

Republic of Botswana
MINISTRY OF HEALTH

CLINICAL MANAGEMENT GUIDELINES FOR NEONATAL CARE

2022
1ST EDITION

MANUAL FOR HEALTH CARE WORKERS PROVIDING
NEONATAL CARE SERVICES IN BOTSWANA

unicef 
for every child



World Health
Organization

SCOPE

The guidelines are intended for use by all health care workers providing care to neonates in Botswana.

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Please use this document in conjunction with the WHO's recently issued guidelines and training materials:

- WHO recommendations for care of the preterm or low-birth-weight infant: <https://apps.who.int/iris/bitstream/handle/10665/363697/9789240058262-eng.pdf?sequence=1&isAllowed=y>
- Standards for improving the quality of care for small and sick newborns in health facilities: <https://www.who.int/publications/item/9789240010765>
- Essential Newborn Care Course: <https://www.who.int/tools/essential-newborn-care-training-course>

DISCLAIMER "Although this document was compiled by practitioners experienced in the care of the newborn and despite the efforts involved in ensuring that the document is accurate and up to date, the user is urged to use best clinical judgement in applying these guidelines. The user is advised to cross check the information contained in this manual with published reference materials."

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ABBREVIATIONS

AAP	American Association of Pediatrics
AHA	American Heart Association
AKI	Acute Kidney Injury
ARDS	Acute Respiratory Distress Syndrome
ARF	Acute Renal Failure
ASD	Atrial Septal Defect
BCG	Bacille Calmette-Guerin
BDG	Beta D-Glucan
BP	Blood Pressure
BPD	Broncho Pulmonary Dysplasia
Bpm	Breaths per Minute
CNS	Central Nervous System
CM	Centimeters
CRP	C-Reactive Protein
CS	Cesarian Section
CSF	Cerebrospinal Fluid
EEG	Electro Encephalogram
ELBW	Extremely Low Birth Weight
EONS	Early Onset of Neonatal Sepsis
FBC	Full Blood Count
g	Grams
Hep B	Hepatitis B
HIE	Hypoxic Ischaemic Encephalopathy
HIHI	Hyper Insulinaemic Hypoglycaemia of Infancy
HR	Heart Rate
HTI	Health Training Institutions
IPC	Infection Prevention and Control
IU	International Units
IUGR	Intra-Uterine Growth Restriction
IV	Intravenous
IVF	Intravenous Fluids
Kg	Kilograms
KMC	Kangaroo Mother Care
LBW	Low Birth Weight
LFTs	Liver Function Tests
LONS	Late Onset of Neonatal Sepsis
MCS	Microscopy, Culture and Sensitivity
MLS	Milliliters
MOH	Ministry of Health
MVT	Multivitamin
NEC	Necrotizing Enterocolitis
NGT	Nasogastric Tube
NPO	Nil per Os (nil orally)
PCR	Protein Chain Reaction
PDA	Patent Ductus Arteriosus
PCT	Procalcitonin
PMTCT	Prevention of Mother to Child Transmissions
PNA	Postnatal Age
PPHN	Persistent Pulmonary Hypertension of the Newborn
PPV	Positive Pressure Ventilation
RDS	Respiratory Distress Syndrome
RFTs	Renal Function Tests
RPR	Rapid Plasma Reagin
TB	Tuberculosis
TNE	Thermoneutral Environment
UNICEF	United Nations Children's Fund
VDRL	Venereal Disease Research Laboratory
VSD	Ventricular Septal Defect
WHO	World Health Organisation

FOREWORD

According to Statistics Botswana, the past decade has seen our nation make significant progress in the reduction of deaths of children under the age of five, from 74 for every 1000 live births to 28 for every 1000 live births between 2001 and 2011. However, reduction in neonatal deaths has been slow and contributes significantly to the under-five mortality in Botswana. It is therefore crucial that reduction in neonatal deaths be accelerated.

This document provides clinical guidance for use by the doctors, registered nurses, nurse-midwives, and other health care workers who are responsible for the care of neonates at all levels of the health care system in Botswana. The clinical conditions included in this manual were selected based on the commonest causes of neonatal morbidity and mortality in Botswana.

The guidelines were developed and reviewed through an extensive consultative process, which included pediatricians, nurse/ midwives, District Health Management Teams (DHMTs), professional regulatory bodies, Health Training Institutions (HTIs), and partners involved in maternal and newborn health care. The newborn technical working group led by the Ministry of Health (MOH) brought together current evidence-based knowledge, in an effort to provide the highest quality of health care to the public.

The Ministry of Health is committed to ensuring that these guidelines are implemented and adhered to by all clinicians entrusted with the delivery of quality neonatal health care services across health facilities in Botswana.

In conclusion, I urge all clinicians to acquaint themselves with these guidelines and utilize them as reference in the provision of quality neonatal health care services at all our health facilities to reduce neonatal morbidity and mortality in Botswana. Finally, let us all ensure that 'ALL NEWBORNS SURVIVE!'

Thank you.



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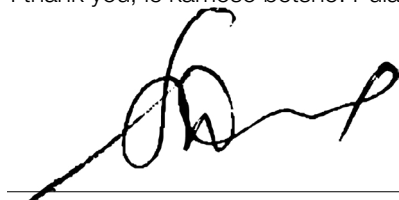
My sincere gratitude is extended to the National Multi-sectoral Technical Working Group (TWG) for their colossal contributions to the development of this invaluable strategic document from its inception in 2017 to completion in 2022. The team, led by Ministry of Health, was made up of clinicians (paediatricians, nurses, midwives) from public and private health facilities, representatives from health professions' regulatory bodies, Health Training Institutions as well as from UN family (WHO and UNICEF Country offices). These included namely: Ms Mabole Masweu, Ms Ruth M Sejese, Ms Rosa Sefako (May her soul rest in peace), Dr Thabiso Mogotsi, Ms Zanele Busang, Ms Lucy Sejo Maribe, Ms Ogar Rapinyana, Ms Irene Pelaelo, Ms Baletlanye Olefile, Dr Seeletso Nchingane, Ms Lindiwe Sebolokelo, Ms Siakhile Nelson, Ms Kgomotso Serefentse, Ms Boineelo Babolayi, Ms Gorataone Montsho, Dr Shiban Madan, Mr Tirelo Bathobakae, Ms Mmapula Mmolotsi, Ms Boineelo Ketshabathupa, Dr Pranab Bakshi, Ms Leah Meyer, Mr Mosimanegape Leburu, Ms Tobokani, Mr Thabo Balone, Ms Jessica Mafa-Setswalo, Ms Kebaagetse Sekwakwa, Dr Oaitse Wally, Dr Ishmael Makone, Dr Pretty Setlhake, Ms Dimpho Motsamai, Ms Tsholofelo Sello, Ms Abea Ratanang, Mr Onalethata Nkosi, Ms Taboka Silas, Ms Omphemetse Mmunyane, Dr Lisani Ntoni, Ms Tswelelo Yvonne Morgan, Mr Kabo Komanyane, Mr Tshepo M. Rakereng, and from the University of Pretoria Dr Anne-Marie Bergh and Dr Elise Van Rooyen.

Your dedication to the development and review of the guidelines has not gone unnoticed. We really appreciate your expertise and dedication towards ensuring that finally there is guidance in the provision of the highest quality neonatal health care services in health facilities in Botswana! Indeed, this is a ground-breaking milestone that will guide health care providers in contributing to reduction in neonatal mortalities which had been a long standing challenge in our health care system.

To the DHMTs and partners who are implementing neonatal health services, we would like to thank you not only for releasing officers to participate in the development of these operational and clinical guidelines, but for continuing to serve neonates with grace and fortitude in the ever-evolving dynamics of life and health service delivery. You are the reason why these guidelines were conceived and finally delivered. Indeed, you have been a voice for the voiceless!

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I thank you, le kamoso betsho. Pula!



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01. ROUTINE CARE OF ALL NEWBORNS

Most newborns require no intervention at birth other than routine normal care. If this is done well, it vastly reduces the likelihood of problems.



1.1 Personnel and equipment to be present at delivery

- At least one health provider trained in neonatal resuscitation must be physically available at the time of birth of all newborns irrespective of risk status (high or low).
NB: There is need to have well established neonatal resuscitation training throughout the country with certification.
- If the delivery is anticipated to be of high risk, advanced neonatal resuscitation may be required. In these cases, at least 2 persons trained in neonatal resuscitation should be present to manage the neonate.
- The resuscitation must be performed within the warm delivery room.
- The health professional designated to care for the neonate at birth should check the equipment for resuscitation preparedness, (**Refer to Resuscitation Equipment in Chapter 2.3**) at the birthing place well in time before the neonate is delivered.



1.2 Care of the newborn after delivery

After the initial assessment (**See Chapter 4**) and the neonate does not require resuscitation, do the following:

- Dry the neonate with a clean dry towel whilst the neonate is placed skin-to-skin on the mother's chest.
- Cover the neonate with a warm, dry cloth and a cap and keep skin-to-skin for at least 1 - 2 hours.
- Continue monitoring the condition and vital signs of the neonate.
- If the neonate is stable wait for at least 1 minute and up to 3 minutes or wait for cessation of the cord pulsation to clamp and cut the cord.
- Check APGAR score at 1, 5 and 10 minutes.
- Confirm the identity and label the neonate.
- Initiate breastfeeding within the first 30 minutes to 1 hour.
- Check vital signs every 15 minutes for the first hour and then half hourly for the next hour (temperature, heart rate, respiration rate and effort). Please refer to the obstetric chart on the management of the 4th stage of delivery.
- Apply eye care prophylaxis (Tetracycline eye ointment).
- Give 1mg Vitamin K intramuscularly for all neonates
- Weigh the neonate, measure the length and head circumference.
- Document all care provided and complete all necessary registers.
- Transfer and hand over the mother and warm neonate to the postnatal ward after two (2) hours.
- A complete newborn examination should be performed and documented before discharge.
- Assess whether neonate is passing urine and stool in the first 24 hours.
- Give BCG and Hepatitis B vaccines within the first 24 hours.
- Keep the umbilical cord clean and dry.

NB: The Newborn should be kept warm throughout and document



02. NEONATAL RESUSCITATION

Spontaneous establishment of respirations immediately after delivery is essential. Approximately 10% of newborns require some assistance to begin breathing at birth. Less than 1% need extensive resuscitative measures to survive.

2.1 Risk factors

Table 1 : Risk Factors

ANTEPARTUM FACTORS	FOETAL FACTORS	INTRAPARTUM FACTORS
- Gestational diabetes - Hypertensive disorders of pregnancy - Cardiac Conditions - Antepartum haemorrhage - Maternal infections - Maternal co-morbidities - Poly/Oligohydramnios - Premature rupture of membranes - Maternal substance abuse - Maternal medical use of drugs e.g. MgSO₄ - Advanced maternal age (>35years) - Lack of antenatal care (non/late booker)	- Isoimmunization/Hydrops fetalis - Poly/Oligohydramnios - Post term gestation - Multiple gestation - Foetal malformation/anomalies - Foetal distress - Size-dates discrepancy (small/large for gestation)	- Instrumental deliveries - Emergency Caesarean-Sections - Abnormal presentation - Precipitous or prolonged labour - Use of general anaesthesia - Prolapsed cord

2.2 Preparation for resuscitation

- Always have resuscitation equipment ready.
- When significant resuscitation is anticipated after a review of the risk factors stated above, it is important to have additional personnel present.
- It is important to have additional personnel present who has acquired the skills and received thorough training in neonatal resuscitation.

2.3 Resuscitation equipment

- Suction equipment**
- Mechanical suction machine and tubes**
 - Closed suction catheters
 - meconium aspirators
- Suction pack, including**
 - Sterile gauze
 - Cotton swabs
 - Gali pot
 - Bulb syringe
 - Suction catheter of varying sizes
- Device for delivering positive pressure ventilation**
 - Bag-mask with reservoir ventilation equipment
 - Face masks of varying sizes
 - Neonatal nasal prongs
- Compressed medical air, oxygen source and blender
- Pulse oximeter and probes
- Intubation equipment**
 - Laryngoscopes with different blade types and sizes.
 - Extra lightbulbs and spare batteries
 - Endotracheal tubes of varying sizes
 - Stylet (optional)

- Adhesive tape for securing devices
- Scissors
- Laryngeal-mask airway
- Oro-pharyngeal airways
- Umbilical vessel catheterization equipment and supplies
- **Umbilical vessel catheterization pack**
 - Sterile gloves
 - Anti-septic prep solution
 - Umbilical venous and arterial catheters and tapes
 - 3-way stop cock
 - Needles of various sizes
 - 2.0- 3.0 non- absorbable suture
- Intravenous catheterization equipment
- Medication
 - Epinephrine (adrenaline) (1:10,000).

NB: If an ampoule with epinephrine (1:10,000) dilution is not available, then the solution can be prepared by diluting the 1mg/1ml (1:1000) ampoule as follows: Draw up 1 ml from the ampoule into a 10 ml syringe and mix it with 9mls of normal saline. This solution provides a 1:10,000 epinephrine solution.

- Isotonic crystalloid solution
 - Normal saline or Ringer's lactate
- Dextrose 10% solution
- **Miscellaneous**
 - Pre-heated radiant warmer and a functioning temperature probe or other heat sources
 - Plastic wrap for neonates
 - Firm padded resuscitation surface
 - Warmed linen
 - Stethoscope
 - Clock
 - Appropriate personal protective equipment (PPE)
 - Transport incubator

2.4 Resuscitation

The resuscitation steps generally follow the neonatal resuscitation program according to the American Association of Paediatrics (AAP) and American Heart Association (AHA) guidelines. (*Refer Appendix 1*)

After initial assessment, if the neonate requires resuscitation, CALL FOR HELP, then proceed with the following steps.



1

- Warm the neonate, clear the airway if necessary, thoroughly dry and stimulate neonate (by gently rubbing the back). This should be done within 30 seconds.
- Suctioning of mouth or nose is not recommended in neonates born through clear liquor or meconium-stained liquor, who start breathing on their own.
- In neonates born through meconium-stained amniotic fluid who do not start breathing on their own, suctioning of the mouth and nose should be done before initiating positive pressure ventilation.

NB: Routine suctioning in the presence of meconium-stained liquor is no longer advised.

2

- Evaluate the breathing and heart rate, if abnormal (apnoea, gasping, or heart below 100bpm) then
- Provide PPV (positive pressure ventilation).
- Monitor oxygen saturation.

3

- After 30seconds, re-evaluate HR, if still below 100bpm then perform ventilator corrective measures (Mask adjustment, repositioning of the airway, suctioning the mouth and nose, opening mouth, increasing pressure and placing an alternate airway such as an endotracheal tube) and continue PPV.

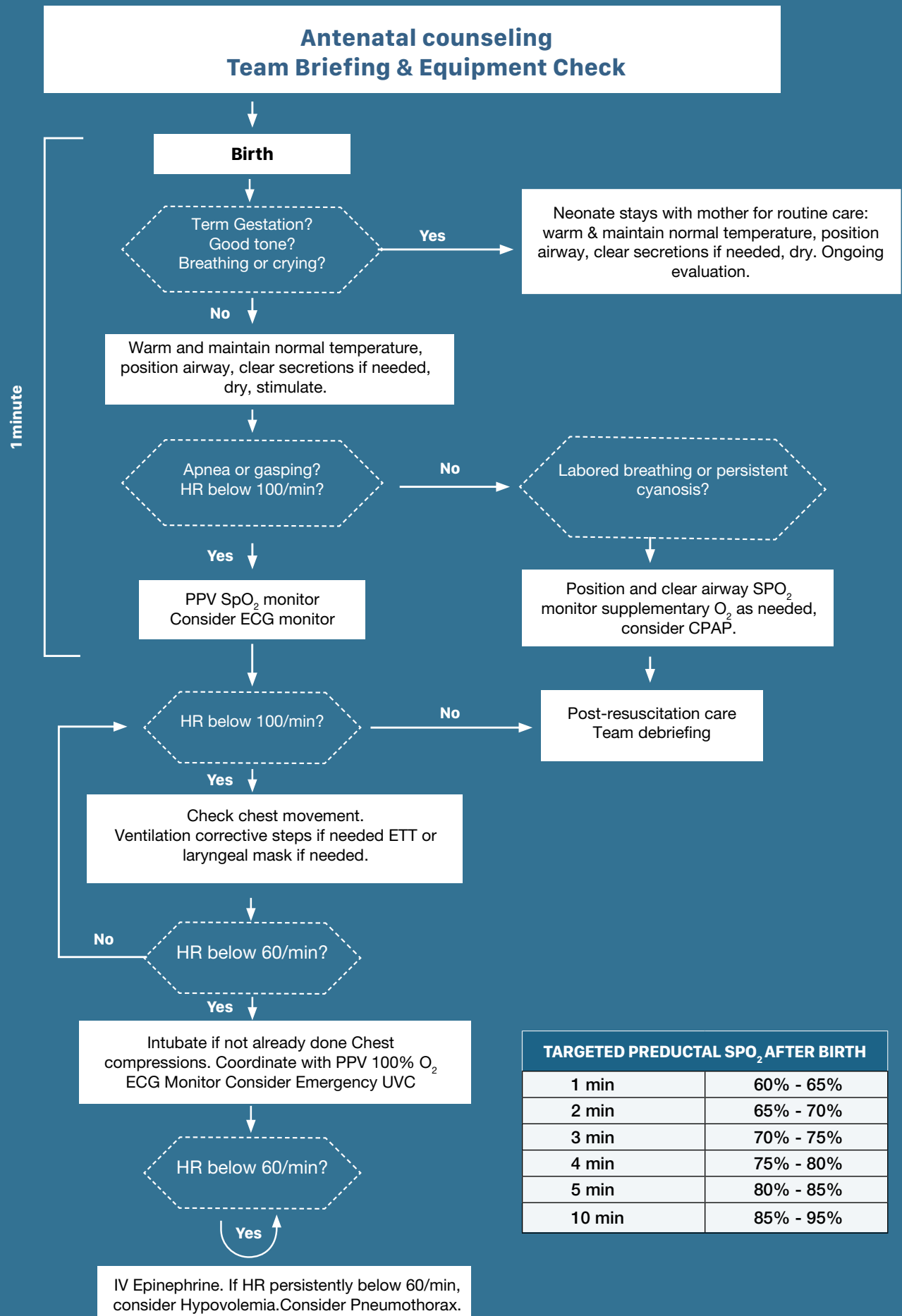
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- Re-evaluate after 30 seconds, if HR <60bpm, then consider intubation if the health worker has the skill to safely perform the intervention
- Start chest compressions, coordinated with PPV using 100% O₂
- Consider inserting emergency umbilical vein catheter (UVC) or alternatively perform intra-venous catheterization

5

- Re-evaluate after 45-60 seconds of effective chest compressions and ventilation. If HR still below 60bpm then:
- Give IV epinephrine while continuing chest compressions and ventilation and consider possible causes of bradycardia
- For a detailed neonatal resuscitation algorithm. (*Refer to the Appendix 1*)

Figure 1: Neonatal resuscitation algorithm (AAP/AHA-From Up to date)



2.5 Post-resuscitation care

Neonates who required resuscitation are at risk of developing post-resuscitative complications. Longer and extended resuscitations are often associated with serious subsequent complications.

Neonates should be observed closely in the neonatal intensive care/neonatal unit or a monitored triage-order for signs of further deterioration or possible complications that may include:

- Hypo/hyperthermia
- Hypoglycaemia
- Central nervous system complications such as apnoea, seizures or Hypoxic Ischemic Encephalopathy (HIE) complications
- Pulmonary complications such as persistent pulmonary hypertension (PPHN), pneumonia, pulmonary air-leaks, transient tachypnoea of the newborn, pneumothorax
- Hypotension
- Renal dysfunction and electrolyte abnormalities
- Feeding difficulties such as Ileus, gastrointestinal bleeding, dysfunctional sucking-swallowing

2.6 Cessation of resuscitation

Resuscitation may be discontinued if:

- After 10 minutes of effective resuscitation the heart rate remains zero.
- After 20 minutes of effective resuscitation, the neonate remains apnoeic and bradycardic (heart rate less than 60 bpm).

Record the event and explain to the mother or parents in a kind and respectful tone. Give them the neonate to hold if they so wish.



03. ROUTINE CARE OF ALL NEWBORNS DURING ADMISSION AND DISCHARGE

3.1 Admission and care

Strict adherence to universal infection prevention and control (IPC) should be followed when caring for all newborns.

- Ensure that the neonate is correctly identified and has a visible identification tag on.
- Conduct a full physical examination of a neonate and document findings.
- Promote feeding from birth
- Check vital signs (temperature, heart rate, respiratory rate) frequently, e.g, six (6) hourly.
- Check for danger signs such as: respiratory distress, hypothermia, fever, poor feeding, convulsions, drowsiness, floppiness, jaundice, and bleeding from the cord. Instruct, educate and make the mothers aware of these danger signs.
- Prompt appropriate measures should be taken if any abnormal vital signs or danger signs are present, including measurement of blood sugar. Bathing the neonate should be delayed for 48-72 hours.
- For prolonged hospital stay, regular weight measurements should be taken every second (2nd) day. Assess the urine and stool excretion pattern (the regular passing of urine and stools).
- Keep neonate warm by covering the neonate with dry clothes and a cap or keep in skin-to-skin position (KMC).
- Advise the mother on appropriate feeding practices such as feeding on demand and to feed every 3-4 hours (at least 7-8 feeds per day).
- Teach the mother the correct positioning of neonate on the breast, attachment and effective suckling of the neonate.
- Administer immunizations: BCG, and hepatitis B according to Expanded Programme on Immunization (EPI) guidelines.
- Assess the neonate's exposure to HIV, hepatitis B, TB and syphilis; follow the appropriate guidelines.
- Document all care provided.

3.2 Discharge

- Conduct a full physical examination of the neonate and document findings.
- Give health education to the mother on the danger signs such as: convulsions, poor feeding, fever, hypothermia, drowsiness or unresponsiveness, lethargy, cyanosis, respiratory distress and jaundice.

NB: If any of these signs are present, the mother should seek medical care as soon as possible.

- General hygiene of the mother and neonate.
- Advise mother to keep the umbilical cord stump clean and dry.
- Advice about appropriate feeding practices.
- Initiate family planning services (educate, counsel and initiate/ provide)
- Continue PMTCT services.
- Decision for discharge is made jointly with the family and the health care provider based upon a satisfactory assessment that the neonate is ready for discharge. As part of the discharge procedure, the mother (family) must be counselled about the well-being of the neonate, follow-ups and when to seek medical attention.
- Advise mother on postnatal follow-up and registration and collection of neonate's birth certificate.
- Educate the mother on the use of over-the-counter medication.
- Document all details in the child's welfare clinic card.

04. ASSESSMENT AND IMMEDIATE MANAGEMENT OF ALL NEONATES ON ADMISSION

Always follow infection prevention principles and practices when examining and treating neonates:

- Assess every neonate for emergency signs as soon as the neonate arrives.
- A triage tool does not replace thorough clinical examination to make a diagnosis but is a screening tool to identify problems that require immediate attention. All newborns should be reviewed immediately upon arrival by a health care worker.

4.1 Triage

The triage concept is used to identify emergencies. This is a logical and quick way of identifying how sick a child is, and categorizing them in one of the following groups, each with a recommended action:

Table 2: Triage Categories and Recommended Actions

CATEGORIES AFTER TRIAGE	ACTION REQUIRED
Emergency Cases	Need Emergency Treatment
Priority Cases	Need Assessment & Rapid Action
Non-Urgent Cases	Need Assessment

In triaging neonates, it is necessary to assess the airway, breathing, circulation, neurological, and hydration status. Perform Immediate appropriate interventions and thereafter re-evaluate the patient's response to the treatment. Each triage category is identified by specific signs and symptoms

Table 3: Triage Categories and Signs

EMERGENCY CASES	• Hypothermia (temp<36 °C) • Apnoea or gasping respiration • Severe respiratory distress (rate>60bpm with chest retractions and/or grunting) • Central cyanosis • Bleeding from any site • Shock (cold peripheries, capillary refill time >3secs, weak & fast pulse) • Coma, convulsions or encephalopathy NB: The neonates with emergency (danger) signs are at high risk of collapsing and require urgent intervention and emergency measures.
PRIORITY CASES	• Low birth weight neonate (<2500gms) • Poor weight gain or weight loss • Respiratory distress (rate>60 without retractions or grunting) • Irritable/restless/jittery • Refusal to feed • Abdominal distension • Jaundice • Pallor • Major congenital malformations • Big neonate - macrosomia (large for gestational neonate) NB: The neonates with priority signs are sick and need immediate assessment, management and treatment.
NON-URGENT CASES	• Transitional stools • Developmental peculiarities • Minor birth trauma • Possetting (regurgitation of small quantities of undigested milk following a feed) • Superficial infections • Minor malformations • All cases not categorized as emergency or priority NB: • The site at the facility where a neonate is first brought to should be the triaging area. All the staff involved in the initial management of a child should be trained in the triaging process. • After emergency treatment, the neonate is further examined to establish a diagnosis and proceed with appropriate management.

05. PERINATAL ASPHYXIA MANAGEMENT

Perinatal asphyxia is a common neonatal problem and contributes significantly to neonatal morbidity and mortality worldwide.

Ninety percent (90%) of asphyxial insults occur in the antepartum or intrapartum periods because of lack of oxygen and/or perfusion to vital organs. As a major concern in perinatal asphyxia, hypoxic ischaemic encephalopathy (HIE) will be the focus of these guidelines.



DEFINITIONS

Perinatal asphyxia: A condition of impaired blood gas exchange occurring before, during or after birth.

Neonatal depression: The condition of any newborn showing a prolonged transition from intrauterine to extrauterine life, in the immediate postnatal period. It presents clinically as depressed neonatal mental status, muscle hypotonia, disturbances in spontaneous respiration and cardiovascular function within the first hour of life.

Neonatal encephalopathy: It is an heterogeneous, clinically defined syndrome characterized by disturbed neurologic function in the earliest days of life in an neonate born at or beyond 35 weeks of gestation, manifested by a reduced level of consciousness or seizures, often accompanied by difficulty with initiating and maintaining respiration, and by depression of tone and reflexes.

Given that the underlying nature of brain injury causing neurologic impairment in a newborn is often poorly understood, "neonatal encephalopathy" has emerged as the preferred term to describe the clinical syndrome of central nervous system dysfunction in the newborn period because it does not imply a specific underlying etiology or pathophysiology.

Hypoxic-ischaemic Encephalopathy (HIE): Lack of oxygen to the brain causing ischaemia, resulting in encephalopathy. The term such as HIE should only be used if a clear sentinel event for example a prolapsed cord or proof of placental disruption. Otherwise, the term, neonatal encephalopathy should be used. (Molloy 2018, Damman 2011)

HIE also presents with evidence of multiorgan dysfunction. However, there must be objective proof such as clinical, biochemical, electrophysiological, radiological, or pathological abnormalities (post-mortem) in order to use the term HIE.

5.1 Risk factors for Perinatal Asphyxia

Table 4: Risk Factors for Perinatal Asphyxia

	MATERNAL FACTORS	FOETAL FACTORS
ANTENATAL	Chronic conditions Hypertension (PET) Diabetes mellitus Substance abuse Arteries placenta praevia	Infections Intra-uterine growth restriction (IUGR) Placental disfunction Abnormal umbilical arteries
INTRAPARTUM	Traumatic delivery Cord prolapse Cord around neck or knotted Uterine rupture Shoulder dystocia Prolonged second stage of labour	Breech delivery Foetal distress Prematurity Post maturity Congenital heart failure (hydrops)
POST PARTUM		Meconium aspiration Persistent Pulmonary Hypertension of the Newborn Respiratory distress Neonatal depression Foetal bleeding

5.2 Diagnosis of HIE

Consider neonatal encephalopathy in any neonate born depressed and with an abnormal neurological examination in the first few hours of life. Use the term **HIE** only if there is clear evidence of **hypoxic and/or ischaemic injury** during the perinatal period.

The following features suggest a hypoxic and/or ischaemic injury during the perinatal or intrapartum period:

- Umbilical artery metabolic or mixed acidaemia (pH < 7)
- Persistence of an Apgar score of 0-3 for longer than 5 minutes
- Examination findings consistent with mild/moderate/severe encephalopathy (*See Table 5: Thompson Score*)
- Multiple organ involvement (e.g., AKI, ARDS, PPHN, NEC, acute hepatitis,)

NB: For practical and convenient purpose, Thompson Scoring has been adopted for use with these guidelines.

Table 5: Thompson Score

CATEGORY	SIGNS OF HIE			
	NORMAL	MILD	MODERATE	SEVERE
Level of Consciousness	0	Hyperalert, stare +1	Lethargic +2	Comatose +3
Posture	0	Fisting/ Cycling +1	Strong Distal Flexion +2	Decerebrate +3
Tone	0	Hyper +1	Hypo +2	Flaccid +3
Primitive Reflexes				
• Moro	0	Partial +1	Absent +2	
• Grasp	0	Poor +1	Absent +2	
• Sucking	0	Poor +1	Absent/ Bites +2	
Respiration	0	Hyperventilation +1	Brief Apnoea +2	Apnoea Needing IPPV +3
Fontanel	0	Not Full Tense +1	Tense (+2)	
Fits	0	Infrequent <3/day (+1)	Frequent >2/ day (+2)	

Bhagwani DK, Sharma M, Dolker S, Kothapalli S. To Study the Correlation of Thompson Scoring in Predicting Early Neonatal Outcome in Post Asphyxiated Term Neonates. J Clin Diagn Res. 2016;10(11):SC16-SC19. doi:10.7860/JCDR/2016/22896.8882

The final score sums the individual points and is interpreted as follows:

- **0-10: HIE Mild severity**
- **11-14: HIE Moderate severity**
- **≥15: HIE Severe**
- **The maximum score is 22**

In normothermic neonates, HIE scores greater than 10 during the first week of life predicts an abnormal outcome (100% sensitivity and 61% specificity).

5.3 Initial management of HIE

1. Resuscitation (*see neonatal resuscitation algorithm*).
2. Clinical head-to-toe examination of the newborn for evidence of abnormal physical features that may suggest alternative or underlying causes of perinatal asphyxia such as congenital conditions with associated organ malformations or dysfunctions.
3. Ensure that the neonate's vitals remain within normal range immediately after delivery including random blood sugar and temperature.
4. See post-resuscitation care (*see Chapter 2.5*).

5.4 Supportive care of HIE

The management consists of supportive care to maintain temperature, perfusion, ventilation and a normal metabolic state including glucose, calcium and acid-base balance. Early detection of complications by clinical and biochemical monitoring and prompt management of any complications is important to prevent extension of cerebral injury.

- **Maintain temperature:** Temperature should be strictly maintained in the range of 36.5 – 37.0°C if there are no cooling facilities. If cooling therapy is available at a tertiary facility discuss possible transfer of patient with them as time is of the essence to get the patient there as soon as possible. Cooling should start within 6 hours of birth. Hypo- and/or hyperthermia imposes additional stress to the neonate by increasing the metabolic need.
- **Maintain perfusion:** Oxygenation should be kept in the normal range by monitoring oxygen saturation (SpO₂) with pulse oximetry. SpO₂ should be maintained between 91-95% as term infants with HIE are at risk of pulmonary hypertension if they are hypoxaemic. Hyperoxia should always be avoided.

- **Maintain normal metabolic state:** Blood glucose level should be kept within the normal ranges to provide adequate substrate for the brain. Hypoglycaemia should be managed according to guidelines. (**See Chapter 10.6: Neonatal Hypoglycemia**). Hypocalcaemia, hyponatremia, hypomagnesaemia, and lactic acidosis can also occur.
- **Fluid management:**
 - Start 10% dextrose at two-thirds of normal maintenance in the first 24 hours as fluid restriction is important.
 - Enteral feeding may be started when there are normal bowel sounds, normal abdominal x-ray and the clinical status is stable. Otherwise keep NPO.
 - In sick babies, start TPN (if available) after 24 hrs post-delivery.
- **Management of seizures: Refer to Chapter 10.13.3**
- **Cardiovascular support:** Maintain normal perfusion pressures appropriate for gestation and birth weight (e.g., mean arterial pressure (MAP) between 35 – 40mmHg for term neonates). Inotropes such as dopamine may be required if infant is hypotensive (Implement in consultation with the specialist).
- Clinical signs that may suggest hypo-perfusion include MAP of <35 mmHg, delayed capillary refill, cold extremities, brady/tachycardia, mottled extremities etc. Poor perfusion or hypotension may necessitate fluid resuscitation with or without inotropic support.

- **INFECTION:** Do a septic work up and start IV antibiotics if septicaemia is being considered. Be cautious with aminoglycosides (e.g., gentamicin) in event of renal impairment. Consider that there is the potential for increased aminoglycoside toxicity in asphyxiated newborns, a second dose of aminoglycosides should only be considered after a review of renal function tests.

Prognosis

Daily clinical neurological assessment with scoring tools (e.g., Thompson HIE score) should be performed for prediction of severity and neurological outcome secondary to HIE.

Communication

Most cases of perinatal asphyxia are unanticipated, and families are often unprepared to deal with the complexities of HIE. Direct, timely and respectful communication between the health-care team and the neonate's family is therefore essential to foster shared decision making with difficult medical and emotional decisions such as discontinuation of life support.

NB: Referral to be done always in consultation with referral hospital. (See Chapter 11)

06. PRETERM AND LOW BIRTH WEIGHT BABIES

6.1 Prematurity



DEFINITION

Babies born less than 37 completed weeks of gestation.

6.1.1 COMPLICATIONS ASSOCIATED WITH PREMATUREITY

Table 6: Complications of Prematurity

Preterm neonates are prone to complications, some of which include:

SYSTEM INVOLVED	COMPLICATIONS
Respiratory	Respiratory Distress Syndrome (RDS) Apnoea of prematurity Broncho-Pulmonary Dysplasia (BPD) Pulmonary Haemorrhage
Metabolic Problems	Hypothermia Hypoglycaemia Jaundice
Infections	Neonatal infection - Early onset < 72hrs - Late onset > 72hrs Congenital Infection e.g., syphilis nosocomial infection
Cardiac	Patent ductus arteriosus (PDA) Ventricular septal defect (VSD) and/ or atrial septal defect (ASD) Complex congenital heart lesion and/or cyanotic cardiac lesion
Neurological	Intraventricular Hydrocephalus Retinopathy of prematurity
Haematological	Polycythaemia Anaemia
Gastric	Feeding intolerance/ difficulties Aspiration NEC (Necrotising Enterocolitis)
Renal	Acute Kidney Injury
General	Drug toxicity*

*** NB: Side effects of drugs can be reduced by calculating dosages according to birth weight and gestation. Use drug formularies developed for newborn and preterm infants (See drug formularies in Appendix 4).**

6.2 Low birth weight (LBW) babies

Table 7: Categories of Low Birth Weight

Low birth weight babies can be categorized into 3 groups according to weight at birth.

A	Low Birth Weight (LBW)	1,500 - 2,499g
B	Very Low Birth Weight (VLBW)	1,000 - 1,499g
C	Extremely Low Birth Weight (ELBW)	Less than 1,000g

NB:

- **LBW may be due to either prematurity or intra-uterine growth restriction (IUGR) or both.**
- **Some premature babies may have birthweight which is large for gestational age hence the use of Ballard Score to calculate gestational age should be emphasized.**

6.2.1 MANAGEMENT OF LOW-BIRTH-WEIGHT BABIES

- Standard routine care and IPC protocols should be always followed.
- All LBW neonates should also be monitored for:
 - Blood glucose levels and temperature checks at birth and then 6-hourly for the first 24 hours.
 - Monitor feeding volumes to ensure tolerance and adequate intake. LBW babies should receive feeds every 3 hours (8 feeds in 24 hours).
 - Observe for appearance of jaundice and occurrence of apnoea attacks.
 - Regular weight checks. Daily weight checks are preferable but every 2 to 3 days may be acceptable.
- Where possible, initiate Kangaroo Mother Care (KMC) for all LBW babies with continuous KMC for stable babies and intermittent KMC for sick babies (**Refer Chapter 6.3: Kangaroo Mother Care**).



Mother caring for pre-term neonate in an incubator

6.2.1.1 MANAGEMENT OF BABIES WEIGHING BETWEEN 2000-2500g



- Babies with a birth weight of 2000g or above are usually strong enough to breastfeed and maintain their body temperature (Mother will need support with establishing breast feeding).
 - Mother should breastfeed the neonate every three hours, preferably on demand, but if neonate is not asking for a feed after three hours, the mother should initiate the feed.
 - Consider introducing cup feeds if neonate is not suckling well.
 - Demonstrate how to do hand expression of breastmilk.
 - Ensure mother has enough breastmilk.
- These neonates can room-in with their mothers in the postnatal ward.
- Perform routine care of the newborn.
- If the mother has a problem with breast milk production or is very ill and unable to provide breast milk, formula feeds may be given to the neonate.

6.2.1.2 MANAGEMENT OF BABIES WEIGHING BETWEEN 1500-2000g



- These neonates should be admitted to a neonatal unit. If clinically stable, start feeds within 60 minutes of birth by allowing neonate to suckle on the breast. These neonates will need assessment of feeding ability. They usually need assistance with feeding as they will not be able to suckle well enough from the breast and will need another mode of feeding.
 - The mode of feeding will include breastfeeding with top-up expressed breastmilk via cup or gastric tube depending on the individual neonate's feeding ability and the mother's competence with breast and cup feeding.
 - Mothers should feed these neonates every three hours and not rely on that the neonate will demand-feed.
 - Neonates fed by gastric tube should be held in the KMC position during the tube feeding session and beyond. (**See feeding chart**).
- For at least the first 24 hours these neonates will need 6-hourly clinical monitoring which include vital signs and blood glucose levels. **NB: (Refer to Facility Protocols)**

6.2.1.3 MANAGEMENT OF VERY LOW BIRTH WEIGHT BABIES BETWEEN 1000-1499g

- These neonates should be admitted to the neonatal unit.
- The neonate should be monitored 3 hourly for the first 24 hours.
- Treatment to prevent apnoea of prematurity should be started immediately in neonates weighing less than 1500g. Apnoea monitoring is important. There are two treatment modalities to choose from and which should continue until at least 34 weeks gestational age.
 - Caffeine loading dose 20mg/kg (which contains 10 mg/kg of caffeine base) followed by 5 mg/kg daily 24 hours later.
 - Aminophylline can be given in absence of caffeine at 7-8 mg/kg loading dose followed by 2 mg/kg/ dose 8 hourly the next day.

NB: Caffeine is preferable especially if a neonate can feed orally, but if not, initiate aminophylline.
- VLBW neonates should be given 10ml/kg per day of enteral feeds, preferably expressed breast milk, starting from the first day of life, with remaining fluid requirements met by intravenous fluids. **(Refer to Appendix 2: Fluid Guidelines)**
 - Only severely distressed or unstable babies should be kept NPO the first day of life.
 - On initiation of feeds, the neonate should be fed via a gastric tube (nasal or orogastric) every three hours, with the neonate held in the KMC position.
 - If the neonate struggles to cope with the total milk volume or develops reflux of feeds, consider feeding smaller volumes more often. A good method is to provide 10 feeds in 24 hours feeding 2-hourly during the day from 06h00 to 18h00 and 3-hourly from 18h00 to 06h00. This allows the mother to have some rest during the night.
- Perform a septic work up and start with empiric IV antibiotics; Ampicillin and Gentamicin **(See Appendix 4 for dosages)**. The antibiotics may be stopped after 72 hours if sepsis is ruled out by screening tests and clinical condition.

6.2.1.4 MANAGEMENT OF EXTREMELY VERY LOW BIRTH WEIGHT BABIES BELOW 1000g

- All ELBW neonates including possible referrals should be discussed with the paediatrician.
- Given the physiological immaturity of these neonates, extreme care should be provided to maintain vitals.
- Treatment to prevent apnoea of prematurity should be started immediately. Apnoea monitoring is important. There are two apnoea modalities to choose from which should continue until 34-36 weeks gestational age or even longer. Extremely preterm neonates with gestational age 28 weeks and less may continue with treatment of prematurity until corrected gestational age of 38 to 40 weeks.
 - Caffeine 10 mg/kg oral dose and 5 mg/kg daily, 24 hours later.
 - Aminophylline 5mg/kg IV loading and 2mg/kg 12hourly
- If the neonate is stable, 3 hourly small trophic/enteral feeds (0.5ml feeds) of colostrum or expressed breastmilk can be given even on day one. The rest of the fluid will be given in the form of IV fluids.
 - Only keep very distressed and unstable neonates NPO for the first 24hrs and on full volume IV fluids **(refer Appendix 2: Fluid guidelines)**.
 - On initiation of feeding, these neonates should be fed via a nasogastric/ orogastric tube every 3 hours while held in the KMC position.
 - If more feeds are needed and smaller feeding volumes change to 10 feeds per day, 2-hourly during the day and 3-hourly at night.
- Perform a septic work up and start with empiric IV antibiotics **(Ampicillin and Gentamicin-See Appendix 4 for Dosages)**. The antibiotics may be stopped after 72 hours if sepsis is ruled out by screening tests and clinical condition.

NB: Refer to facility/hospital protocols.



6.3 Kangaroo Mother Care



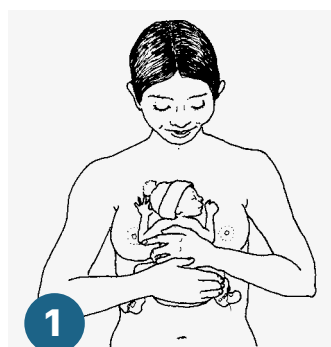
DEFINITION

Kangaroo Mother Care (KMC) is care of a neonate who is continuously carried in skin-to-skin contact upright against the mother's chest (or guardian) and secured with a cloth. The neonate should be in this position day and night (at least 20 hours a day) and neonate should be exclusively breastfed (ideally) either by direct breastfeeding or by giving the neonate expressed breast milk via a cup or tube.

6.3.1 CONSIDERATIONS BEFORE INITIATING KMC

- Before initiating KMC, counsel the mother on KMC.
- Ensure that the room is at least 25 °C.
- While the mother/guardian is holding the neonate, describe to her each step of KMC, demonstrate to them, and then allow her to go through the steps herself. Provide counselling of benefits of KMC, newborn danger signs and general hygiene.
- Initiate Kangaroo Mother Care for all LBW babies KMC can be continuous for stable babies and intermittent for sick babies.
- While the neonate is recovering from an illness, the mother/guardian can begin to hold the neonate in skin-to-skin contact (intermittent KMC) for short periods of time (minimum of 1 hour at a time). It is good to do this around feeding times. The neonate will absorb the feed better when held in the skin-to-skin position when tube feeding or after breast and cup feeding.
- Support the mother/guardian in placing and maintaining neonate in KMC position.

6.3.2 STEPS IN POSITIONING THE NEONATE FOR KMC

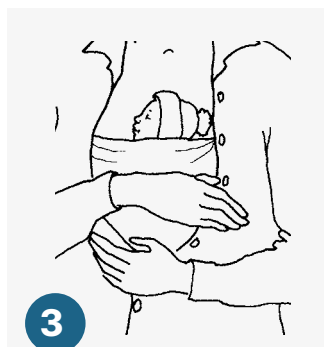


1 Dress the neonate in a nappy and a cap. Place the neonate upright between the mother's breasts.



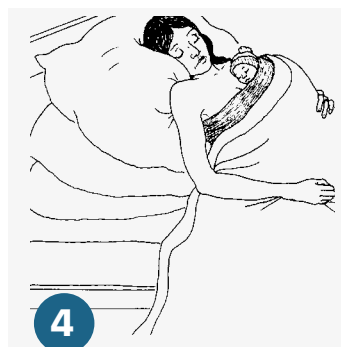
2 Secure the neonate on the mother's chest with a cloth making sure that the neonate's head is secure in the sniffing position.

Put a blanket or a shawl around the back of the neonate for additional warmth.



3 Instruct the mother to put on a front-opened top; a top that opens at the front to allow the face, chest and abdomen, arms and legs of the neonate to remain in continuous skin-to-skin contact with the mother's chest and abdomen.

Instruct the mother to keep the neonate upright when walking or sitting.



4 Advise the mother to have the neonate in continuous skin-to-skin contact 24 hours a day (Unless interrupted by feeding or other care procedures). In the case of intermittent KMC the neonate should be kept in the KMC position for at least 60 minutes or longer.

Advise the mother to sleep in a half-sitting position or on at least two pillows in order to maintain the neonate's head higher than the body to prevent reflux of feeds.

6.3.3 KMC BENEFITS

KMC has many benefits apart from keeping the neonate warm. These include:

BENEFITS TO THE NEONATE	BENEFITS TO THE MOTHER
• The neonate breathes better, is calmer and gains weight better. • The neonate needs the mother to move around, walk, turn around and sit down. This stimulates the neonate's neurodevelopment, balance with walking, and later hand-eye coordination for writing and catching a ball etc. • The neonate's sleep quality improves, sleep cycles of quiet and active sleep occur about every 60 minutes for 28 weeks gestation. Sleep cycles are important in the development of all the sensory systems and to keep the plasticity of the brain intact. Thus, KMC is neuroprotective. • The neuroprotective qualities of KMC leads to advanced neurodevelopment which allows neonates to establish breastfeeding and cup feeding at an earlier age than previously believed & breastfeeding is possible in gestational ages much less than 34 weeks gestation. • The skin-to-skin contact stimulates the parasympathetic nervous system via release of oxytocin. This stimulation reduces stress, improves absorption of food, and stabilizes the cardiovascular and respiratory systems. • Oxytocin reduces the experience of painful stimuli by working directly on the morphine receptors in the brain. • Oxytocin also has a direct anti-inflammatory effect. This is one reason why neonates in KMC have a reduced infection rate. Breast milk also protects infants against infections.	• Neonates cry less and have longer periods of quiet alert periods. During these times, mothers can interact with their infants, resulting in better bonding and attachment. • Oxytocin is also secreted in the mother while doing KMC. This result in better breast milk production, reduces depression and stimulates involution of the uterus with less uterine bleeding. • Oxytocin is also responsible for an increase of blood supply to the breast skin causing the skin to be warmer than other areas. This is important in the regulation of the neonate's temperature. • The mother's skin is colonized by commensal bacteria that are protective against invasive bacteria which colonizes the neonate in the hospital. This is protective against nosocomial infections. The mother's skin is also a biological membrane that keeps the neonate's skin well hydrated, and this also is protective against invasion of bacteria through the skin.

6.4 Vitamin and Iron Supplementation for Preterm Babies

Preterms are at an increased risk of micronutrient deficiencies because of low body stores at birth, low nutritional intakes and maternal deficiencies such that most preterm infants require supplementation soon after birth. Vitamin and mineral requirements for preterm neonates are not clearly established.



CAUTION is required with vitamin supplementation because toxicity may occur with both water- and fat-soluble vitamins because of immature renal and hepatic function. Micronutrient supplementation may be needed with certain types of infant formula.

Start oral supplements when neonates are on full enteral feeds.

Table 8: Vitamin and Mineral Supplementation

SUPPLEMENT	ROUTE & DOSAGE	TIMING & DURATION
Vitamin K	1mg (IM) in all neonates.	At birth
Multivitamin preparation (Confirm with pharmacist on standard content of MVT)	0.6ml (5-10 drops) /day (which usually provides vitamin A of 1000 IU/day and vitamin D 400 IU/day)	When taking full feeds until 12 months of age
Folate	Preterms; 0.1mg per day NB: Not routinely prescribed for term Babies	Start at 2 weeks of age until 6-12 months of age.
Vitamin D	Most preterm infants need a dosage of at least 800 IU vit D. The multivitamin preparations usually contain 400 IU. An extra 400 IU Vit D should be given to all preterm neonates	2-12 months
Iron Supplement	0.4mL (2.5mg) daily dose. Increase to 1mL at discharge with full feeds.	From 14 days after birth for 12 months.

NB: Preparations may contain varying amounts of components-Please see table 9 for individual requirement of recommended supplements.

Table 9: Standard Daily Requirement of Key Vitamins Contained in MVT Preparations

COMPONENT	TERM	PRETERM (DOSE/KG)
Vitamin A	700mcg	700 - 1500mcg
Vitamin B1	1.2mg	0.18 - 0.24mg
Vitamin B2	1.4mg	0.25 - 0.36mg
Vitamin B6	1.0mg	0.15 - 0.2mg
Vitamin C	80mg	18 - 25mg
Vitamin D	400IU	800 - 1000 IU

6.5 Apnoea of Prematurity



DEFINITION

Apnoea is the cessation of breathing for >20 seconds OR for any duration if associated with cyanosis, desaturation and/or bradycardia.

Apnoea of prematurity is a diagnosis of exclusion; therefore, it is important to rule out other causes of apnoea and manage accordingly.

Table 10: Common Causes of Apnoea in Preterm Infants

CAUSE	ACTION
Hypoxia	Check oxygen saturation
Hypoglycaemia	Check blood glucose
Sepsis	Special investigations to exclude sepsis Blood and urine. Septic workup.
Seizures	Exclude meningitis by doing LP. Manage the seizures.
Electrolyte Abnormalities	Take blood for U&E, Calcium, Phosphate and Magnesium.
Anaemia	Take blood to check haemoglobin. Give blood transfusion if severe anaemia.
Temperature Instability	Check for fever or hypothermia - If fever investigate. - If hypothermia place in skin-to-skin to warm infant. - Consider infection and exclude by doing septic workup.
Hypotension	Check blood pressure, consider starting on inotropes if very low Give fluid bolus and refer to paediatrician.
PDA	Cranial ultrasound

Make sure neonate is receiving caffeine or aminophylline for apnoea of prematurity if all above conditions are excluded.

Neonates with a birth weight of <1.5 kg or a gestational age <34 weeks are prone to apnoea and should be treated with methylxanthine and monitored for apnoea.

- Caffeine to be started in neonates weighing less than 1500g to prevent apnoea of prematurity. Caffeine loading dosage is 20mg/kg (Which contains 10 mg/kg of caffeine base) and thereafter a maintenance dosage of 5 mg/kg daily, 24 hours later. Continue with caffeine therapy until neonate reaches 34-36 weeks gestational age. Apnoea monitoring is important.
- In absence of caffeine aminophylline can be given at 7-8 mg/kg loading dose and then maintenance of 2 mg/kg/dose 8 hourly.

Persistent Apnoea of prematurity despite preventative treatment requires management at facilities with capacity for ventilatory support.

6.6 Discharge of the LBW/ Preterm Neonate

Before discharging the neonate, check the following:

- The neonate has already transitioned from tube to cup feeding.
- The neonate has established breastfeeding with supplementary cup feeds.
- The neonate passes stools and urine regularly. Breast fed babies may pass one stool in seven days or have 7 stools in one day (formula fed neonates can pass stool 48-72 hourly). This is normal as long as the neonate does not have a distended abdomen.
- All vital signs are stable.
- Neonate is gaining adequate weight for 3 consecutive days (Adequate weight gain is 10-30g per day).
- Neonate should have regained birthweight or weigh at least 1,800-2,000g before discharge.
- Ensure Mother is confident of taking care of the neonate.
- Mother has learnt the skills to breastfeed her neonate, hand express her breast milk and feed her neonate using cup feeding.
- Mother has enough breastmilk.
- Mother is practicing KMC consistently.
- Ensure neonate is on the recommended vitamin and mineral supplements and mother understands how to give the treatment at home.
- Neonate has been immunised and received the recommended vaccines i.e., BCG, and hepatitis B.
- Ensure that all mother's antenatal blood results are available and have been acted upon appropriately.
- Follow-up appointments.
 - Weight checks weekly until review at 6 weeks PNC review by the doctor.
 - Routine monthly child welfare clinic visits should be continued accordingly.
 - If the LBW neonate is not sick, the vaccinations schedule is the same as for term babies.
 - Then 3 monthly follow-up visits for neurodevelopmental assessment until 2 years of age.
 - Hearing and ophthalmology reviews maybe necessary (if not sure discuss with the paediatrician).
 - Ophthalmology screening to exclude retinopathy of prematurity is recommended for all babies born less than 1500g or 34 weeks of gestational age.

Table 11: Recommended Newborn Ophthalmology Screening

WEIGHT /GESTATIONAL AGE	AGE AT FIRST SCREENING
<1250g or 32 weeks	4 weeks PNA
1250g - 1500g	6 weeks PNA

- All babies >1500g/34 weeks GA who had haemodynamic instability, mechanical ventilation or required supplemental oxygen for more than 2 weeks should be screened between 4-6 weeks after birth.
- Screening should be arranged via the local eye clinic services.
- Feeding advice to be given on discharge:
 - Neonate on breast and cup feeds continue with the same volume at home.
 - When neonate reaches 2,5 kg weight the top-up cup feeds can be stopped, and mother can only breastfeed.
 - If neonate is going home not on breast feeding, then

advise mother to increase the volume of feeds by 3ml every 3 to 4 days until volume is 50 mls then increase according to neonate's requirements afterwards

- Continue KMC at home (less than 2Kg) to facilitate growth of neonate.
- Document the following in the **child welfare card**:
 - The birth weight and gestational age.
 - Note down any other problems in addition to LBW such as jaundice or sepsis.
 - Record feeding method and volume if neonate is still cup feeding or on formula feeds.
 - Record the date and weight on discharge
 - Ensure HIV status is known and recorded.
 - Ensure Vitamin K has been administered and recorded.
 - Ensure BCG and Hep B have been given and recorded.
 - Maternal medical and obstetric history
 - Significant medical conditions
 - Antenatal Blood results e.g., Blood Group, Rh Status etc.
- **Counseling for care of LBW at home. (See Chapter 3.2)**

07. NEONATAL INFECTIONS



7.1 Management of a neonate with risk factors for infection

The aim is to minimise the risk of infection and identify neonates who have developed signs of infection.

- Take a proper history from the mother's previous medical history, current and past pregnancies, and the delivery.
- Do a thorough examination of the neonate including vital signs.
- For a neonate born to a mother with prolonged rupture of membranes (PROM) and signs of chorioamnionitis, the neonate should be started on empirical IV antibiotics after special investigations such as FBC, CRP, blood cultures and urine for MCS were taken and administer treatment for 48-72 hours.
- Observe neonate in the ward for at least 48hrs, if there are not clinically or laboratory signs of infection at delivery.
- Any neonate with signs of infection should be treated according to neonatal sepsis protocol.

7.2 Neonatal Sepsis

DEFINITION

Sepsis is a serious systemic condition as a result of the presence of harmful microorganisms in the blood or other tissues and the body's response to their presence potentially leading to substantial morbidity and mortality in a neonate. The body's response to the infection may lead to haemodynamic changes (shock) and the malfunctioning of various organs. A neonate may initially present with little or no clinical manifestations. Always keep a high index of suspicion when neonates present with non-specific signs and exclude sepsis by doing special investigations and close observation of the neonate.

Neonatal sepsis can be classified according to the age at the onset of signs.

- **Early Onset Neonatal Sepsis (EONS):** Onset of signs occurring within 72 hours of life.
- **Late Onset Neonatal Sepsis (LONS):** Onset of symptoms occurring after 72 hours to 28 days of life.

The organisms causing EONS are maternally acquired whereas those causing LONS are mostly hospital acquired.

Most common pathogens associated with EONS are Group B Streptococci (GBS), Escherichia coli (E. coli), Enterococcus faecalis (E. faecalis), and Listeria monocytogenes, whereas LONS is commonly caused by Coagulase negative Staphylococci (CONS), Staphylococcus aureus, Klebsiella pneumoniae, E. coli, E. faecalis and Acinetobacter baumannii. Pseudomonas aeruginosa is an uncommon but very serious nosocomial infection among neonates with high mortality.

Table 12: Risk factors for Neonatal Sepsis

MATERNAL FACTORS	NEONATAL FACTORS
Prolonged rupture of membranes (PROM) >18 hours	Foetal distress
Pyrexia	HIE
Peri-partum infection e.g., UTI, chorioamnionitis, foul smelling liquor.	Preterm delivery
Unhygienic delivery environment – home birth, BBA	Needing IV fluids for a long period of time
Instrumental deliveries	Neonates not receiving breastmilk

7.2.1 CLINICAL PRESENTATION OF NEONATAL SEPSIS

Table 13: Clinical presentation of Neonatal Sepsis

The neonate with neonatal sepsis may present with the following non-specific, multiple signs and symptoms:

Neurological	- Diminished spontaneous, activity, lethargy, hypotonia (floppy neonate) less vigorous suckling or no suckling. - Temperature instability - Jitteriness, convulsions, irritability, body stiffness (hypertonia).
Respiratory	Apnoea, symptoms of respiratory distress (tachypnoea, expiratory grunting, & severe chest in-drawing), central cyanosis.
Cardiac	Tachycardia, hypotension, poor circulation, skin mottling, cold peripheries.
Skin	Skin rashes, pallor, jaundice, sclerema (panniculitis).
Gastrointestinal (GI)	Abdominal distension, hepatomegaly, vomiting and diarrhoea.

7.2.2 MANAGEMENT OF NEONATAL SEPSIS

- Do a rapid assessment of the patient. (*Refer to Chapter 4: Rapid Assessment and Stabilisation of a Neonate*)
- Take blood and urine samples for a septic work-up, that include:
 - Full Blood Count (FBC) with differential count
 - Blood, urine and CSF for microbiology, culture, and sensitivity
- Chest x-ray if respiratory signs and abdominal x-ray, if abdominal distension.
- Do inflammatory markers e.g., CRP, PCT, BDG etc.
- Initiate IV antibiotics immediately for at-least 5-7 days. (*See Appendix 3: Dosages*)
- For EONS- Start with ampicillin and gentamicin.
- Consider changing antibiotics if little or no clinical improvement after 2-3 days or if suggested by laboratory MCS results.

NB: Always have a high index of suspicion when babies present with a combination of these signs or symptoms.

Consider repeat cultures if no clinical improvement or when changing antibiotic regimen.

An institutional antibiogram are important in informing the choice of antibiotics. Usually, the second line antibiotics choice is cefotaxime and vancomycin.

NB: Persistent infection should be discussed with paediatrician.

- If there are signs of skin involvement, consider Staphylococcal infection and treat with cloxacillin (If not available, use vancomycin).
- For LONS management is like EONS except.
 - The usual first line antibiotics of choice is cefotaxime and vancomycin, unless otherwise indicated by institutional antibiograms. Potential source of infection may inform the choice of antibiotics.
 - A lumbar puncture is always indicated for LONS.

NB: If the infant is unstable or not improving, consult for possible referral to next level of care.

7.3 Neonatal Meningitis



DEFINITION

Inflammation of the meninges during the first 28 days of life. In neonates, the common causes of infection are Group B Streptococcus and coliform bacteria e.g. E. coli.

Neonatal meningitis can be classified according to the age at the onset of signs:

- Early Onset Neonatal Meningitis: Onset of symptoms occurring within 72 hours of life.
- Late Onset Neonatal Meningitis: onset of symptoms occurring after 72 hours to 28 days of life.

7.3.1 SIGNS AND SYMPTOMS

Generalised signs of infection.

- Fever, drowsiness, lethargy, Irritability, high pitched cry, apnoea and poor feeding.

Specific signs of infection

- Convulsions and bulging fontanelle

7.3.2 DIAGNOSIS

Do a lumbar puncture and CSF analysis for all neonates suspected of having meningitis except where It is contraindicated.

CONTRAINDICATIONS OF LUMBAR PUNCTURE:

severe respiratory distress, the lumbar skin is infected, there is a bleeding tendency, or if the neonate is haemodynamically unstable.

7.3.3 MANAGEMENT

- Do a rapid assessment. (*Refer to Chapter 4: Rapid Assessment and Stabilisation of a Neonate*).
- Take samples for a septic work-up, that include FBC and differential count.
- Blood, CSF and urine for microbiology, culture, and sensitivity.
- Consider imaging if indicated
- Do inflammatory markers e.g., CRP, PCT, BDG etc.
- Start antibiotics immediately after doing a septic work-up
 - Antibiotics treatment of choice is like neonatal sepsis management (*See Chapter 7.2.2*)

NB: Unstable or not improving, consult for possible referral to next level of care.

7.3.4 FOLLOW-UP

- Neonates who have had neonatal meningitis have a higher risk of developing neurological sequelae.
- Neurodevelopmental assessments are required every 3 months in the first year of life.

7.4 Neonatal Conjunctivitis (Ophthalmia neonatorum)

DEFINITION

It is an inflammation of the conjunctiva which presents within the first 4 weeks of life.

Ophthalmia neonatorum may present with eye discharge and hyperaemia and is most often caused by micro-organisms such as:

- ***Neisseria gonorrhoea*** (gonococcus) which present with early onset, severe, mucopurulent discharge associated with conjunctival injection, eyelid oedema, tenderness and often preauricular lymphadenopathy.
- ***Chlamydia trachomatis*** usually presents a bit later 5-14 days of life with acute infection of the conjunctiva that is characterized by erythema and oedema of the eyelids, palpebral conjunctivae, and later a purulent eye discharge.

7.4.1 GENERAL MANAGEMENT OF NEONATAL CONJUNCTIVITIS

Important facts in the management of conjunctivitis is:

- a. The mucopurulent discharge is contagious for 24 – 48 hours after initiation of treatment. The infection can spread easily (from eye to eye or to other people through touch). Thorough and frequent hand washing is important to prevent cross infection and wearing gloves when cleaning the neonate's eyes is essential.
- b. The mucopurulent discharge can cause corneal perforation if not cleaned by thorough eye toilet (washing) every 2-6 hours.
- c. Systemic treatment is required for most of the infective causes of neonatal conjunctivitis which include: Gonococcal, staphylococcal, chlamydia, pseudomonas, and herpetic infections

- d. Avoid covering the eyes with an eye patch.
- e. Examination for signs of systemic disease is essential. Infants with conjunctivitis are at risk of secondary infections such as sepsis, meningitis and pneumonia.

7.4.2 STICKY EYES & MILD CONJUNCTIVITIS

- Topical treatment as outpatient is appropriate if neonate has no other serious problems.
- The mother must wash her hands before and after application of eye ointment.
- Show the mother how to wash the eyes with lukewarm (previously boiled water) and how to apply ointment into the eyes.
- Tetracycline eye ointment is applied four times a day for 5 days.
- Review 48-hours after starting treatment. If the neonate has not improved treat as for severe conjunctivitis.

7.4.3 SEVERE NEONATAL CONJUNCTIVITIS

The eyelids are swollen, erythematous, tender, with a purulent discharge and the neonate appears ill.

7.4.3.1 Management

- Admit patient to hospital as there is a risk for blindness and systemic complications.
 - Examine the patient at least twice a day.
 - Take an eye swab of the discharge for microscopy, culture and sensitivity studies.
 - Irrigate both eyes with normal saline initially every one to two hours and then 6-8-hourly until the discharge has been completely cleared.
 - Start any of the following systemic antibiotics immediately
 - Ceftriaxone 50 mg/kg IM/IV stat (Maximum dose of 150mg)
- AND**
- Erythromycin 12.5mg/kg orally 6 hourly for 7 days

Continue topical treatment of the eyes with 1% Tetracycline eye ointment 6 hourly

OR

Chloramphenicol eye ointment 8 hourly
Also treat mother and partner for STIs as per STI treatment guidelines.

7.4.3.2 Follow-up

Ophthalmologic evaluation and follow-up are necessary because complications such as corneal scarring or perforation may develop especially in gonococcal disease. In the case of herpes infection severe long-term complications such as chorioretinitis, cataracts and retinopathy may develop.

7.5 Management of Congenital Syphilis at a Hospital



DEFINITION

Congenital syphilis is an intrauterine infection caused by the spirochete *Treponema pallidum*. If the woman is untreated the foetus has a 60-90% chance of becoming infected.

Infection can result in stillbirth, prematurity, low birth weight or a wide spectrum of clinical manifestations. Usually, severe cases are clinically apparent at birth. Symptoms of this disease may not become apparent until several weeks or months after birth and, in some cases, may take years to appear. Therefore, it is important to serologically screen all pregnant mothers for syphilis.

7.5.1 MANAGEMENT OF EXPOSED ASYMPTOMATIC AND SYMPTOMATIC NEONATES.

- If a mother has a positive syphilis serology during pregnancy and she received treatment of 2,4 million IU Benzathine Penicillin IM per week for 3 weeks and the treatment was completed 30 days or more before delivery no additional therapy or measures are required.
- If the mother was not treated for syphilis or insufficiently treated or treated shortly before delivery or the treatment is not clear and the newborn does not present with any clinical signs of syphilis then the newborn only needs one dose of Benzathine Penicillin 50,000IU/kg IM. (Max. 150, 000 IU)
- If mother was not treated or insufficiently treated and the newborn has signs of syphilis which include:

Table 14: Signs & Symptoms of Congenital Syphilis

LBW and/ or Prematurity	Jaundice (Conjugated Bilirubin)
Respiratory distress	Blistering rash on hands & feet
Pale and Anaemic (Hydrops)	Coryza (snuffles)
General Oedema	Pseudo paralysis
Petechiae	Osteitis
Hepatosplenomegaly	Condylomata lata

7.5.2 TREATMENT OPTIONS FOR SYMPTOMATIC NEONATES:

- Hospitalize newborn for treatment.
 - a. Aqueous penicillin G 50,000IU/kg/ per dose
12 hourly (if < 1 week old) for 10 days
8 hourly (if > 1 week old) for 10 days. OR
 - b. Procaine penicillin G 50,000 IU/kg IM once a day for 10 days.
NB: If ≥24hrs of therapy is missed, the entire course must be restarted.
 - c. Benzyl penicillin 50,000IU/kg IM single dose.
- Perform RPR or VDRL tests on infant and repeat after treatment is completed.
- Check HIV and hepatitis B status of parents.

7.5.3 DIFFERENT LABORATORY TESTS FOR SYPHILIS

- There are Non-specific Screening tests such as RPR (Rapid plasma reagent) test (the sensitivity is approximately 78% to 86%) and VDRL (Venereal disease research laboratory) test.
- Specific confirmatory tests include the direct FTA-ABS (fluorescent treponemal antibody absorption) test which is used to detect antibodies to the bacteria *Treponema pallidum*.

NB: FTA-ABS has a sensitivity of 84% for detecting primary syphilis and 100% for secondary and tertiary syphilis. The FTA-ABS test for *T. pallidum* is easier to perform than dark-field microscopy. It detects antigen and, thus, does not require the presence of motile treponemes. It is the most specific test for the diagnosis of syphilis when lesions are present.

Other screening tests

- X-rays of long bones showing typical syphilitic lesions at the epiphysis.
- Positive serologic tests on CSF.

7.5.4 LABORATORY DIAGNOSIS

Confirmatory test can demonstrate *Treponema Pallidum* by using any of the following tests:

1. Performing dark field microscopy of clinical lesions.
2. PCR other equivalent direct Molecular methods of clinical lesions.
3. Immunohistochemistry (IHC) or special stain such as Silver Staining of clinical specimen.

7.5.5 MANAGEMENT

Initial evaluation includes:

- Quantitative non-treponemal tests such as VDRL or RPR on infant serum.
NB: The non-treponemal test that is performed on the infant should be the same as that which was done on the mother so that the infant's titres can be compared with the mother's titres.
- Thorough physical examination of newborn looking for clinical evidence of congenital syphilis.
- Follow the algorithm below on evaluation of Suspected Syphilis.

7.5.6 DISCHARGE AND FOLLOW-UP

- Sero-reactive neonates or those born to mothers who were sero-reactive at delivery should be monitored for clinical or serologic manifestations of congenital syphilis with 3 monthly physical exams and repeat VDRL/RPR titres until the tests become non-reactive or titre decreases 4-fold e.g., 1:32 to 1:8 or 1:16 to 1:4.
- If titres increase or remain reactive for 6-12 months, the infant should be re-evaluated for congenital syphilis and re-treatment considered.
- Neonates with neurosyphilis should undergo repeat CSF examination 6 monthly until the CSF is normal. If CSF VDRL remains positive at any 6-monthly interval, re-treatment is recommended.

7.5.7 TREATMENT OPTIONS

- Aqueous Penicillin G 50 000U/kg IV 12hrly (<1 week old) or 8hrly (>1 week old) OR Procaine penicillin G 50 000U/kg IM once for 10 days.

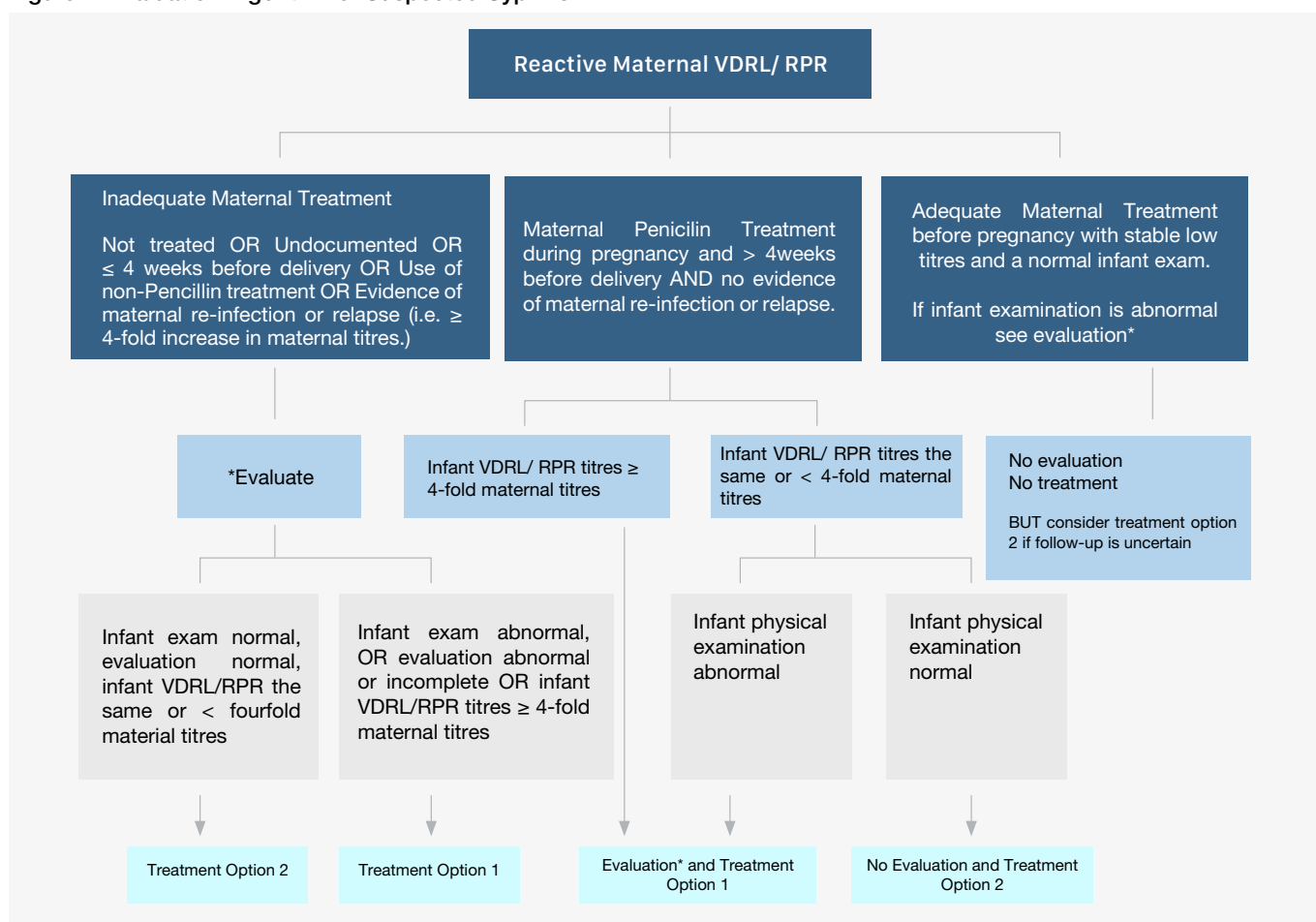
NB: If ≥24hrs of therapy is missed, the entire course must be restarted.

- Benzathine penicillin G 50 000U/kg IM, single dose (max 150 000U).

7.5.8 TREATMENT FAILURE

Failure of the VDRL or RPR titres to decline, or if they increase after 6-12 months of age then the infant/ child should undergo a lumbar puncture to obtain cerebrospinal fluid (CSF) for VDRL, cell count, and protein, and be treated with 10 days of parenteral penicillin, even if they were treated previously.

Figure 2: Evaluation Algorithm of Suspected Syphilis



Evaluation* FBC, quantitative VDRL (or test similar to maternal test), other tests as clinically indicated in a symptomatic infant e.g., Cerebrospinal Fluid (CSF) examination for cell count, protein, and quantitative VDRL, chest X-Ray (if there's respiratory distress) long-bone X-Rays, eye examination, liver function tests, neuroimaging, auditory brainstem response.

7.6 Infection of the umbilicus (Omphalitis)



DEFINITION

It is an infection of the umbilicus and/or surrounding tissues. It may be characterized by purulent discharge of the umbilical cord stump with surrounding induration, erythema, and tenderness.

Umbilical discharge without other signs of inflammation may not be omphalitis and other pathologies should be considered.

- The umbilicus usually separates 10–14 days after birth, and the wound heals within 15–20 days. Until the wound is healed, this is an important entry point for infection, which can quickly lead to sepsis.
- Complications of omphalitis may include
 - Umbilical arteritis
 - Portal vein thrombosis
 - Liver abscess
 - Peritonitis
 - Necrotizing fasciitis
- Early recognition and treatment of an infected umbilicus are essential to prevent complications.
- Always observe strict infection prevention practices to prevent spreading one neonate's infection to other neonates in the nursery.

7.6.1 LOCAL INFECTION OF UMBILICUS

- Whenever possible, obtain a sample of the umbilical discharge for MCS prior to the start of antibiotics.
- For neonates with minimal symptoms
 - Wear clean examination gloves
 - Wash the umbilicus using normal saline
 - Continue routine care of the umbilical cord

There is no evidence of efficacy of topical applications such as alcohol, mupirocin or the administration of oral antibiotics in the infants.

Antibiotic treatment of choice is like severe omphalitis. Close observation for signs of severe omphalitis with regular follow-ups is important.

7.6.2 MANAGEMENT OF SEVERE OMPHALITIS

- The neonate's umbilicus is swollen, draining pus, or foul smelling (infected) and the surrounding tissue is red and indurated.
- There may be signs of systemic involvement.
- Treat with IV/IM antibiotics against gram positive and negative organism including staphylococcal organism. **See Chapter 7.1.3: Choice of Antibiotics.**
- A typical 10-day course of IV antibiotics is administered and modified according to the clinical course and MCS results.
- Provide general care as described for a local infection of the umbilicus.

7.7. MANAGEMENT OF HIV EXPOSED NEONATES AT ALL LEVELS OF CARE

- *Refer to HIV Care Clinical Guidelines*

7.8. MANAGEMENT OF NEONATAL TUBERCULOSIS AT ALL LEVELS OF CARE

- *Refer to the National Tuberculosis Programme Manual*

08. NON-INSTITUTIONAL DELIVERIES (BORN BEFORE ARRIVAL)



DEFINITION

These deliveries encompass the birth of any baby which occurs outside of the birth centre setting.

8.1 Management of neonates born before arrival

- Conduct an initial assessment and manage accordingly (*Refer to Chapter 4*).
- Secure umbilical cord with a cord clamp and clean cord with normal saline
- Assess the hygiene of environment and materials used in the delivery of the neonate and consider tetanus prophylaxis
- Continue Routine care of the newborn (*See Chapter 1*) These neonates may have complications by being hypothermic or hypoglycaemic. They also have a higher incidence of neonatal infection (EONS).
- Ensure Antenatal Care information is available and acted upon especially with regards to neonatal HIV prophylaxis.

09. ABANDONED / ORPHANED NEONATE AT A HOSPITAL



DEFINITIONS

Child Abandonment: This is the practice of relinquishing interest and claims over one's offspring in an illegal way with the intent of never resuming or reasserting guardianship.

Orphan: This is a child whose parents have died, or are unknown, or have permanently abandoned them. In common usage, only a child who has lost both parents due to death is called an orphan.

NB: Abandoned neonates fall under the care of the Child Protection Services. Children for adoption fall under the care of Social Welfare Services Management.

9.1 Management of abandoned Neonate

- Conduct an initial assessment of the neonate and manage accordingly (*Refer to Chapter 4*).
- Assess postnatal age and gestational age (*Refer to Appendix 7: Ballard Score*).
- Get as much detailed information as possible and act accordingly.
- Assess the hygiene of the neonate and consider tetanus prophylaxis.
- Follow appropriate feeding procedures for the neonate.
- Report the issue to social worker.
- This child should be in the care of the hospital until social welfare identifies a place of safety for the neonate.
- Follow PMTCT and syphilis guidelines and manage accordingly.
- Document all care provided.

10. COMMON NEONATAL CONDITION

10.1 Respiratory Distress of the Newborn



DEFINITION

A newborn experiencing abnormal respiratory rate and/or respiratory effort.

10.1.1 DIAGNOSTIC CRITERIA OF RESPIRATORY DISTRESS

Presentation with two or more of the following signs in a newborn neonate:

- Tachypnoea (fast breathing) >60 breaths / minute
- Expiratory grunting
- Intercostal and sternal retractions (recession or chest in-drawing).
- Central cyanosis while breathing room air.

Clinical presentation may include any of the following signs or symptoms.

- Bradypnoea (<30 breaths per minute)
- Inspiratory Stridor
- Nasal flaring
- Abnormal breathing patterns.
- Desaturation (<90-94%)
- Apnoea
- Head bobbing (increased effort of breathing).

10.1.2 Table 15: Newborns at Risk of Developing Respiratory Distress

MATERNAL FACTORS	NEONATAL FACTORS
Diabetic Mothers	Preterm Babies
Caesarean Section Deliveries	Perinatal Asphyxia
Instrumental Deliveries	Congenital Abnormalities
Peripartum Infections	Metabolic Disorders
Hypertensive disorders of Pregnancy	Meconium Aspiration
Meconium-Stained Liquor Precipitated labour	Congenital Infection • Pneumonia • Septicaemia • Meningitis
Prolonged rupture of membranes	

10.1.3 Table 16: Common Causes of Respiratory Distress

PRIMARY LUNG & AIRWAY PROBLEM	NON-PULMONARY PROBLEM
Respiratory Distress Syndrome (RDS) of prematurity	Hypovolaemia & Hypotension (shock) Cardiac Conditions
Meconium Aspiration Syndrome (MAS)	Neonatal Encephalopathy with acidosis Hematological Conditions
Congenital Pneumonia	Hypo & Hyperthermia Neonatal sepsis Hypoglycaemia
Transient Tachypnoea of the newborn (TTN)	Persistent Pulmonary Hypertension of the newborn (PPHN)

[illegible]

- Imaging, Chest X-ray, echocardiogram and CT scan where indicated.
- Laboratory investigations to consider; FBC & differential, Inflammatory markers (e.g. CRP), blood gas, and blood, CSF and urine for MCS.

- Conduct initial assessment,
- Give supplementary oxygen & ventilatory support if indicated. (Refer to Section 4. Assessment and immediate management of all neonates on admission).

Determine if resuscitation is needed:

- If the answer is Yes**, initiate neonatal resuscitation and stabilize the neonate first. (*See Chapter 2: Neonatal Resuscitation*)

- Place on cardiorespiratory monitor for respiratory rate, oxygen saturation, heart rate and blood pressure.
- Establish intravenous access (peripheral, central, umbilical or intraosseous) and commence appropriate IV fluids.
- If there is hypoxia, provide enough oxygen support to keep oxygen saturation between 90 to 94% (85% to 90% if there is congenital cyanotic heart lesion).
- Treat any identifiable causes or problems (e.g., hypoglycaemia, infection, anaemia, etc.).
- Monitor vital signs on neonate.
- Keep the neonate Nil Per Os until stable.
- Insert gastric tube for gastric decompression.
- If still no clinical improvement, transfer to hospital or ICU capable of assisted ventilation immediately.

- *For further management refer to individual conditions in Chapter 10.*

Meconium aspiration syndrome (MAS) occurs when a newborn breathes a mixture of meconium and amniotic fluid into the lungs around the time of delivery resulting in respiratory distress, with characteristic radiological findings (hyperinflation, and patchy opacities) whose symptoms cannot be explained otherwise.

- Physiologic stress at time of pregnancy, labour and delivery.
- Post-dates/maturity
- Prolonged or difficult labour
- Hypertensive disorders of pregnancy
- Maternal diabetes
- Maternal respiratory or cardiovascular diseases
- small for gestational age
- Oligohydramnios
- Chorioamnionitis or other infections

- Rapid breathing (Tachypnoea)
- Apnoea
- “Flat neonate” (General body weakness)
- Nasal flaring
- Retractions
- Tachycardia
- Cyanosis or desaturation
- Rattling sounds (Rales)
- Rhonchi (wheezing)
- Greenish yellow staining of the umbilical cord, nail beds or skin.

- Meconium aspiration syndrome (MAS) is suspected when
 - There is history of meconium-stained liquor
 - There's history of respiratory distress
 - A neonate shows respiratory distress in the setting of meconium-containing amniotic fluid.
- Diagnosis is confirmed by chest x-ray showing hyperinflation with variable areas of atelectasis and flattening of the diaphragm (**Refer to Chapter 10.1.4: Diagnostic Investigations**).

- Conduct initial assessment, and if significant meconium stained and non-vigorous at birth intubate and suction meconium before stimulation and ventilation. **(Refer to Chapter 2.4. and Chapter 4).**
- Maintain optimal thermal environment.
- Minimal handling.
- Adequate oxygenation, (keep SPO_2 90- 94%)
 - If ventilatory support as indicated, refer to a centre with the capacity to provide ventilatory support.
- Optimise blood pressure with IV fluids and inotropes.
- Correction of acidosis hypoglycaemia and other metabolic disturbances.
- IV antibiotics (Ampicillin 50mg/kg IV 12 hourly and Gentamycin 5mg/kg once daily IV).

Review antibiotics and change after 2-3 days if no improvement.

- Consider surfactant if no improvement.
- Consider pulmonary vasodilatation (e.g., sildenafil).
- Consider sedation and muscle relaxant.

10.3 Respiratory Distress Syndrome of prematurity (Hyaline Membrane Disease)



DEFINITION

Respiratory Distress Syndrome (RDS) is a common problem in premature babies. This disorder is caused primarily by deficiency of pulmonary surfactant in an immature lung leading to pulmonary collapse, impaired gas exchange and respiratory failure.

10.3.1 RISK FACTORS

- Prematurity
- Maternal diabetes
- Perinatal asphyxia
- Multiple gestation
- Secondary surfactant deficiency e.g., due to MAS
- Chorioamnionitis
- Precipitous labor
- Hypothermia or cold stress
- Patent ductus arteriosus (PDA)
- Caesarean Section delivery

10.3.2 CLINICAL MANIFESTATIONS

- Tachypnoea (Fast Breathing)
- Nasal flaring
- Grunting
- Chest retractions
- Cyanosis
- Apnoea
- Reduced air entry
- Shock

10.3.3 DIAGNOSIS

- **Refer to Chapter 10.1.4: Diagnostic Investigations.**
- Pulse oximetry and arterial blood gas results
- Special investigations such FBC and differential, infection markers such as CRP, blood for MCS, blood glucose monitoring.
- Chest X-ray (may show small lung volumes and classic diffuse ground glass appearance with bilateral air broncho-grams).

10.3.4 MANAGEMENT

- Conduct initial assessment; give supplementary oxygen and ventilatory support if indicated. (**Refer to Chapter 2.4 and 4: Assessment & Immediate Management of all Neonates.**)
- Give surfactant in severe RDS (In consultation with pediatrician)
- Maintain optimal thermal environment (prevent hypothermia).
- Minimal handling and noise.
- Adequate oxygenation but avoid oxygen toxicity. (aim for saturation of 90- 94%).
- Ventilatory support as indicated
- Optimal blood pressure – consider inotropes if indicated (consult paediatrician).
- Correction of acidosis, hypoglycemia and other

metabolic disturbances.

- IV antibiotics (Ampicillin 50mg/kg IV 12 hourly and Gentamycin 5mg/Kg once daily IV). Review antibiotics and change after 2-3 days if no improvement.
- Keep NPO and put on IVF
- Monitor for possible complications
- Where there are limited resources to provide adequate care refer to the next level of care facility (**refer to Chapter 11: Referral Guidelines**).

10.4 Neonatal Apnoea



DEFINITION

It is the cessation of breathing for >20 seconds, or a shorter respiratory pause associated with cyanosis, desaturation and/or bradycardia.

10.4.1 TYPES OF APNOEA

- Central Apnoea:** Caused by decreased central nervous system stimuli to respiratory muscles and its characterised by a lack of respiratory effort.
- Obstructive Apnoea:** Caused by airway obstruction and occurs when respiratory effort persists.
- Mixed Apnoea:** It is a combination of both central and obstructive apnoea.

Apnoea is different from periodic breathing which, while also being common in premature newborns is a pause in breathing that lasts just a few seconds (5-10 seconds) and is followed by several fast and shallow breaths. **Periodic breathing does not cause a change in facial color (such as blueness around the mouth) or a drop-in heart rate.** A neonate who has periodic breathing starts regular breathing again on his or her own. Although it can be frightening, periodic breathing usually causes no other problems.

10.4.2 Table 17: Risks and Common Causes of Neonatal Apnoea

PERINATAL	• Prematurity • Maternal sedation or analgesia in labour • Abstinence syndrome (mother drug addict) • Perinatal asphyxia • Neonatal Infections
RESPIRATORY	• RDS
CVS	• Congenital Cardiovascular Disorders e.g., PDA • Hypovolaemia
CNS	• Intraventricular Haemorrhage • Meningitis • HIE • AOP
OTHER	• Congenital malformations • Neonatal drugs e.g., sedatives • Metabolic disorders e.g., Hypoglycaemia • Anaemia

10.4.3 DIAGNOSIS/WORK-UP

Investigations depend on the most likely cause, but might include the following:

- Imaging (x-ray, echocardiogram, CT scan/MRI).
- Electrophysiological (EEG)
- Laboratory (FBCs, RFTs, LFTs, CMP, CRP, Septic work-up, Blood gases, blood sugar etc.)

10.4.4 MANAGEMENT

For assessment and initial management (*refer to Chapter 2.4 and Chapter 4*).

Further management will depend on the cause of the apnoea.

10.5 Haemorrhagic Disease of the Newborn

DEFINITION:

Haemorrhagic disease is a bleeding problem that occurs in a neonate during the first few days of life or as late as the first week of life. Babies are normally born with low levels of Vitamin K, an essential factor in blood clotting. A deficiency in Vitamin K is the main cause of haemorrhagic disease in newborn babies. It is also known as Vitamin K deficiency bleeding (VKDB).

10.5.1 TYPES OF HDN

Early HDN Occurs within 24 hours of birth and is usually due to maternal drugs e.g. antiepileptics

Classic HDN Occurs from 2 to 7 days and usually due to low vitamin K levels or malabsorption of Vitamin K

Late onset HDN 2- 12 weeks, even up to 6 months

10.5.2 RISK FACTORS

- Neonates who do not receive preventive vitamin K in an injection at birth.
- Neonates born to mothers on:
 - Anticoagulants
 - Anticonvulsants
 - Anti-TB drugs
- Exclusively breastfed neonates.
- Maternal short gut syndrome.
- Neonates with liver diseases.
- Preterm neonates.

10.5.3 CLINICAL PRESENTATION

Neonates can bleed from various sites such as: mucosal orifices, injection sites, skin bruising, cephalhematoma and intracranial bleeds. Neonates may also present with secondary complications of bleeding such as pallor, shock, irritability, jaundice e.t.c.

Intracranial bleeding is mostly associated with late VKDB and presents with a floppy neonate, lethargy, feeding difficulties, bulging fontanelles, decreased respiratory rate, altered consciousness, convulsions, or pallor. It has a mortality of 20%–50% and associated morbidity.

10.5.4 Diagnosis

No test is diagnostic for HDN. Do coagulation profile and Full blood count. The platelet level is normal, and PT and PTT are prolonged in HDN. Need to exclude other potential causes of neonatal bleeding such as sepsis.

- Further investigations will be guided by clinical findings.

10.5.5 MANAGEMENT

Prevention

- Giving every newborn neonate vitamin K 1mg IM soon after birth.

Immediate treatment

For serious/life-threatening bleeding, treatment include:

- Fresh frozen plasma (FFPs) 20ml/kg
- Consider blood transfusion
- Late VKDB can present with neurological abnormalities and intracranial haemorrhage. The most common form being sub-dural haemorrhage may require surgical intervention and regular follow-up
 - Infants presenting with a non-life-threatening bleed only need to be treated with Vitamin K 250-300mcg (IV or Subcutaneous).

For early and classic forms of hemorrhagic disease of the newborn, the treatment is with oral vitamin K (2mg dose) repeated at 2-4 weeks and at 6-8 weeks.

For the late form of the disease, oral vitamin K is not as efficacious as parenteral, and hence currently, 0.5-1 mg single IM dose is administered to infants.

For neonates weighing less than 1500 gm, 0.5 mg IM single dose is given.

For neonates weighing more than 1500 gm, 1 mg IM single dose is given.

All breastfed babies with diarrhea and malabsorption require an additional post-natal dose of vitamin K to prevent late vitamin K deficiency bleeding.



ALL BABIES SUSPECTED OF INTRACRANIAL BLEEDING OR WITH SERIOUS/LIFE-THREATENING BLEEDING SHOULD BE REFERRED TO A TERTIARY FACILITY AFTER STABILIZING AND ADMINISTRATION OF VITAMIN K.

10.6 Neonatal Hypoglycemia

DEFINITION

It refers to low blood sugar (glucose) in a neonate in the first few days after birth. Low blood glucose is a level less than 2.6 mmol/l.

The condition usually occurs when the neonatal blood glucose level is less than the metabolic requirements of the neonate.

10.6.1 REQUIREMENTS

The glucose requirements for a term and preterm neonate are 4-6mg/kg/min and 6-8mg/kg/min respectively.

Persistent Neonatal Hypoglycaemia

Defined as recurrent hypoglycaemia which does not resolve within 5-7 days or requiring infusions above 10 mg/kg/min of glucose. It occurs in 5% of neonates with hypoglycaemia.

Table 18: Neonates at Risk of Hypoglycaemia

Decreased Supply • Preterm • IUGR • Polycythaemia • Asphyxia	Endocrinopathies • Pituitary deficiency e.g., GH, septo-optic dysplasia • Adrenal e.g., congenital adrenal hyperplasia
Increased demand • Hypothermia • Infection/sepsis. • Infant of a diabetic mother – macrosomia • Haemolytic disease of the newborn. • Beckwith-Wiedemann syndrome. • Hyper Insulinaemic • Hypoglycaemia of infancy (HIHI). • Congenital Heart Disease	Inborn Errors Metabolism • Carbohydrate metabolism disorders: ◦ Glycogen storage disease. • Amino acidopathies. • Organic acidaemias. • Fat oxidation defects.
Maternal Medications • Salicylates • Beta-Sympathomimetics • Chlorpropamide • Benzothiadiazide	

10.6.2 PRESENTATION

Clinical manifestations of hypoglycaemia are non-specific and are like other neonatal disorders. Symptoms of hypoglycaemia should improve with correction of the hypoglycaemia.

These may include:

- Refusal to feed
- Jitteriness
- Irritability
- Abnormal cry
- Hypotonia
- Apnoea
- Tachypnoea
- Tachycardia
- Pallor
- Sweating
- Subnormal temperature
- Convulsions
- Drowsiness
- Cyanotic spells

10.6.3 MANAGEMENT

- Anticipating neonates at risk for hypoglycaemia is key in preventing the development of symptomatic hypoglycaemia. Actions to reduce risk of hypoglycaemia is to:
 - Introduce feeds early (within 30 minutes to 1hr after birth) or use IV (10% dextrose) fluids if nil per os.

If Neonate is hypoglycaemic

a. Asymptomatic, clinically well and feeding

- Give feeds and measure glucose after 30 minutes
 - If normal, continue monitoring
 - 1-hourly for the first 3 hours then
 - 3-hourly for the next 24 hours
 - If abnormal
 - Start on 10% Dextrose solution at a glucose delivery rate of 6mg/kg/min in term and 8mg/kg/min in preterm infants and
 - Admit neonate.

NB: CALCULATION OF GLUCOSE INFUSION RATE

$$\text{Glucose delivery in mg/kg/min} = \frac{\% \text{ Dextrose of X drip rate (ml/hr)}}{\text{Weight (kg)} \times 6}$$

b. Asymptomatic not on feeds i.e., on IV fluid

- i. Ensure the line is working and the neonate is getting adequate glucose delivery.
 - ii. If above (i) is implemented already
 - And random blood sugar (RBS) > 1.5mmol/L
 - Increase glucose infusion rate by 1-2mg/kg/min and review after 30mins.
 - And RBS <1.5 mmol/L
 - Then give 2-5ml/kg of 10% dextrose IV,
 - Increase glucose infusion rate by 1-2mg/kg/min and repeat glucose check after 30minutes.
 - NEVER GIVE UNDILUTED 50% DEXTROSE TO NEONATES!!!
 - If RBS is normal, then [see Chapter 10.6.3: A (i)]
 - If RBS remains low, then consult Paediatrician.
- NB: Glucose delivery may be improved by increasing the concentration or flow rate depending on clinical circumstances**

c. Symptomatic

- i. Ensure the line is working (Insert IV line if not already inserted) and the infant is getting adequate glucose delivery.
- ii. Then give 2-5ml/kg of 10% dextrose IV and repeat glucose check after 30 minutes.
- iii. Increase glucose infusion rate by 1-2mg/kg/min every 2-3hours as bolus is given in between to a maximum of 12.5mg/kg/min.
- iv. If RBS remains low, then consult Paediatrician.

NB Dextrose concentration of >12.5% requires a central line/ umbilical line
When blood glucose level stabilizes (between 2.8 and 11mmol/L) for 12 to 24 hours or beyond 11mmol/L at any point in time, consider weaning infusion appropriately.

Table 19. Conversion of Glucose Infusion Rate from ml/kg/24 hours to mg/kg/min Conditional on Strength of Dextrose Solution.

RATE OF INFUSION		Strength dextrose solution will provide mg/kg/min glucose			
ml/kg/24hrs	ml/kg/min	4%	10%	15%	20%
60	2.5	1.7	4.2	6.2	8.4
80	3.0	2.2	5.6	8.3	11.2
90	3.3	2.5	6.3	9.4	12.5
100	4.2	2.8	6.9	10.4	13.8
120	5.0	3.3	8.3	12.5	16.6
150	6.3	4.2	10.4	15.6	20.8
180	7.5	5.0	12.5	18.7	25.0
200	8.3	5.6	13.9	20.8	27.8

10.7 Vomiting and Abdominal Distension

10.7.1 VOMITING



DEFINITION:

Vomiting is the involuntary, forceful expulsion of the contents of one's stomach through the mouth and sometimes the nose. Progressively worsening projectile vomiting in the first months of life is concerning for pyloric stenosis and requires immediate imaging and surgical referral.

Spitting up or regurgitation (possetting) of small quantities of milk after a feed is common in a newborn neonate, they are usually transitory, and has no effect on growth. If regurgitation is persistent and in large amounts, it may indicate serious conditions such as gastroesophageal-reflux-disease (GERD). GERD is reflux that produces troublesome symptoms for the patient and may lead to complications, such as respiratory complications, failure to thrive and reflux esophagitis.

A single incidence of vomit is not necessarily pathological. Feeding should continue as normal under close supervision. Repeated vomiting must be investigated and managed.

Vomiting is problematic if it:

- Is very forceful or projectile.
- Occurs regardless of method of feeding.

- Involves vomiting entire feedings after every feed.
- Contains bile or blood.
- Occurs in a neonate who has abdominal distension.
- Associated with instability of vital signs.

10.7.2 ABDOMINAL DISTENSION



DEFINITION

Enlargement of the abdomen due to an underlying disease of dysfunction.

Table 20: Causes of Abdominal Distention

FUNCTIONAL/MEDICAL	STRUCTURAL/SURGICAL
• Sepsis, NEC with ileus • Electrolyte imbalance causing intestinal ileus • Ascites from liver, kidney or heart disease. • Haemorrhage from trauma or bleeding conditions. • Pneumoperitoneum. • Swallowed air. • Constipation.	• Intestinal malformations such as intestinal atresia, malrotations etc. • Hirschsprung's Disease. • Intussusception. • Organic masses e.g., Hepatomegaly, tumours. • Omphalocele/Gastroschisis.

An ileus and an intestinal obstruction have similarities, but an ileus results from muscle or nerve problems that stop peristalsis while an obstruction is a physical blockage in the digestive tract. However, a type of ileus known as paralytic ileus can cause a physical blockage due to a build-up of food in the intestines.

10.7.3 GENERAL MANAGEMENT OF BABIES WITH VOMITING AND ABDOMINAL DISTENSION

- Do a rapid assessment. (*Refer Chapter 4: Rapid Assessment and Stabilisation of a Neonate*)
- Insert a nasogastric tube for free drainage if there is abdominal distension.
- Monitor and replace gastric losses accordingly
- Keep NPO on maintenance IVF at appropriate rates
- Investigate for underlying causes.
- Do an abdominal and chest X-ray with the NGT in-situ.

10.7.4 SPECIFIC MANAGEMENT FOR CONDITIONS CAUSING VOMITING AND/OR ABDOMINAL DISTENSION IN A NEONATE

10.7.4.1 Necrotizing Enterocolitis



DEFINITION

Is an ischaemic and inflammatory necrosis of the bowel primarily affecting premature neonates after the initiation of enteral feeding.

10.7.4.1.1 RISK FACTORS

Are related to the following

- Prematurity
- Microbial Colonization
- Enteral Feeding
- Circulatory Instability
- Maternal Cigarette Smoking
- Polycythaemia and hyper-viscosity syndrome
- Blood Transfusion
- Formula feeds

Early diagnosis may impact the outcome and depends on which neonates are at risk and careful observation of these neonates for signs suggestive of NEC.

10.7.4.1.2 CLASSIFICATION OF NEC ACCORDING TO THE MODIFIED BELL'S CRITERIA

Table 21: Staging of NEC

STAGE	CLINICAL (SYMPTOMS AND SIGNS)	ABDOMINAL X-RAY
I. Suspected	Mild illness • Feeding Intolerance • Abdominal Distension	Non-Diagnostic/Specific
II. Definite	Moderately ill (As above) AND may have Bloody stools	Pneumatosis Intestinalis
III. Advanced	Critically ill (As above) AND systemic signs of sepsis	Pneumatosis Intestinalis +/- Perforation

10.7.4.1.3

CLINICAL PRESENTATION

Signs of NEC are variable

- Feeding difficulties
- Vomiting
- Abdominal Distension
- Bloody Stools or gastric contents
- Gastric Aspirate
- Lethargy, apathetic
- Sepsis
- Shock
- Peritonitis with or without perforation

10.7.4.1.4

MANAGEMENT

- General management as above (*See Chapter 10.7.3: GENERAL MANAGEMENT OF BABIES WITH VOMITING AND ABDOMINAL DISTENSION*).
- Start 2nd Line Antibiotics; Typically, triple antibiotics: Cefotaxime, Vancomycin and Metronidazole.
- Subsequent management should be according to the Modified Bell's Staging criteria and discussed with the specialist.
- Manage as a neonate with Sepsis (*See Chapter 7.2*)

NB: REFER TO A DISTRICT OR TERTIARY HOSPITAL

10.7.4.2

Suspected gastrointestinal malformation or obstruction

- General management as above (*See Chapter 10.7.3*)
- Organize transfer, and urgently refer the neonate to a tertiary hospital for surgical intervention.

10.7.4.3

Swallowed maternal blood/meconium

- If vomiting is caused by blood swallowed during breastfeeding (cracked nipples):
 - Observe the mother while she breastfeeds. Assess her technique and suggest changes as necessary.
 - If the neonate is feeding well and there are no other problems requiring hospitalization, discharge the neonate.
- If vomiting is caused by blood swallowed at the time of birth:
 - Attach a syringe to the gastric tube and aspirate the stomach contents; do a stomach wash out with normal saline 10ml/kg.
 - Allow the neonate to begin breastfeeding. If the neonate cannot be breastfed, give expressed breast milk.
 - Remove the gastric tube after two successful feeds.
 - If the neonate is feeding well and there are no other problems requiring hospitalization, discharge the neonate.

10.8 Macrosomia



DEFINITION

Any neonate born weighing more than 4000g or more than 90th percentile for gestational age.

Macrosomia is associated with an increased risk of several complications such as:

- Hypoglycaemia (50%).
- Polycythaemia
- Electrolyte disturbances (up to 50%)
- Meconium Aspiration Syndrome
- Birth injuries
- Birth asphyxia
- Cephalhaematomas – subperiosteal or subaponeurotic
- Respiratory distress

10.8.1 MANAGEMENT

NB: The management will be according to the clinical complication that the neonate present with.

- Check blood glucose at birth, if hypoglycaemia-refer to the guideline on hypoglycaemia (*See Chapter 10.6*).
- Assess for birth injuries e.g. clavicle and/or humerus fractures, brachial plexus injuries, cephalohaematomas.
- Assess for syndromes that may be associated with macrosomia e.g., Beckwith-Wiedemann syndrome, neonate of a diabetic mother etc.
- Assess for any respiratory distress (*refer to Chapter 10.1: Respiratory Distress of the Newborn*).

10.9 Neonatal Jaundice



DEFINITION

Jaundice refers to the yellowish discolouration of the skin, sclera, mucous membranes and nails caused by the presence of bilirubin in elevated concentration.



Jaundice baby

10.9.1 CAUSES OF NEONATAL JAUNDICE

Table 22: Causes of Neonatal Jaundice

Increased production of bilirubin - Haemolysis (RBC destruction) due to: - Rh, ABO and minor group incompatibility - RBC membrane defect - Sepsis - Haemorrhage e.g., cephalohaematoma - Increased number of RBC - Polycythaemia (Hematocrit >65) - Delayed cord clamping - Increased entero-hepatic circulation - Delayed passage of meconium - Delayed introduction of feeds - Poor feeding	Altered hepatic clearance of bilirubin - Shortage of uridine diphosphate glucuronyl transferase (UDPGT) production or activity (physiological). - Immaturity - Metabolic or endocrine disorders - Alteration in hepatic function and perfusion - Sepsis - Asphyxia - Acidosis - Drugs and hormones - Hepatic obstruction - Congenital anomalies e.g., biliary atresia - Biliary stasis - Excessive bilirubin load - Congenital syphilis - Congenital hypothyroidism
Mixed - Sepsis - Intrauterine Infections - Respiratory distress syndrome - Birth trauma - Infant of diabetic mother	Other causes - Breast milk jaundice - Breast feeding jaundice

10.9.2 RISK FACTORS FOR JAUNDICE

- LBW babies
- Preterm babies
- IUGR and SGA
- A neonate with a sibling who had neonatal jaundice.
- Presence of haemolysis.
- Infections.
- Babies poorly fed, breast fed babies.
- Babies with cephalo-haematoma /bruising, breech presentation.
- Blood incompatibility.
- Maternal diabetes.

10.9.3 CLASSIFICATION

- a. **Physiological Jaundice** - A newborn's immature liver often can not remove bilirubin quickly enough, causing an excess of bilirubin. Jaundice due to these normal newborn conditions is called physiologic jaundice, and it typically appears on the second or third day of life.
- b. **Pathological Jaundice** - is the most serious type of jaundice. It occurs within 24 hours after birth and is characterized by a rapid rise in a neonate's bilirubin level that requires phototherapy and any signs of underlying illness. The most likely cause is blood group incompatibility, sepsis or liver disease.

10.9.3.1 Physiological Jaundice

CHARACTERISTICS

- Appears after 24 hours
- Maximum intensity by 4th-5th day in term & 7th day in preterm
- Serum bilirubin level depend on age and gestational age at delivery (*See Figure 3: Phototherapy Chart*)
- Clinically not detectable after 14 days
- Mostly disappears without any treatment

NB: Neonate should, however, be watched for worsening jaundice.

MANAGEMENT OF PHYSIOLOGICAL JAUNDICE

- Can be managed at home.
- Should be followed up postnatally at 72 hours and day 6 of life (domiciliary).
- Encourage exclusive breastfeeding – make sure mother has enough breastmilk and that neonate is feeding well from the breast. Otherwise suggest top-up cup feeds with expressed breastmilk after a breastfeeding session to prevent dehydration.
- Explain the condition of the neonate to the care giver.
- Health education given to mother should include:
 - To return if jaundice does not resolve by two weeks of age
 - If condition worsens or danger sign(s) appear.

If there is worsening of the yellow discolouration when it spreads to the peripheral limbs.

10.9.3.2 Pathological Jaundice

- Appears within 24 hours of age.
- Increase of bilirubin 87 $\mu\text{mol/l}$ / day or > 5 mg/dl/day.
- Jaundice persisting after 14 days in term babies and 21 days in preterm babies.
- Clay/white coloured stool.
- Coke coloured urine.
- Direct bilirubin >20% of the total serum bilirubin



Jaundice baby undergoing Phototherapy

MANAGEMENT OF PATHOLOGICAL JAUNDICE

- Take history on the following details:
 - Onset of symptoms
 - Previous history of jaundiced sibling
 - Blood group and Rhesus factor of mother
 - Maternal infections (TORCHes- congenital infections of Toxoplasmosis, Others (Treponema Pallidum, Varicella- Zoster Virus, Parvovirus B19), Rubella, Cytomegavirus, Herpes simplex and other organisms)- prolonged jaundice.
 - Maternal malaria
- Proceed with the following laboratory tests:

NB: investigations will be guided by onset and type of jaundice.

 - FBC, peripheral blood smear, Blood culture, CRP
 - Serum bilirubin: direct, indirect and total.
 - Direct Coombs' test.
 - Rh factor and Blood grouping for both mother and neonate.
 - TORCH screening depending on the clinical findings.
 - LFTs
 - Abdominal Ultrasound.
- Encourage exclusive breast feeding or expressed breast milk by cup or through NGT.
- Begin PHOTOTHERAPY according to the Bilirubin Charts below:

NB: Babies under phototherapy must be fully exposed with only eyes that are covered with appropriate phototherapy goggles.

- Bilirubin levels should be done daily.
- Stop phototherapy when the level is 50 $\mu\text{mol/L}$ below the threshold level.
- Babies with haemolytic disease, bilirubin levels should be checked 12–24 hours after cessation of phototherapy to monitor for significant rebound.
- For levels above the threshold for exchange transfusion (*see Figure 4: Exchange Transfusion Chart*), start double phototherapy & discuss with paediatrician at referral centre.

Figure 3: Phototherapy Chart (Requires Expert Advice)

In presence of risk factors use one line lower (the gestation below) until <1,000g.

If gestational age is accurate, rather use gestational age (weeks) instead of body weight.

Neonates > 12 hours old with Total Serum Bilirubin (TSB) level below threshold, repeat TSB level as follows:

1 - 20 $\mu\text{mol/L}$ below line: repeat TSB in 6hrs or start phototherapy and repeat TSB in 12-24hrs.

21 - 50 $\mu\text{mol/L}$ below line: repeat TSB in 12-24hrs.

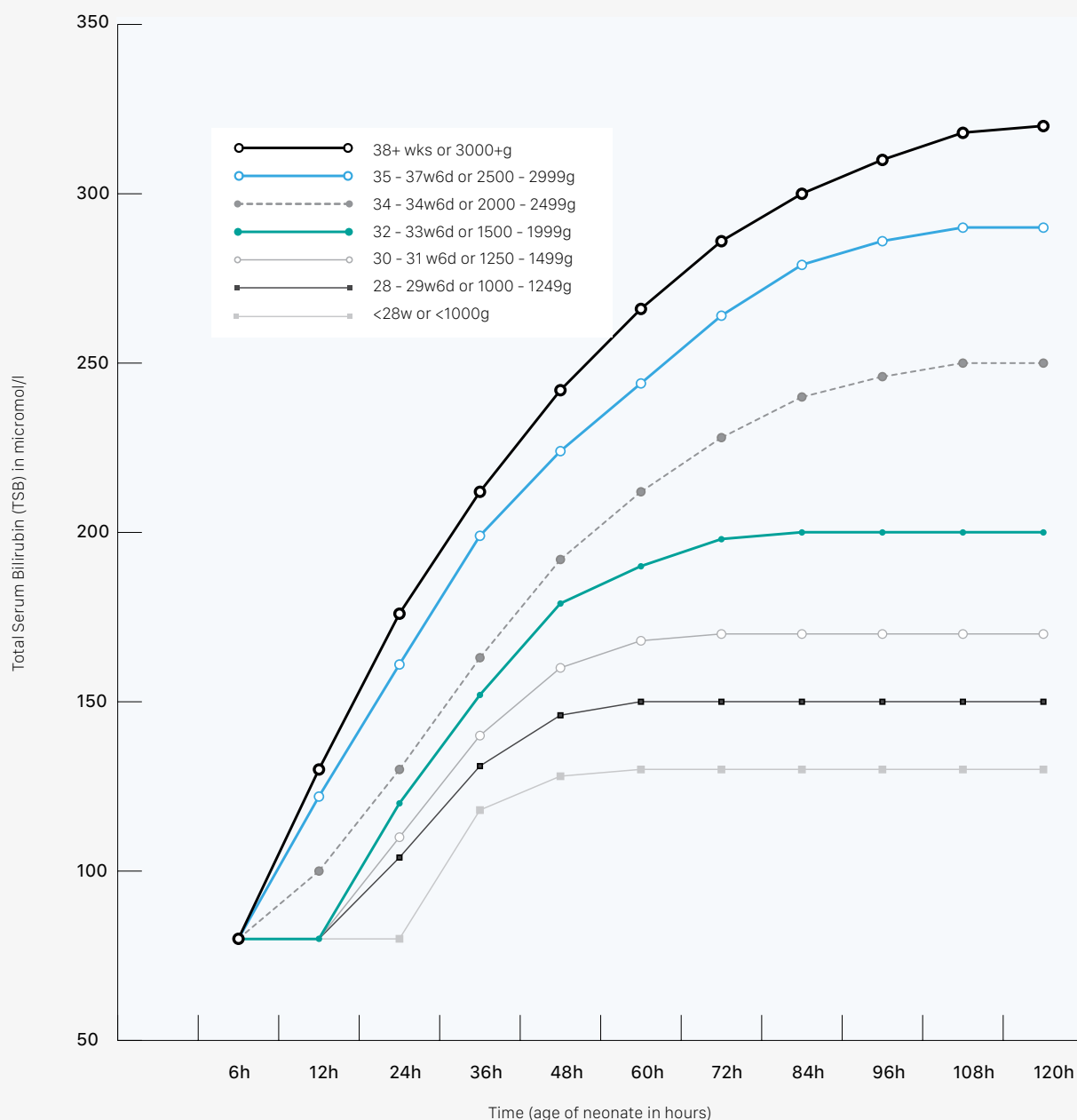
> 50 $\mu\text{mol/L}$ below line: repeat TSB until it is falling and/or until jaundice is clinically resolving.

Neonates under phototherapy:

Check the TSB 12 - 24hrly but if TSB >30 $\mu\text{mol/L}$ above the line, check TSB 4 - 6hrly.

STOP phototherapy:

If TSB > 50 $\mu\text{mol/L}$ below the line. Recheck TSB in 12-24hrs.



NB: START INTENSIVE PHOTOTHERAPY WHEN THE TSB IS $\geq$ THE LINE ACCORDING TO GESTATION OR WEIGHT.

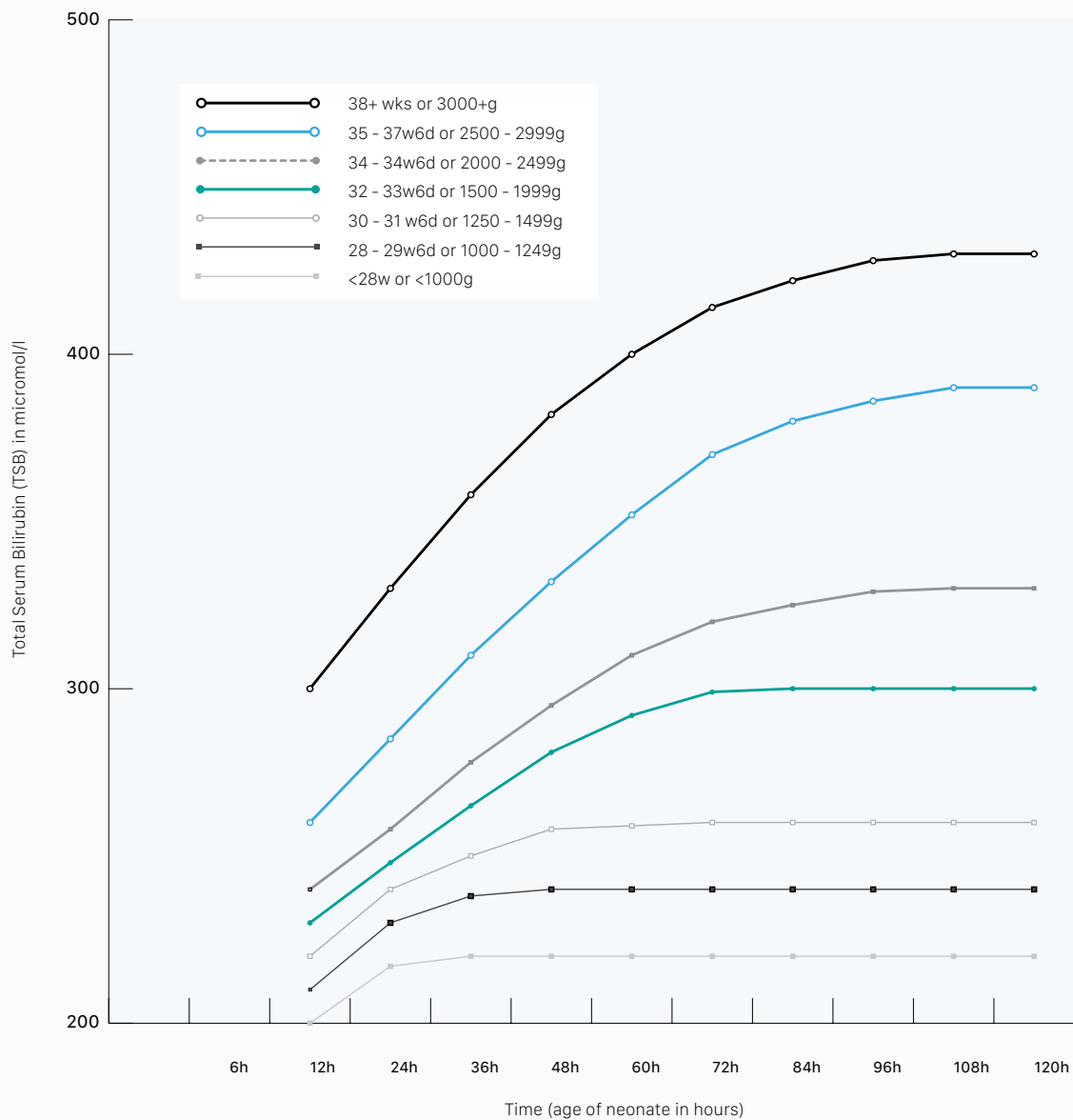
Figure 4: Exchange Transfusion Chart (Requires Expert Advice)

In presence of sepsis, haemolysis, acidosis, or asphyxia, use one line lower (gestation below) until <1000g
If gestational age is accurate, rather use gestational age (weeks) instead of body weight.

NB:

1. Neonates who present with TSB above threshold should have Exchange done if the TSB is not expected to be below the threshold after 6hrs of intensive phototherapy.
2. Immediate Exchange is recommended if signs of bilirubin encephalopathy and usually also if TSB is >85 $\mu\text{mol/L}$ above threshold at presentation.
3. Exchange if TSB continues to rise > 17 $\mu\text{mol/L/hour}$ with intensive phototherapy.

Babies who were on phototherapy require follow-up post-discharge. The following information need to be completed, along with the standard discharge summary.



10.10 Thermal Management

A newborn neonate is homeothermic at birth (metabolic activity keeps the body temperature at a constant level), but the heat exchanges with the environment are greater in the neonate than in the adult, explaining the increased risk of body hypo- or hyperthermia.

Thermal protection of the newborn is a set of continuing measures, which starts at birth, to ensure that a body skin temperature of 36.0°C to 36.5°C is maintained. Thermal care is central to reducing morbidity and mortality in newborns. Thermoregulation is the ability to balance heat production and heat loss in order to maintain body temperature within a certain normal range. Thermoregulation in a neonate occurs when the neonate is kept in a thermoneutral environment.

A thermoneutral environment (TNE) is a narrow range of environmental temperatures at which the basal metabolic rate (BMR), and oxygen consumption of the neonate is at a minimum and the neonate can maintain a normal body temperature.

- As opposed to TNE, thermoregulatory environment refers to environmental temperature beyond TNE range, at which neonate would be able to maintain its body temperature but by increasing its BMR.
- The neonates therefore should be kept in TNE so that their energy is utilized for growth and other vital functions.

Figure 5: Range of Neutral Temperature Varies According the Gestation and Postnatal Age

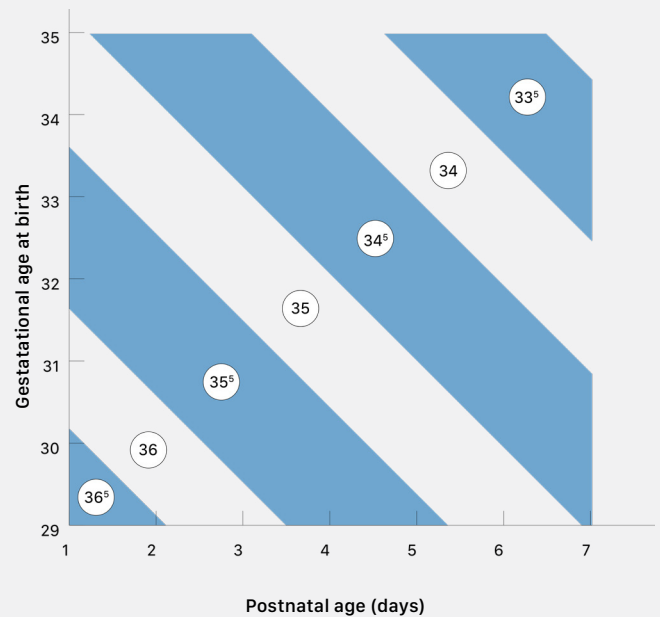


Figure Adopted from Gomella, T Lacy; Cunningham, M. Douglas; Neonatology 7th Edition. McGraw-Hill Education. Kindle Edition.

10.10.1 THE WARM CHAIN

Incorrect care of the neonate at birth is the most important factor influencing the occurrence of hypothermia.

The “warm chain” is a set of interlinked procedures and steps taken at birth and during the next hours and days in order to minimize heat loss in all newborns. Failure to implement any one of these procedures will break the chain and put the newborn neonate at risk of hypothermia. The 10 steps are described below:

THE WARM CHAIN	
1. Warm delivery room	7. Mother & Neonate together
2. Immediate Drying	8. Warm Transportation.
3. Skin-to-Skin Contact	9. Warm Resuscitation
4. Breast-Feeding	10. Training & Awareness raising
5. Bathing & weighing postponed	
6. Appropriate clothing/ bedding	

WARM DELIVERY ROOM

- The room should be clean, warm (at least 25-28°C) and free from draughts from open windows and doors or from fans.
- If the temperature of the room is less than optimal, a heater should be available to warm the room. All the towels, blankets, caps, neonate's clothes should be prewarmed.
- The radiant warmer should be switched on at least 20 to 30 minutes in advance and put into manual mode with 100% heater output.
- A neonate is wet at birth and a wet neonate cool down very quickly. Therefore, the neonate should immediately be dried with a dry towel, including the head, while the cord is still attached to the neonate.
- After drying thoroughly, the neonate should then be covered with a second, dry towel and a cap put on its head.
- The neonate should immediately be placed skin-to-skin on the mother's chest or abdomen while mother is being attended including placental delivery, episiotomy, suturing, during transfer and kept in postnatal ward for initial few hours.
- The neonate should be uncovered as little as possible during assessment of its condition, during eye care and while the cord is tied and cut.

- Skin-to-skin contact can also be used afterwards to keep the neonate warm if the room is cool, for example at night, or to rewarm a neonate who is found to be mildly hypothermic.

BREAST FEEDING

- Breast feeding should begin as soon as possible after birth preferably within an hour. This ensures adequate supply of calories for heat generation and prevents the development of hypoglycaemia.

BATHING AND WEIGHING

- Bathing should be postponed in a term neonate for at least 48 to 72 hours. Postpone weighing and measurement of head circumference and length till after the neonate has fed from the breast.

CLOTHING AND BEDDING

- Newborns should be covered with one (or) two more layers of clothes than adults. Clothing should always include a cap.

ROOMING IN

- Neonate and mother should preferably not be separated and breastfeeding on demand should be practiced.

WARM TRANSPORTATION

- In case of transport- whether to home, to another hospital / another Section, thermal protection should be ensured.
- Stable neonates including preterm and LBW neonates should be transported well wrapped and in skin-to-skin contact with mother.
- VLBW, unstable, admitted neonates should be transported using an incubator. Temperature should be checked before and after transport.
- All peripheral hospitals caring for high-risk mothers should go for in-utero transfer as early as possible.

WARM RESUSCITATION

- Ensure the room is always kept warm at all times.

TRAINING AND AWARENESS RAISING

- All the health care personnel involved in newborn care should be adequately trained and informed about the principles of observing the warm chain of care.

10.11 Hypothermia



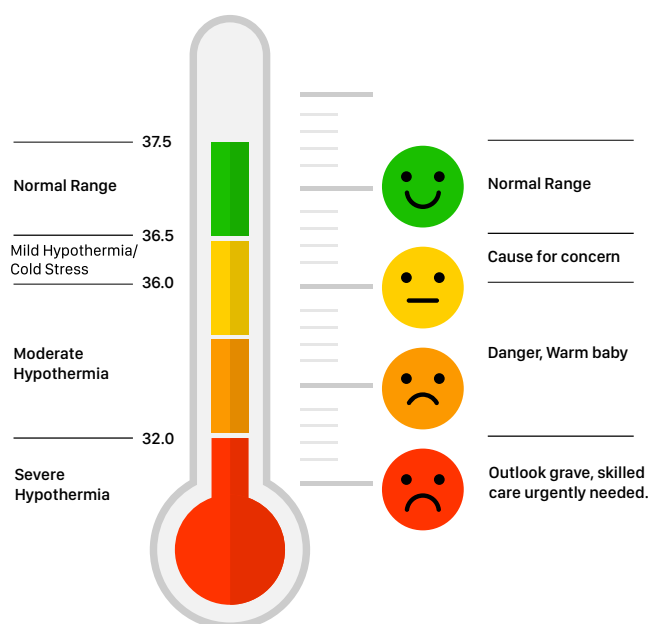
DEFINITION:

Skin temperature less than 36°C or core temperature less than 36.5°C

Newborns have certain characteristics such as a large body surface area in relation to weight, a large head in proportion to the body and little subcutaneous fat which results in increased risk of heat loss, especially in preterm and LBW babies. When heat loss exceeds the neonate's ability to produce heat, the neonate's body temperature drops below the normal range and neonate becomes hypothermic.

10.11.1 CLASSIFICATION OF HYPOTHERMIA

Figure 6: Body Temperature in the Newborn Infant (°C)



10.11.2 CLINICAL FEATURES OF HYPOTHERMIA

- Initial signs of hypothermia are generally those which appear because of peripheral vasoconstriction like pallor, acrocyanosis, cool extremities, decreased peripheral perfusion, or there can be early signs of CNS manifestations like irritability.
- Later signs include features of CNS depression like lethargy, bradycardia, apnoea, poor feeding, hypotonia, weak suck or cry, emesis. Because of increase in pulmonary artery pressure, there can be symptoms of respiratory distress mainly tachypnoea. Abdominal signs like increased gastric residuals, abdominal distention or emesis can occur.
- Prolonged hypothermia leads to increased metabolism leading to hypoglycaemia, hypoxia, metabolic acidosis, coagulation failure, PPHN and acute kidney failure. In severe hypothermia extreme cases there is a high likelihood of mortality.
- Chronic periods of cold stress may lead to poor weight gain.

10.11.3 RISK FACTORS OF HYPOTHERMIA

- Wet neonate
- Sepsis
- Exposure to cold environment
- Prematurity
- Post-maturity
- IUGR
- Depletion of energy substrates e.g., Hypoglycaemia
- Condition with increased metabolic demands
- Metabolic diseases e.g., hypothyroidism, adrenaline insufficiency

10.11.4 MANAGEMENT

Management of hypothermia depends on the degree of the hypothermia.

Table 23. Core (Rectal) Temperature Ranges (AAP, GOMELA)

Normal	36.5-37.5 °C
Mild hypothermia (cold stress)	36-36.4 °C
Moderate hypothermia	32-35.9 °C
Severe hypothermia	< 32 °C
Hyperthermia	>37.5 °C

A. COLD STRESS

- The best action to warm a neonate with cold stress is to place the neonate skin-to-skin on the mother's chest and keep the neonate there till rewarmed.
- *Clothes and blankets are not effective in warming a neonate who has become cold or hypothermic.*
- Another option is to place the neonate near a heater or in an incubator if the mother is not able to provide skin-to-skin care.
- Warm the environment including the room or bed.
- Immediately breastfeed the neonate.
- Monitor axillary temperature every hour till it reaches 36.5°C, then hourly for next 4 hours, 2-hourly for 12hours thereafter.

B. MODERATE AND SEVERE HYPOTHERMIA

All neonates with moderate to severe hypothermia should immediately be admitted to the hospital.

Neonates should be rewarmed at a rate between 0.5-1.0°C per hour.

In this situation, one should provide the neonate with an additional source of heat.

- Maintain skin-to-skin contact
- Warm room/bed
- Take measures to reduce heat loss
- Provide extra heat with a room heater, radiant warmer, incubator or applying a warm towel
- Check the blood glucose
- Start IVF.
- Provide oxygen if needed.

10.12 Hyperthermia

Hyperthermia is also a common problem with neonates. Temperature of more than 37.5°C is defined as hyperthermia in newborns.

10.12.1 CLINICAL FEATURES OF HYPERTHERMIA

- Signs of dehydration (sunken eyes or fontanelle, loss of skin turgor, or dry tongue and mucous membranes)
- Poor or no feeding
- Respiratory rate more than 60 breaths per minute
- Heart rate more than 160 beats per minute.
- Lethargy
- Irritability
- Severe forms of hyperthermia can lead to shock, convulsions, even death in neglected cases.

10.12.2 CAUSES

- Hot environment e.g., high room temperature
- Neonate Sepsis
- Dehydration fever
- Post vaccination fever
- Drug withdrawal
- Hyperthyroidism
- Drug effect e.g., Prostaglandin E1

10.12.3 MANAGEMENT OF HYPERTHERMIA

- If the hyperthermia is due to overwarming under a radiant warmer or in an incubator:
 - Check radiant warmer probe position and environmental temperature.
 - Reduce the temperature setting of the warming device.
 - If the neonate is in an incubator, open the incubator portholes until the temperature of the incubator is within the normal range.
 - Remove external heat sources e.g., blankets, heaters.
 - Undress the neonate partially then recheck the temperature every 30min.
- If the neonate has hyperthermia but not due to overwarming or clothing exclude the following:
 - **Sepsis** - Observe for signs of sepsis (e.g., poor feeding, vomiting, breathing difficulty) neonate.
 - Consider infection as a cause of the pyrexia, do septic work up and start antibiotics. (See Section 7.1 Neonatal Sepsis).

NB: The result of dehydration in a

neonate is excessive loss of weight. If a neonate has a high fever with excess weight loss it can be presumed that the fever is caused by the dehydration. Fever due to dehydration will generally subside with rehydration. Breastfeeding problems may often be the cause of poor feeding and dehydration in the neonate. Correction of breastfeeding issues or when extra feeds are given by cup, will usually resolve the weight loss problem.

- Measure the neonate's temperature every 30 minutes until it normalises. Once the neonate's temperature is within the normal range, measure the neonate's temperature every three hours for 24 hours
- If the neonate's temperature remains within the normal range continue with routine monitoring.

10.13 Neonatal Seizures



DEFINITION

A seizure is a burst of uncontrolled abnormal electrical activity between neurons or nerve cells that causes temporary abnormalities in muscle tone or movements (stiffness, twitching or limpness), behaviours, or states of awareness.

Neonatal seizures (NS) are the most frequent and distinctive clinical manifestation of neurological dysfunction in the newborn infant within the first 28 days of life. Neonates with NS are at a high risk of neonatal death or neurological impairment/epilepsy disorders in later life.

10.13.1 CLASSIFICATION

The most widely used scheme is by Volpe of 4 main types of neonatal seizures:

1. SUBTLE SEIZURES

These seizures are called subtle because the clinical manifestations are often missed. They are the most common type, constituting about 50% of all seizures. Common examples of subtle or atypical seizures include:

- Ocular** – Tonic, horizontal deviation of eyes or sustained eyes opening with ocular fixation or cyclic fluttering.
- Oral–Facial–Lingual movements** - Chewing, tongue-thrusting, lip-smacking, etc.
- Limb movements** - Cycling, paddling, boxing-jabs, etc.
- Autonomic phenomena** - Tachycardia or bradycardia
- Apnoea** may be a rare manifestation of seizures, particularly in term neonates. Apnoea due to seizure activity has an accelerated or a normal heart rate when evaluated 20 seconds after onset. Bradycardia is thus not an early manifestation in convulsive apnoea but may occur later due to prolonged hypoxaemia.

2. CLONIC SEIZURES

- They are rhythmic jerks that constitute 25% of all seizures. They may localise in a small part of the face or limbs, axial muscles and the diaphragm or be multifocal or hemiconvulsive.
- They have both fast and slow components, occur with a frequency of 1-3 jerks per second, and are commonly associated with EEG changes.
- Focal clonic seizures have the best prognosis.

3. TONIC SEIZURES

- This type (5%) refers to a sustained flexion or extension of axial or appendicular muscle groups.
- These seizures may be focal or generalized and may resemble decerebrate (tonic extension of all limbs) or decorticate posturing (flexion of upper limbs and extension of lower limbs).
- Usually there are no EEG changes in generalized tonic seizures.

4. MYOCLONIC SEIZURES

- These manifest as single or multiple lightning-fast jerks of the upper or lower limbs and are usually distinguished from clonic movements because of more rapid jerks, absence of slow return and predilection for flexor muscle groups.
- Common changes seen on the EEG include burst suppression pattern, focal sharp waves and hyperarrhythmia.
- Myoclonic seizures constitute 20% of all seizures and carry the worst prognosis in terms of neurodevelopmental outcome and seizure recurrence.

10.13.2 CAUSES OF NEONATAL SEIZURES

- Hypoxic-Ischaemic Encephalopathy (HIE):** HIE secondary to perinatal asphyxia is the commonest cause of neonatal seizures.
- Metabolic causes:** Common metabolic causes of seizures include hypoglycaemia, hypocalcaemia, & hypomagnesaemia. Rare causes include pyridoxine dependency and inborn errors of metabolism (IEM).
- Bilirubin encephalopathy**
- Infections:** Meningitis should be excluded in all neonates with seizures. Meningoencephalitis secondary to intrauterine infections (TORCH group, syphilis) may also present as seizures in the neonatal period.
- Intracranial haemorrhage:** Seizures due to subarachnoid, intraparenchymal or subdural haemorrhage occur more often in term neonates, while seizures secondary to intraventricular haemorrhage (IVH) occur in preterm neonates.
 - Most seizures due to intracranial haemorrhage occur between day 2 and 7 of age.
 - Seizures occurring in a term 'well neonate' on day 2-3 of life is often due to subarachnoid haemorrhage.
- Developmental defects:** Cerebral dysgenesis and neuronal migration disorders are rare causes of seizures in the neonatal period.
- Miscellaneous:** They include.
 - Polycythaemia,
 - Maternal narcotic withdrawal,
 - Drug toxicity (e.g., theophylline, doxapram),
 - Accidental injection of local anaesthetic into scalp may be suspected in the presence of fixed and dilated pupils and absence of doll's eye reflex.
 - Phacomatosis (e.g., tuberous sclerosis, incontinentia pigmentii).
 - Multifocal clonic seizures on the 5th day of life may be related to low zinc levels in the CSF fluid (benign idiopathic neonatal convulsions).

Seizures due to subarachnoid haemorrhage (SAH) and late onset hypocalcaemia carry a good prognosis for long term neuro-developmental outcome while seizures related to hypoglycaemia, cerebral malformations, and meningitis have a high risk for adverse outcomes.

10.13.3 MANAGEMENT

Immediate Management

- Maintain airway, breathing and circulation (**Refer Chapter 4: Rapid assessment and stabilisation of a neonate**)

- Stabilise vital signs
- **Check blood sugar, if hypoglycaemic see Chapter 10.6: Neonatal Hypoglycaemia.**

NB: If blood glucose cannot be measured give empirical treatment with glucose 2mls/kg of 10% dextrose intravenously or via nasogastric tube.

- Control convulsions with a loading dose of phenobarbitone at 20 mg/kg IV over 5-10 min.
 - If still fitting after 10 minutes give additional
 - phenobarbitone 10mg/ kg IV up to a total maximum of 40mg/kg. Watch for apnoea. Always have a bag-mask available.
- If seizures are not aborted after a course of phenobarbitone give phenytoin loading dose 20mg/kg IV over 20-30 minutes in normal saline at a rate of not more than 1 mg/kg/min.
 - May repeat dose of 5mg/kg to a total maximum dose of 30mg/kg.
 - Heart rate and rhythm should be monitored during phenytoin infusion.

NB: If in a primary facility where there is no neonatal unit, consider referral after the above steps as the patient may be at risk of respiratory depression.

- If seizures have not arrested with above measures, patient will require benzodiazepines and therefore require discussion with a paediatrician and referral to a centre with intensive care facilities.

Maintenance Treatment

Phenobarbitone 5mg/kg per day IV/PO daily OR Phenytoin 3-8mg/kg IV in 2-4 divided doses.

NB: Phenytoin oral suspension has very erratic absorption from the gut and should be avoided in neonates.

10.13.4 INVESTIGATIONS

- Serum electrolytes (sodium, calcium, magnesium)
- Full blood count, CRP
- Blood culture and lumbar puncture if sepsis is suspected
- Serum liver function tests
- TORCH screen if congenital infections are suspected
- Cranial Ultrasound scan
- EEG

After investigations

- Treat the cause accordingly.
- Continue monitoring the neonate every 15 minutes until stable then hourly.
- Explain the condition of the neonate to the mother (Guardian).
- Practice minimal handling of the neonate.

11. REFERRAL GUIDELINES

A seamless transport of neonates from a referring centre to a higher level neonatal intensive care unit (NICU) enables each patient to benefit from the regionalization and specialization of critical care personnel and services.

- For specific conditions please refer to the specific subSections or chapters for guidance on when to refer.
- In general, babies who appear unwell or raise concern must be immediately discussed with the neonatal team and assessed for potential admission/referral to a neonatal unit.
- Neonates at risk need to be identified and transferred as early as possible and ideally, they should be transferred in-utero.

11.1 The Process of Referral

EFFECTIVE COMMUNICATION

The referral facility must be informed about the patient beforehand.

- Call the admitting doctor to discuss the neonate's condition including important details from the mother's maternal history, delivery history, birth-weight and gestational age, vitals, clinical examination findings, any laboratory results, management and treatment given. All information relevant to the clinical evaluation and care of the patient should be readily available to facilitate efficient and effective communication.
- On the transport form document the details of the neonate, the current clinical status of the neonate, reasons for referral and management/treatment given to the neonate (**See Appendix 5**).
- The transporting team (Emergency Medical Services) must be informed beforehand about the patient's potential referral and given the go-ahead once the patient has been accepted by the referral institution.
- Explain the neonate's condition to the parents and reason for transfer and state where the patient is being referred to and which ward.

With newborn neonates the mother usually accompanies the neonate to the referral hospital.

11.2 Preparation Before Transport

1. Assess neonate's readiness for transport (including suitable mode of transport e.g., road or air) in discussion with the referral facility.
 - Stabilize the general clinical condition. Ensure vital signs are assessed and within normal range including HR, RR, SpO₂, BP, Temperature and Blood Sugar. (**See Chapter 4**).
 - Ensure that the neonate is correctly identified with a visible identification tag.
 - All records must be made available including parent's contact details.
2. Encourage the mother to accompany the neonate.
3. Arrange for a health care provider trained in neonatal resuscitation to accompany the patient during transfer and they must have the ability to contact medical personnel at any time during transport.

11.3 Pre-transfer stabilization

Optimize airway breathing and circulation. (**See Chapter 4**).

Before transfer assess the following:

AIRWAY

- Is the airway patent?
- Is the airway secure (make sure the ETT is well secured prior to transfer)?

BREATHING

- Is there sufficient spontaneous respiratory effort?
- If not breathing spontaneously is artificial ventilation adequate?

CIRCULATION

- Is perfusion to essential organs adequate?
- Check capillary refill time and ensure it is <3 seconds, if prolonged consider a 10ml/kg normal saline bolus over 20-30 minutes.
- Check blood pressures where feasible and consider inotropes in consultation with the paediatrician.

Nutrition and hydration

- Neonates who are stable can safely be given a milk feed 1 hour before transportation, unless enteral feeding is contraindicated. Also ensure iv line is secured.
- All premature and sick neonates. Neonate should be transported with an IV line secured and IV fluids running at an appropriate rate.

Monitoring of homeostasis

- Continuous pulse oximetry, HR, RR and BP
- **Metabolic**
 - Maintain blood sugar (2.6-6.9 mmol/L)
 - Maintain normal temperature. **See Chapter 10.10: Thermal Management.**

Medication

Ensure that tetracycline eye ointment and Vitamin K has been given to a newly born neonate.

- Ensure all prescribed medication has been given especially antibiotics.
- Continuous infusions like inotropes must not be interrupted throughout the referral process.
- Ensure additional IV access.

11.4 Neonate care during transport

- Comfort
 - Ensure the neonate's comfort throughout transportation and consider need for sedation.
 - Ensure that minimal active intervention (unless necessarily indicated) will be required during the transfer including minimal handling. All necessary procedures should be performed before transportation.
- Maintain optimal ABCs, vitals, homeostasis, nutrition and hydration.
- Assess the neonate continuously.
- Keep a clear concise record of events
- Anticipate potential problems e.g., Dislodged ETT and intravenous line and have contingency plans in place.

11.5 Transport equipment

- Transport Incubator
- Transport Ventilator
- Medical gases e.g., Oxygen
- Clinical monitors for
 - HR, RR, SpO₂, BP, Temperature, ECG, glucose
- Suction machine and suction catheters preferably closed suctioning technique if intubated.
- Intravenous infusion pumps
- Equipment for intubation (**See Chapter 2.3**)
- Intravenous cannulas of varying sizes
- Glucometers
- Drugs
 - Adrenaline (1:10,000) ready prepared and labelled specifically for the neonate.
 - 10% Calcium Gluconate.
- Crystalloid Fluids
 - 5% and 10% Dextrose Solution
 - Ringer's lactate
 - Normal Saline
 - Half Darrow's Solution
 - Neonatalyte

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13. APPENDICES

APPENDIX 1: Resuscitation of the newborn

STEP 1: Airway

Dry the neonate, keep warm and stimulate the neonate.

Clear the airway if indicated.

STEP 2: Breathing

If the neonate is not breathing or is gasping

- Call for help
- Open airway by placing neonate's head in neutral or sniffing position with chin lifted slightly. Too much flexion or hyperextension of the neck closes the airway.
- Begin bag-mask ventilation within 30 seconds from birth if the neonate is not breathing (apnoeic) or is gasping.
 - Choose mask that covers nose and mouth but doesn't extend below chin (too big).
 - Use "C-grip" to hold mask to face, use remaining 3 fingers to gently pull jaw up to mask.
 - Give breaths (bagging) (40-60 breaths/min).
 - Watch for good chest rise with every breath.
- Re-assess after 30 seconds for airway, breathing and circulation.

Step 3: Circulation

If HR<60 after 30-60 seconds begin chest compressions.

- Give chest compressions (90 compressions per minute) that are performed with one ventilation interposed after every third compression.
- Place thumbs on lower sternum, just below nipple line, ensure firm support at back of neonate.
- Compress about 1/3 of chest depth
- Leave thumbs or fingers in contact with newborn's chest during relaxation phase.
- Coordinate compressions with bag-mask ventilation at 30 breaths/minute.
- Call for assistance (for IV access, intubation, adrenaline).
- Re-assess after 60-90 seconds

NB: Whenever chest compressions are provided, increase the oxygen concentration to 100% and wean rapidly when the heart rate recovers, and chest compression is no longer needed.

Step 4: Drugs

If heart rate remains <60/minute, consider intubation and administration of drugs.

- Give Adrenaline 1:10,000 at 0.1ml/kg intravenously or 1ml/kg via endotracheal tube
 - Dilution of 1:1000 adrenaline to get a 1:10 000 solution: Using 1:1,000 ampoule adrenaline, draw up 1 ml and add 9 ml of saline. This will give 10 ml of 1:10 000 adrenaline solution.
- Volume resuscitation (suspected history of abruption or clinically pale neonate) give normal saline at 10 mL/kg bolus.
- Manage hypoglycaemia with 10% dextrose 2-4 mls/kg intravenously.

APPENDIX 2: Fluid and Feeding Plan

13.2.1 Total IV Fluids Intake Per Day

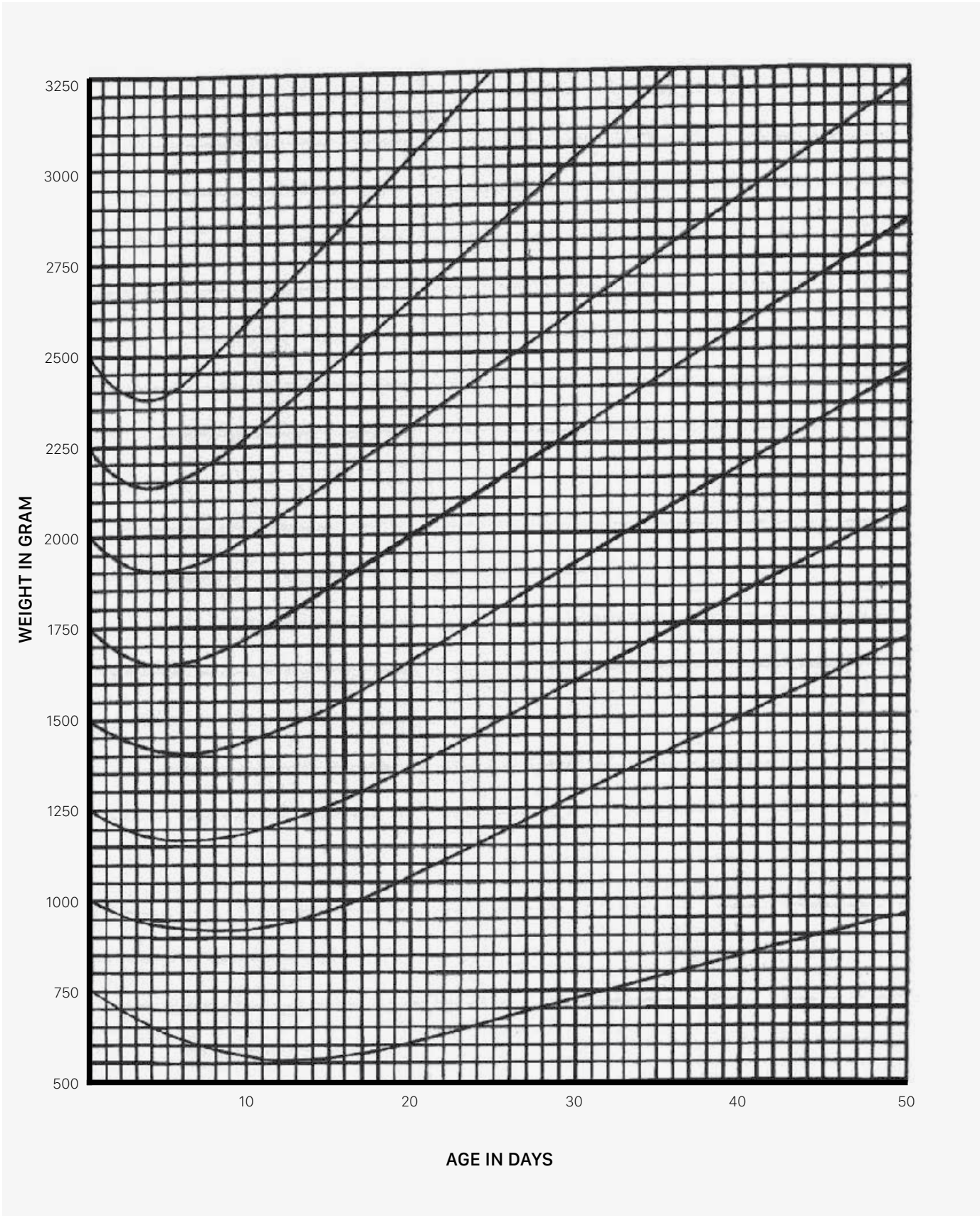
DAY OF LIFE	1	2	3	4	5
VOLUME	ml/kg/day	ml/kg/day	ml/kg/day	ml/kg/day	ml/kg/day
ELBW	80	100	120	140	150
VLBW	70	90	110	130	150
LBW	60	90	120	140	150

13.2.2 Oral Intake

AGE IN DAYS	Day 1	Day2	Day3	Day 4	Day 5-9	Day 10
ELBW	NPO if respiratory distress May start with trophic feeds of 0,5-1ml 3hlyx8 via gastric tube	1 or 2 ml/3hrly	2or 3 ml/3hrly	Increase by 10-20 ml/kg/day	Increase 20 ml/kg/day	160 – 180 ml/kg/day If PDA or chronic lung disease keep at 160 ml/kg/day
VLBW	Start with feeds if stable 10-20 ml/kg/day	Increase by 20 ml/kg/day	Increase by 20-30 ml/kg/day	Increase by 20-30 ml/kg/day	40 ml/kg/day	180 ml/kg/day
LBW	60 ml/kg/day	90 ml/kg/day	120 ml/kg/day	150 ml/kg/day	180 ml/kg/day	180 ml/kg/day
Term	60 ml/kg/day	90 ml/kg/day	120 ml/kg/day	150 ml/kg/day	150 ml/kg/day	150 ml/kg/day

- All preterm and LBW neonates' feeds should be calculated at 180 ml/kg/day reduce this volume if the neonate has chronic lung disease of prematurity and or a significant PDA.
- Term neonates and formula fed neonates should receive a total volume of 150 ml/kg/day and if poor weight gain consider increase to 160 ml/kg/day.
- If babies continue with poor weight gain, consider fortification of feeds and discuss this with a dietitian.
- Initiate breastfeeding as soon as possible even in ELBW and VLBW infants. At first, they will only practice non-nutritive suckling on the breast. These practice suckling is very important in order to establish breastfeeding.
- All babies receiving expressed breastmilk via gastric tube feeds should be fed in the KMC (skin-to-skin) position. This helps with absorption of feeds.
- Introduce cup feeds while a gastric tube is in situ and wean the neonate from the gastric tube by increasing the cup feeding volume slowly and decreasing the tube volume.
- It should be possible for gastric tube feeds to discontinue when the neonate reaches a weight of 1500 – 1600 grams. However, it depends on the neonate's neurodevelopment and ability to suckle, swallow and breathe. If the neonate spill feeds from the cup or does not gain weight when the tube is removed, consider to re-insert the gastric tube. Satisfactory daily weight gain is 15 to 20 grams per day for LBW and preterm infants and 30 grams per day for term neonates.
- Remember all babies first lose weight before regaining their birthweight. The smaller and more preterm, the longer it takes to regain birthweight.

APPENDIX 3: Daily weight gain chart LBW and premature neonates



APPENDIX 4: Commonly prescribed drugs on formulary, subject to availability.

DRUG	FORMS	DOSAGE
Acetazolamide	250mg tab	5mg/kg/dose q8 po max 100mg/kg/day incr by 25 mg/kg/day neonate: 5 mg/kg/dose q6 hrs
*Acyclovir	200mg tab 250mg inj	Neonatal HSV: 20mg/kg/dose IV q8 if CNS to treat for 21 days Neonatal varicella: 20 mg/kg/dose q 6 for 5 days Zoster in HIV+: 10mg/kg/dose IV q8 or 800mg PO 5x/24hr ≥12yrs [max po 80mg/kg/24hr]
Adrenaline (epinephrine)	1mg/ml inj (1:1000)	0.01mg/kg/dose (Dilute to 1:10,000), IV or 0.1mg/kg ET q3-5min Anaphylaxis 0.01 mg/kg/dose (1 :1000) Croup neb: 0.5 ml (1 :1000) /kg in 3 ml NS (max adrenalin 5ml)
Aminophylline	25mg/ml	Neonatal apnoea: Load 6 mg/kg IV over 20 minutes then 2mg/kg/dose IV/PO given over 5-10 minutes Q 6 to 8 hrs
Amoxycillin	250mg tab 125mg/5ml mixture	Infant < 3 mnth: 10-15 mg/kg/dose PO q12 Child: Std Dose 12.5-25 mg/kg/dose PO q12 High Dose 40-45 mg/kg/dose PO q12 [max 2-3g/24hr] Pneumonia divides q 8 hrs
Amphotericin B (not liposomal)	50mg inj	Prehydrate IV 20 ml/kg then 0.5-1mg/kg diluted to 0.1mg/mL in D5W q24hr (protect from light) run 1st dose over 6hr [max 1.5mg/kg/24hr]. Follow Cr, K, Mg, Plt. Cryptococcal Meningitis: 1 mg/kg/dose
Ampicillin	250mg inj	Neonate: <7 days: 150 mg/kg/dose IV/IM q12 hrs ≥7 days: <1200gm 100 mg/kg/dose IV/IM q12 hrs ≥7 days: 1200-2000gm 50 mg/kg/dose IV/IM q 8 hrs ≥7 days: > 2 kg 50 mg/kg/dose IV/IM q 6 hrs Child: 25-50mg/kg/dose IV/IM q6 Meningitis: 75-100 mg/kg/dose IV/IM q6 [max 12g/24hr]
Atropine	1mg/ml inj	Prolonged resuscitation: 0.01-0.3 mg/dose q 10-15 min x 2-3 doses for organophosphate poisoning: 0.03mg-0.04mg/kg IV, repeat half dose in 15 minutes and hourly till toxic
Augmentin (Amoxycillin+ clavulanic acid)	250 + 125 tab 250 + 6.25/5ml mix 500 + 100mg inj	Dosing based on amoxycillin component: <3 months: 15mg/kg/dose PO q12 ≥3 months: 6-15 /kg/dose q8 Severe infections: 50mg/kg/dose IV q6 Adults: 250-500mg po q8
Beclomethasone nasal spray	50mcg spray	1 spray each nostril 1-2 x daily
Benzyl benzoate	25%	Apply x2, 1wk apart (scabies)
Betamethasone	0.1% cream 0.1% ointment	Potent topical steroid. Apply sparingly 1-2x daily, not to face or nappy area. Discontinue as soon as possible.
Caffeine Citrate	10mg/ml mix	Neonatal apnoea: 20 mg/kg loading dose over 30 min, then maintenance 5-12 mg/kg/dose q 24 hrs
Calcium gluconate	300mg tab 100mg/ml inj	Neonate: 50-200 mg/kg/dose q6 Infant: 50-125 mg/kg/dose IV q6 100-200 mg/kg/dose PO q6 Child: 50-125 mg/kg/dose PO/IV q6 Arrythmia: 60-100 mg/kg q 10 min max 800 mg/dose Avoid mixing with bicarbonate and ceftriaxone
Captopril	25mg tab	6mo: 0.01-0.5mg/kg/dose q8-12 PO Child: 0.3-0.5mg/kg/dose q8-12 PO
Cefotaxime	500mg, 1g inj	1 mo-12 yr: 25-50 mg/kg/dose IV q6-q8 >50kg:1-2gIVq6-12 Meningitis: 75 mg/kg/dose IV q6 [Max 12g/24hr] Neonates: Age Weight Dosage (IV/IM) All neonates <1,200 g 50 mg/kg/dose IV/IM q12h Postnatal age <7d 1,200-2,000g 50 mg/kg/dose IV/IM q12h Postnatal age <7d >2,000 g 50 mg/kg/dose IV/IM q8h Postnatal age >7d 1,200-2,000g 50 mg/kg/dose IV/IM q8h Postnatal age >7d>2,000 g 50 mg/kg/dose IV/IM q6h
Cefpodoxime*	40mg/ 5ml 100mg tab	15 d - 6mo: 4 mg/kg/dose po BD 6 mo - 2 yrs: 40 mg/dose po BD 3 - 8 yrs: 80 mg/dose po BD 9 - 12 yrs: 100 mg/dose po BD 12 - 18 yrs: 100-200 mg/dose po BD

DRUG	FORMS	DOSAGE
Ceftriaxone	250mg Inj 1g inj	50-150mg/kg/dose q12-24 IM/IV Meningitis (& penicillin resistant pneumococci): 50mg/kg/dose IM/IV q12 or 100mg/kg/dose q24 [Max 4g/day] neonates: Age Weight Dosage (IV/IM) Postnatal age <7d All weights 50 mg/kg/dose IV/IM q24h Postnatal age >7d <2,000 g 50 mg/kg/dose IV/IM q24h Postnatal age >7d >2,000 g 75 mg/kg/day IV/IM q24h Avoid with IV calcium, caution if on Ringers Lactate Gonococcal: Prophylaxis 25-50 mg/kg/dose x 1 Disease: 25-50 mg/kg/dose q 24 hrs x 7 days (14 days for CNS disease) Ophthalmia uncomplicated: 50 mg/kg/dose x 1
Chloramphenicol	1g inj	12.5-18mg/kg/dose IV/IM q6 Meningitis: 18-25/kg/dose IV/IM q6
Chlorpheniramine (antihistamine)	4mg tab 0.4mg/ml syrup 10mg/ml inj	6-12months: 1mg/dose po q12 1-5 yr: 1-2mg/dose po q8 6-12yr: 2-4mg/dose po q6 >12yr: 4mg po/dose q6-8
Clindamycin	600mg/ 4ml inj	Child: 6.25-10 mg/kg/dose q 6 IV (2.5-7.5mg/kg/dose PO q6) Neonate: Age Dosage Postmenstrual age <29 wk 7.5 mg/kg/dose IV q12h Postmenstrual age >29 wk 7.5 mg/kg/dose IV q8h
Clotrimazole	1% cream	Apply q12
Cloxacillin	250mg cap 25mg/ml mix	12-25mg/kg/dose IV/IM/PO q6 Severe infection: 50mg/kg/dose IV/IM/PO q6 [max 500mg/dose]
Cotrimoxazole (TMP + SMZ)	80 + 400 tab 40 + 200/5ml susp	Dosing based on TMP component: (write out dose in ml) Mild infection: 4-5mg/kg/dose PO q12
	16 + 80/ml inj	PCP prophylaxis: 2.5-5mg/kg/dose PO q24 PCP treatment: 5mg/kg/dose PO/IV q6
Dexamethasone	0.5mg tab 4mg/ml inj	Croup: 0.6mg/kg PO/IM/IV x 1 Inflammatory: 0.02-0.1mg/kg/dose PO/IM/IV q6-q12 Hib meningitis: 0.4mg/kg/dose IV q12 x 2days Cerebral Oedema: Loading 1-2mg/kg IV/IM x 1, then 0.25-0.5 mg/kg/dose q4-6 [max 16mg/24hr] Neonatal Chronic Lung Disease Dosing Frequency Day 10.1 mg/kg q12h * Two total doses Day 20.075 mg/kg q12h * Two total doses Day 30.05 mg/kg q12h * Two total doses
Diazepam	2mg, 5mg tab 5mg/ml inj	Status: 0.2-0.5mg/dose IV q15-30min [max 5mg <5y, 10mg >5y] Status: 0.5mg/kg/dose PR x1 (use iv prep) [max 20mg] Sedation: 0.1mg/kg/dose IV x1 [max 10mg]
Doxycycline	100mg tab	NOT for children < 8 yr ≤45 kg: 2.2mg/kg/dose PO qd-bd >45 kg: 100mg/dose day PO qd-bd [max 200mg/day]
Enalapril	5mg, 20mg tab	0.05-0.25mg/kg/dose PO q12-q24 [max 40mg/day]

DRUG	FORMS	DOSAGE		
Erythromycin	250mg tab 125mg/5ml susp	10-15mg/kg/dose PO q6-8 Neonate:		
		Indication	Dosage	Comment
		Systemic Infections	Erythromycin estolate (Ilosone): 10 mg/kg/dose PO q8h. Erythromycin ethylsuccinate (ESS, EryPed): 10 mg/kg/dose PO q6h	Administer with feeding to enhance absorption of Erythromycin ethylsuccinate and to reduce possible GI upset
		Severe Systemic Infections/NPO	5-10 mg/kg/dose, IV q6h. (Dilute to 1-5 mg/mL and infuse >1 h) Prophylaxis: 0.5-1 cm	Use only preservative-free IV erythromycin formulations Ophthalmia Administered at birth
		neonatorum	ribbon of 0.5% ointment into each eye *1	
		Chlamydia conjunctivitis	0.5-1 cm ribbon of 0.5% PO ointment into each conjunctival sac q6hx7d	therapy is preferable to topical therapy for eradication of nasopharyngeal carrier state. Treat mother and her sexual partner
		Prokinetic agent Initial: 3 mg/kg/ IV >60 min, followed by 4-5 mg/kg/dpse PO in 3-4 doses 30 min pre-meals		
Ferrous fumarate	45mg Fe/5ml	Treatment: 3-6mg Fe/kg/dose PO od (may divide q8) Prophylaxis: 1-2mg Fe/kg/dose qd (may divide q8)		
Ferrimed	50mg Fe/5ml	Treatment: 3-6mg Fe/kg/dose PO od (may divide q8) Prophylaxis: 1-2mg Fe/kg/dose qd (may divide q8)		
Ferrous sulfate	60mg Fe/tab	Treatment: 3-6mg Fe/kg/dose PO od (may divide q8) Prophylaxis: 1-2mg Fe/kg/dose qd (may divide q8)		
*Fluconazole	50mg, 200mg tab 50mg/5ml susp 2mg/ml inj	Oral/eosophageal Candidiasis: loading 6mg/kg PO/IV x1 Maint 3mg/kg PO/IV q24 Cryptococcal meningitis: loading 12mg/kg PO/IV x1 Maint 6-12mg/kg q24 Neonate:		
		Postmenstrual age Postnatal age Dosing interval		
		≤29 wk	0-14 d >14 d	72 h 48 h
		30-36 wk	0-14 d >14 d	48 h 24 h
		>37-44 wk	0-7 d >7 d	48 h 24 h
		>45	All ages	24 h
Folic acid	5mg tab	Severe Malnutrition: Day 1: 5mg PO x 1 then 1 mg/d x 2 weeks		
Furosemide	10mg/ml 40mg tab 10mg/ml inj	1-6mg/kg/dose PO q12-24 0.5-2mg/kg/dose IV q6-12 (replace with KCl 1meq to 1mg furosemide)		
Gancyclovir	500mg/ 10ml 50mg/ml	5 mg/kg/dose IV every 12 hours Congenital CMV: 5-7.5 mg/kg/dose q12 hrs x 4-6 weeks		
Gentamycin	10mg, 20mg, 40mg, 80mg inj	5mg/kg/day IV/IM q24 neonate: Age IV Dosage		
		<35 wk postmenstrual age3 mg/kg/dose q24h ≥35 wk postmenstrual age4 mg/kg/dose q24h [Max 2 mg PO/day 3 mg IV/dose or 9 mg IV/day]		

DRUG	FORMS	DOSAGE
Granisetron (Kytril)	1mg tab	10 mcg/kg/dose PO/IV Q12-24H [Max 2 mg PO/day 3 mg IV/dose or 9 mg IV/day]
Hydrocortisone	100mg inj	Asthma: 2mg/kg/dose IV q6 Inflammatory: 1-5mg/kg/dose IV q12-24
Hydrocortisone	1% cream/ ointment	Weak topical steroid. Apply 1-2 x daily
Ibuprofen	400mg tab	10mg/kg/dose PO q6 Neonates: PDA: 10 mg/kg day1, 5 mg/kg days 2 and 3
*IVIG	5g, 6g, 10g, 12g IV	Guillain Barre: 400mg/kg IV od x5 days Kawasaki 1-2g/kg IV x 1 or 400mg/kg/day IV x 4days
Ketamine	50mg/ml inj	1-2mg/kg IV (onset -2min, last 20-60min) 4-5mg/kg IM (onset 5-10min, last 30-90min)
Mannitol	20% soln	Cerebral edema: 0.25-0.5g/kg/dose IV q4-6 (over 20-30min) May give furosemide 1mg/kg concurrently or 5min before mannitol. May increase gradually to 1g/kg/dose IV if needed
Methylprednisolone	80mg/ml inj	Asthma: 2mg/kg/dose – loading, then 0.5mg/kg/dose IV q6
Metoclopramide	10mg tab 5mg/ml inj	GERD: 0.1-0.2mg/kg/dose IV/PO/IM up to q6 Antiemetic: 1-2mg/kg/dose IV/IM/PO q2-6
Metronidazole	200mg tab 200mg/5ml susp	C Diff/Bacterial Infxn: 7.5mg/kg/dose PO/iv q6 x 10days Amebiasis :11.5-16.5mg/kg/dose PO q8 x 10 days Giardia: 5mg/kg/dose PO q8 x 5days
Midazolam	5mg/ml inj (In PMH lockbox)	0.05-0.1mg/kg/dose IV [max 2mg]
Morphine sulfate	15mg/ml inj	0.1-0.2mg/kg/dose IV q2-4 prn [max 15mg] IV:PO = 1:3 (<3 yrs, 0.1-0.2mg/kg/dose; >3yrs, 0.2-0.4mg/kg/dose)
Multivitamin	100ml	2.5-5 mL PO OD
*Mupirocin	ointment	TDS x 1 week
Nalidixic acid	500mg tab 60mg/ml mix	>3 months age:12.5-15mg/kg/dose po qid x5d (dysentery)
Omeprazole	20mg tab	1mg/kg PO od (may divide BD) Or: ≥ 2 years: <20kg – 10mg po qd ≥20kg – 20mg po qd
Paracetamol	500mg tab 24mg/ml syrup	10-15mg/kg/dose po q4-6
PCN benzathine	2.4MU inj	Congenital Syphilis: 0.05MU/kg IM qwk x3 Rheumatic Fever Prophyl: 0.025-0.05MU/kg IM q3-4wk
PCN benzyl (x-pen)	1MU, 5MU inj	50,000 U/kg/dose IV q6 Meningitis: 100,000 U/kg/dose IV q6
Pen V	250mg tab 125mg/5ml powder	<12yo: 6.25-12.5mg/kg/dose q6-8 [max 3g/day] >12yo: 250-500mg po q6-8
Pethidine (Demerol)	50mg/ml inj	0.5-1 mg/kg/dose IM q4-6 prn; for IV dilute to 5-10 mg/mL and give over 2-5 min [max 100mg/dose]
Phenobarbitone	30mg, 60mg tab 3mg/ml mix 200mg/ml inj	15-20mg/kg IV x1 (load for status), may repeat in 10 mg/kg to total of 40 mg/kg load. Maintenance of 2.5-5 mg/kg/dose PO/IV q12 (See AED chart)
Phenytoin	25mg, 100mg tab 25mg/ml mix 10mg/ml inj	15-20mg/kg IV (load for status) [max 1500mg/day] Maintenance 2.5-5 mg/kg/dose PO/IV BD Give at a rate at ≤1 mg/kg/min, diluted in NS to 10 mg/mL or less Pt should be on ECG monitor during infusion (see AED chart)
Pipercillin-tazobactam	4g/0.5 vial (4.5g vial)	90mg/kg/dose iv q6 - 8 [max 45g q6]
Prednisolone	1mg tab 5mg tab 15mg/5ml liquid	0.5 to 1 mg/kg/dose po qd-bid (asthma) 0.5-2mg/kg/dose po qd(may divide up to q6) (inflammatory)
*Sildenafil	25mg tab 50mg tab	PPHN: Start 250-500 mcg/kg PO/NG every 4-8 hrs Max 2 mg/kg every 4 hrs
Silver sulphadiazine	1% cream	
Spironolactone	25mg tab	0.5-1.5mg/kg/dose po bid (may div up to qid) [max 200mg/day]

DRUG	FORMS	DOSAGE		
Survanta	25mg/4ml vial	Surfactant	Doses	Comments
		Beractant (Survanta)	4 (mL/kg/dose	Divided into four aliquots, with up to three additional doses (four total), administered q6h if needed
Thiamine	100mg/ml iv	10-25mg iv daily		
Vancomycin	500mg inj	31-60 days 10mg/kg/dose IV slow infusion q8 >2m: 10-15mg/kg/dose IV infusion q8 Meningitis: 15 mg/kg/dose IV infusion Q6H [max 1g/dose, 4g/day] Neonate: Postnatal ageWeight (kg)Dose (mg/kg/dose) <7 d <1.2 kg 15 mg/kg IV q24h <7 d 1.2-2 kg 10 mg/kg IV q12h <7 d >2 kg 15 mg/kg IV q12h >7 d <1.2 kg 15 mg/kg IV q24h >7 d 1.2-2 kg 15 mg/kg IV q12h >7 d >2 kg 10 mg/kg IV q8h		
Vitamin K		0.1-0.3mg/kg/day (chronic liver disease)		
Warfarin	1, 2, 3, 5mg tab	Titrate to effect		

APPENDIX 5: Transport form for neonates

TRANSPORT FORM FOR NEONATES (Adopted from Chris Hani Baragwanath Neonatal Protocols 2010)									
INFANT INFORMATION			INFORMATION ABOUT THE MOTHER						
Name:			Name:						
Hospital Number:			Hospital Number:						
Referring Facility:			Age:			Gra [] Para: []			
Name of Referring Doctor			Booked? Yes [] / No []						
Telephone:			Address:			Telephone No:			
Accepting Doctor			Rhesus Group: Pos [] / Neg [] / Unknown []						
INDICATION FOR REFERRAL			HIV Status: Pos [] / Neg [] / Unknown []						
Prematurity/ LBW []			RPR [] / VDRL []: Pos [] / Neg [] / Unknown []						
Respiratory Distress []			Antenatal Steroids given? Yes [] / No []						
Sepsis []			Intrapartum Antibiotics given? Yes [] / No []						
Asphyxia []			MODE OF DELIVERY						
Surgical []			Normal Vaginal []			Breech		Forceps	
Other (specify)			Caesarian Section			Vacuum			
Name of Ambulance Service			Name of Accompanying Health Care Worker:						
Time Transport Called			Time Transport Arrived (h)			Time Transport Departed (h)			
Mother Informed About Transfer: Yes [] / No []									
BIRTH HISTORY									
Birth Date DD/MM/YYYY []			Time of Birth		Birth Wt. grams		APGARs [] / [] / [] 1min/ 5min/10min		
			Sex Male [] / Female []		Gestation. weeks				
Eye ointment given? Yes [] / No []			Vit. K given? Yes [] / No []						
RESUSCITATION (tick appropriate)									
Breathing			Circulation			Drugs/ Medication			
Spontaneous			Chest Compression? Yes [] / No []			Adrenaline given? Yes [] / No []			
Bag Mask Vent			If provided - Duration [] mins			If given - Dose (mg) [] cycles []			
Oxygen			Comments			Other Medications given			
Intubated? Yes [] / No []									
If Yes; Size [] & Length []									
SYSTEMIC EXAMINATION FINDINGS									
VITAL SIGNS									
TIME	Color	Capillary Refill Time (Sec)	Temp (°C)	Heart Rate	Blood Pressure	Respiratory Rate	Saturation (SpO ₂)	Blood Glucose	
Time Transport Called									
Time Transport Arrived									
Time Transport Departed									
INFUSIONS & DRUGS									
Time	Solution & Rate	Inotropes (Name & Dose)	Antibiotics given	Boluses Given					
Time Transport Called									
Time Transport Arrived									
Time Transport Departed									
RESPIRATION/ MECHANICAL VENTILATION									
Time	On a Ventilator? Yes [] / No []	Surfactant given? Yes [] / No [] Time (h)	Oxygen given? Yes [] / No [] if yes % O ₂	If on a Ventilator, State PIP PEEP Rate			Comments		
Time Transport Called									
Time Transport Arrived									
Time Transport Departed									
BLOOD GAS									
Time	pH	pCO ₂	HCO ₂	pO ₂	Comment on Blood Gas results				
(h)									
(h)									
(h)									

APPENDIX 6 : Discharge information on all neonates with neonatal jaundice

NAMED				D.O.B			G.A	
BIRTH WEIGHT			BLOOD GROUP			RHESUS		
MOTHER'S BLOOD GROUP			RHESUS			DCT		
PREVIOUS RHOGAM GIVEN	YES	NO	NA			DATE		
DATE COMMENCED ON PHOTOTHERAPY						TSB VALUE		
DATE STOPPED ON PHOTOTHERAPY						TSB VALUE		

NEUROLOGICAL STATUS AT DISCHARGE	

APPENDIX 7: Ballard Score Sheet

NEUROMUSCULAR MATURITY

MATURITY RATING

SIGN	SCORE							SIGN SCORE
	-1	0	1	2	3	4	5	
Posture								
Square Window								
Arm Recoil								
Popliteal Angle								
Scarf Sign								
Heel To Ear								
TOTAL NEUROMUSCULAR SCORE								

TOTAL 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

SIGN	SCORE							SIGN SCORE
	-1	0	1	2	3	4	5	
Skin	Sticky, friable, transparent	gelatinous, red, translucent	smooth pink, visible veins	superficial peeling &/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 40-50mm: -1 <40mm: -2	>50 mm no crease	faint red marks	anterior transverse crease only	creases ant. 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	sl. curved pinna; soft; slow recoil	well-curved pinna; soft but ready recoil	formed & 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	prominent clitoris & small labia minora	prominent clitoris & enlarging minora	majora & minora equally prominent	majora large, minora small	majora cover clitoris & minora		
TOTAL PHYSICAL MATURITY SCORE								

Gestation by Dates

		Weeks
Birth date	Hour	
		am pm
APGAR	1 min	5min

Scoring

Gest. Age by Maturity Rating	_____ weeks
Time of Exam	Date _____ am Hour _____ pm
Age at Exam	_____ hours

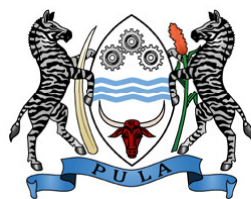
Signature of Examiner

M.D. / R.N.

References :

Ballard JL, Khoury JC, Wedig K, *et al*: New Ballard Score, expanded to include extremely premature infants. *J Pediatrics* 1991; 119:417-423.

<http://ballardscore.com/Pages/ScoreSheet.aspx>



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