 2 weekly		average daily dose - 30mg/kg/day		
Phenytoin	Load 15-20mg/kg **max** 1500mg/					-avoid in patients with heart block and sinus bradycardia -may cause cardiovascular collapse if given at > mg/kg/min
	Maintenance					
	Neonate	4-8mg/kg/day		BD		
	Infant	8-10mg/kg/day		BD-TDS		
	6 m-3yr	10mg/kg/day		BD-TDS		
	4-6yr	7.5-9 mg/kg/day		BD-TDS		
	7-16yrs	6-8 mg/kg/day		BD-TDS		
	Antiarrythmic-digoxin toxicity	Load 1.25mg/kg IV Q5min to total of 15mg/kg				
		Maintenance 5-10mg/kg/day BD-TDS				
Phenobarbitone	Load 15mg/kg **max** 1000mg **additional** 5mg/kg/dose Q15-30min **max total** 40mg/kg					may cause resp depression and hypotension IV if given too fast -can cause hepatic failure
	Maintenance					
	Neonate	3-5mg/kg/day		OD-BD		
	Infant	5-6mg/kg/day		OD-BD		
	1-5yrs	6-8mg/kg/day		OD-BD		
	6-12yrs	4-6 mg/kg/day		OD-BD		
	>12yrs	1-3 mg/kg/day		OD-BD		
	hyperbilirubinemia	3-8 mg/kg/day		BD-TDS		
Sodium valproate	**PO** initial 10-15mg/kg/day OD-TDS increase 5-10mg/kg/day weekly **max** 60mg/kg/day					dose related thrombocytopenia, hepatitis and suicidal behaviours
	Maintenance 30-60mg/kg/day **BD-TDS**					
	RECTAL	**LOAD** 20mg/kg/dose – **prep 1:1 ratio with saline for syr**				
		Maintenance :10-15mg/mg/dose Q8hrly				

COMMON MEDS:
Steroids/Endocrine/Asthmatic

ANTI-ASTHMATICS		
Salbutamol	MDI has 0.6mg per puff 4-6 puffs inhaler 4-6breaths upto 2 doses 0.15mg/kg/dose – **max** 2.5mg (<5yrs) 5mg (>5yrs)	,consider cardiac monitoring and serum potassium levels in high doses
Magnesium sulphate	**Adjuvant in severe airway reactive airway disease excercebation** Child 25-75mg/kg/dose over 20mins **max dose** 2g	Beware of hypotension, resp depression and complete heart block. Ca gluconate as antidote Caution in renal failure or use of digoxin
Prednisone	**Acute asthma** – 1-2mg/kg/day x 5-7 days Benefit for taper above 7 days of use **Anti-inflammatory** – 0.5-2mg/kg/day OD-BD	
Ipratropium	Best used on 24hrs on excercerbation <12yrs 200-500mcg/dose (4-8 puffs) Q20 mins then Q2-4hrly PRN >12yrs 500mcg/dose (8 puffs) Q20min then Q2-4hrly PRN	- caution with narrow angle glaucoma and bladder neck obstruction

Dexamethasone			*avoid in active untreated infections*
	Airway oedema	*0.5-2mg/kg/day QID (24 hours before extubation and continue 4-6 doses after extubation)*	
	Croup	*0.6mg/kg/dose IV/PO/IM X1*	
	Antiemetic - chemo	*Initial 10mg/m2* ***max*** *20mg* *Maintenance 5mg/m2/dose Q6 IV*	
	Brain tumour associated cerebral oedema	*Load : 1-2mg/kg/dose X1* *Maintenance : 1-1.5mg/kg/day Q4-Q6hrly*	
	****Max dose** – 16mg/24hrs*		

Hydrocortisone				
	Status asthamaticus			
	Load	4.8mg/kg/ **max dose** 250mg dose IV		
	Maintenance	8mg/kg/day Q6 IV		
	Anti-inflammatory/immunosuppressive			
	Child	Po 2.5-10mg/kg/day BD-TDS	IV/IM 1-5mg/kg/day OD-BD	
	Adrenal insufficiency			
	Acute adrenal crisis	50mg/m2 bolus followed by 50mg/m2/day continuous drip vs Q3-Q4 doses		
	Maintenance	25-100mg/m2/day BD-Q4 hrly		
Thyroxine	1-3 mo	10-15mcg/kg/day OD		Contraindicated in MI, untreated adrenal insufficiency
	3-6 mo	8-10mcg/kg/day OD		
	6-12 mo	6-8mcg/kg/day OD		
	1-5yrs	5-6mcg/kg/day OD		
	6-12yrs	6mcg/kg/day OD		
	>12yrs	4-5mcg/kg/day OD		

#s FOR CONSULTATION / REFERRAL

KIJABE COVERAGE NURSE 24/7
0787 145 122 / 0711 959 139

CARDIOLOGY
Dr Jowi
office landline 020 2710062
office cell 0722 200 512
Hurlingham Heart Clinic
5th Avenue House, 2nd floor
5th Avenue Road, off Ngong Road
Dr Gachara
0733 419 500 (KNH)
Mater Hospital cardiac surg program
Victoria 0721 886 518

ENDOCRINOLOGY
Joyce Mbogo- 0731226927

PULMONOLOGY
Dr Waris -0733725972
Oxygen nurse Saulo-0720426830

ENT
David Nolen 0708 994 544
Audio Tech Jonathan 0723 652 822

GASTROENTEROLOGY
Aga khan Clinic appt 0724 940 616

INFECTIOUS DISEASES
Infection Control Nurse Ginny Barnett
0717 226 771

KENYATTA HOSPITAL MAIN LINES
0722 829 500 020 2726300

Kenyatta NICU
0722 829500 0722 829501
0722 829502

LAB
Lancet 0736 493 100, 0729 111 110

NAIVASHA AIC
0733 422 346

NEEDY CHILDREN
Kijabe Needy Children's Fund
- Dennis 0709 728 235

Mater Hospital Cardiac Surg Program
Victoria 0721 886 518
Finance office 0722 623 110

NUTRITION
Irene 0702 606 878

PHARMACY
Kijabe Inpatient 020 324 6295

SECURITY
020 3246377
Police 020 324610