THE REPUBLIC OF UGANDA

MINISTRY OF HEALTH

CLINICAL PROTOCOLS FOR MANAGING SMALL AND SICK NEWBORNS

September, 2023

FOREWORD

Uganda has made progress in reducing newborn mortality from 27/1,000 live births in 2016 to 22/1,000 live births in 2022 (UDHS reports). Despite this reduction, the number of newborns dying is still unacceptably high moreover from preventable causes, including birth asphyxia, prematurity, and sepsis, among others.

Ministry of Health, together with stakeholders, has made several efforts to address the situation, including improving the quality of antenatal, intrapartum, and postpartum care, constructing and functionalizing some neonatal units across the country, availing essential newborn care commodities and improving the referral systems across the country. The country has also made a deliberate effort to invest in the capacity for neonatal care skills for both preservice and in-service health workers. This has resulted in the development of the neonatal fellowship program, the in-service training package for neonatal nursing, and several clinical trainings and mentorships in evidence-based packages, like kangaroo mother care and essential newborn care, care for the small and sick newborn specifically targeting health workers involved in newborn care.

In light of the above, the MoH, working with stakeholders, has developed a comprehensive clinical protocol handbook for managing small and sick newborns. This pocket-size handbook can be used as a bedside aide and a quick reference for all health workers caring for small and sick newborns. This document will also be a standard reference for all capacity-building activities nationwide.

I sincerely thank all those who have contributed to developing this guide, including partners and health workers. Their dedication and expertise have been instrumental in ensuring that this resource meets the highest standards of quality and relevance.

Finally, I encourage all healthcare facilities, both public and private, to embrace these protocols as a cornerstone to improve the quality of care for sick and small babies in Uganda.

Dr Charles Olaro
Director Clinical Health Services, Ministry of Health

ACKNOWLEDGEMENTS

The development of these protocols for the management of small and sick newborns builds on the earlier efforts by the MoH in developing the Essential Maternal and Newborn Clinical Guidelines. This pocket-size book will be a quick bedside reference for all health workers caring for small and sick newborns. It is also a reference guide for all capacity-building activities across the country.

I want to extend special thanks to Jesca Nsungwa, Richard Mugahi, Kathy Burgoine, Bodo Bongomin, Elias Kumbakumba, Deogratias Migadde, Chris Ebong, Agnes Namagembe, Robert Mutumba, Tom Ediamu, Nasur Mubarak, Kagimu Richard, Hilda Namakula, Christine Otai, Yahaya Senyonjo, Nakibuuka Jessica, Kettie Bagambe, Geraldine Basanyukira, Jolly Nankunda, Brenda Tusiime, Nakibuuka Victoria, Rajab Ssensalire, Emily Tumwakire, John Paul Bagala, Tumusiime Lawerence, Kemigisa Divine Mercey, Stella Kyoyagala, and Gertrude Namazzi whose invaluable insights and contributions have been instrumental in shaping these guidelines into a resource of the highest caliber. Their expertise has ensured that the guide is relevant, practical, and aligned with the evolving needs of our healthcare system. Special thanks to the teams from Mulago Specialized Women and Neonatal Hospital, Nsambya Hospital, Kiwoko Hospital, Mbale regional referral hospital, and Hoima Regional Referral Hospitals who provided a wealth of clinical experiences that shaped the context and practicaibility of these protocols.

I also extend my gratitude to the dedicated healthcare providers who will utilize this guide in their capacity-building efforts. Your commitment to delivering exceptional newborn care is vital to the success of this endeavor, and I am confident that this pocket handbook will serve as a valuable tool in your efforts.

Finally, I sincerely thank all stakeholders who have supported and endorsed this initiative. Special thanks to the Uganda Pediatric Association, USAID MCHN Activity, Adara Development, UNICEF, and WHO. Together, we are working towards a stronger, more resilient healthcare system that prioritizes the well-being and safety of our patients.

Dr Richard Mugahi
Assistant Commissioner R&I Division Ministry of Health

TABLE OF CONTENTS

SECTION ONE

1.1 GENERAL PROTOCOLS

1.1.1 Assessment and care of the neonate at birth

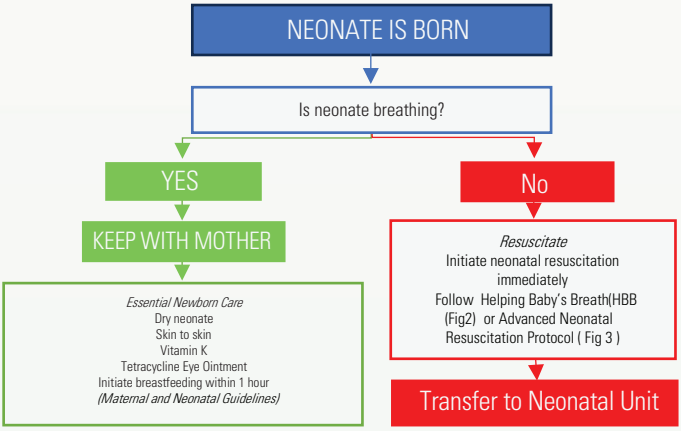
Every neonate needs a quick assessment at birth to determine need for resuscitation and act within the Golden minute. This should be done before assessing the Apgar score and health care providers should not wait for Apgar score to determine the need for resuscitation. Resuscitation should be done following the protocols: HBB Second Edition for Basic resuscitation and Advanced Neonatal Resuscitation.

The Apgar score should NOT be used to determine which neonates need resuscitation at birth. If a baby is born NOT breathing, initiate resuscitation immediately. Ventilation should have commenced within the Golden Minute.

Do Apgar Score at 1.5 and 10 Minutes,

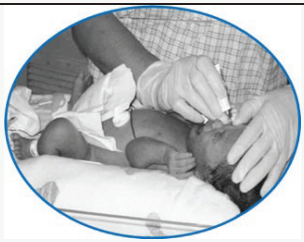
A neonate who requires no resuscitation at birth is provided with the Essential Newborn Care

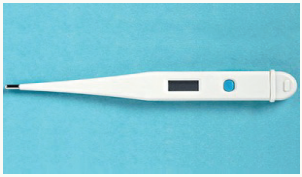
Figure 1**: Assessment of a neonate at birth**



1.1.2 Essential Care for every neonate

Consider the seven elements of essential neonatal care

Keep neonate warm	Nurse baby skin to skin, Place the baby skin to skin between the mother's breast, Cover baby, Dress the baby with a cap, socks and nappy.	
Breastfeed within the first hour	Assist with attachment and positioning to initiate breast feeding in the first hour of life.	
Cord care	Apply 7.1% chlorhexidine di-gluconate (chlorhexidine 4%) for 7 days **OR** Dry cord care	
Eye prophylaxis	Administer tetracycline eye ointment in both eyes after birth.	

Vitamin K	Administer Vitamin K IM in the anterolateral aspect of the mid-thigh. Give 1mg for full term neonates and 0.5mg for preterm neonates. .	
Assessment	Weigh the baby, monitor feeding, temperature, respiration, heart rate, activity, colour and urine output every 6 hours and record.	
Immunization	Give BCG, Hepatitis B 0 and Polio 0 at discharge.	

1.1.3 Antepartum and intrapartum risk factors for neonatal resuscitation

It is not possible to predict all the neonates that need resuscitation and a health care provider attending to a delivery should always prepare for resuscitation at all deliveries. The following risk factors in the table below increase the risk of the need for resuscitation.

Antepartum risk factors	Intrapartum risk factors
• Rupture of membranes for a period of ≥18 hours • Pre-eclampsia and eclampsia • Maternal infection – Malaria, HIV • Premature labour • Multiple births • Antepartum Haemorrhage	• Prolonged labour • Precipitate labour • Excessive bleeding • Breech presentation • Shoulder dystocia • Fetal distress • Meconium-stained amniotic fluid • Foul-smelling amniotic fluid • Cord prolapse

1.1.4 Neonatal resuscitation

The level of neonatal resuscitation will depend on the level of training and skill of the health worker available. All healthcare workers caring for neonates in all health facilities must be trained in Helping Neonates Breathe (Figure 2) every 2 years. In Level 2 and Level 3 neonatal units there must be healthcare workers trained in advanced neonatal resuscitation techniques (Figure 3)

Figure 2: Helping Babies Breathe for all healthcare facilities (Second Edition)

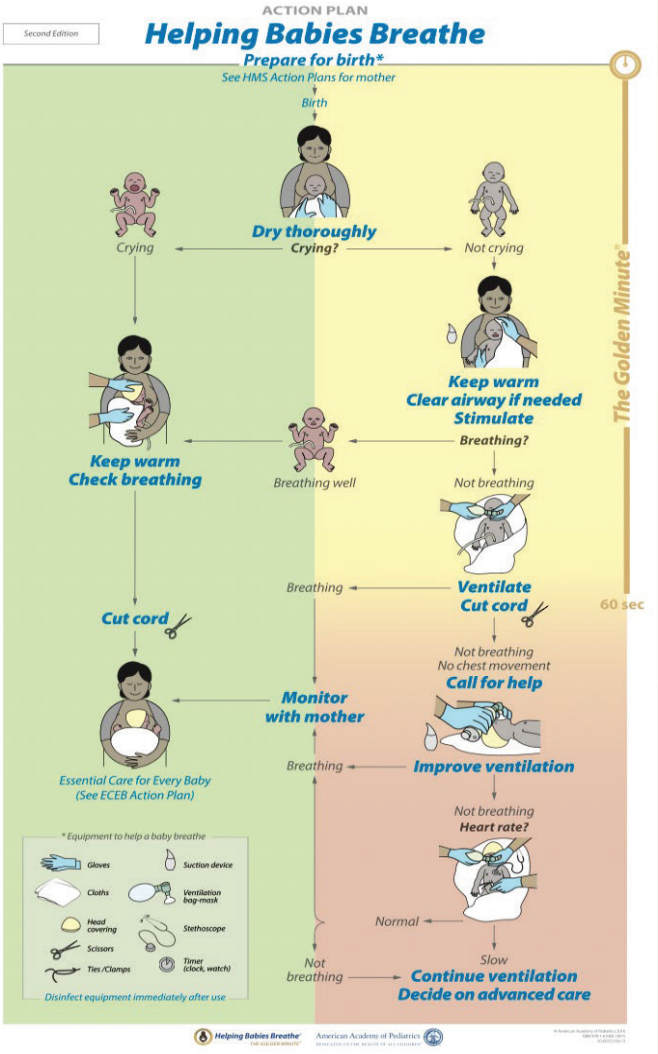
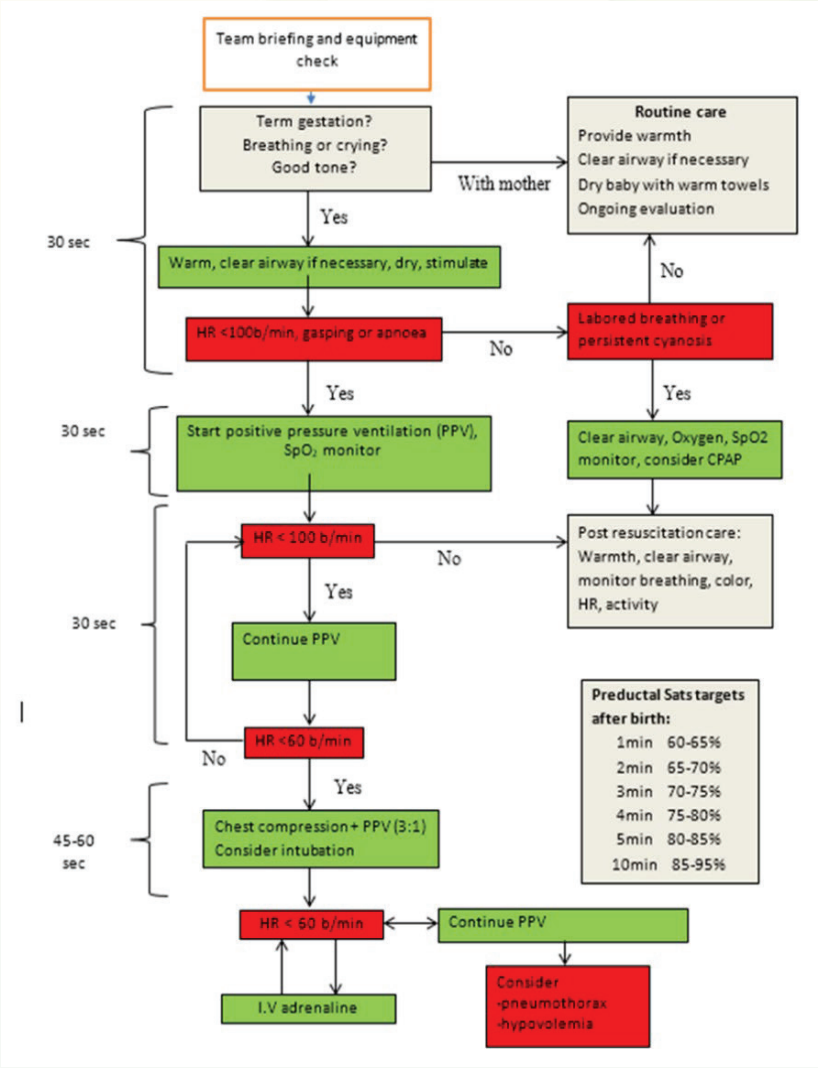
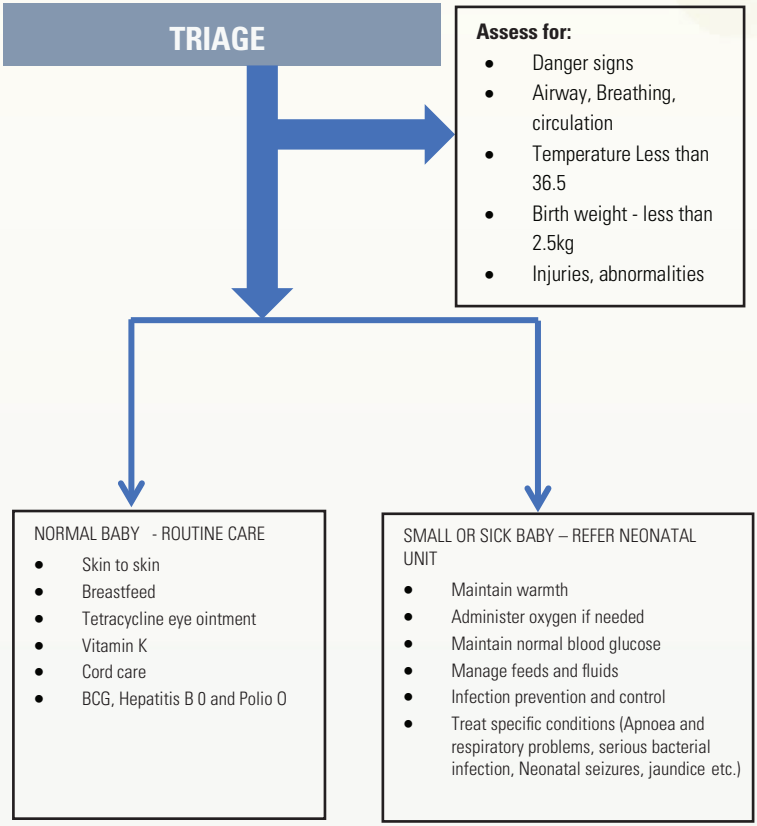


Figure 3: Advanced Neonatal Resuscitation when trained personnel



1.1.5 TRIAGE OF NEONATE AT BIRTH

Figure 4: Triaging the neonate after birth



1.1.6 TRIAGE OF NEONATE AT THE NEONATAL UNIT

Triage is done at admission to the neonatal unit. Firstly, to determine if the neonate is breathing and whether resuscitation is required. Secondly to look for emergency signs and initiate emergency treatment as indicated in Table 1.

Table 1: Classify need for emergency care and ACT NOW

Not breathing at all **OR** Gasping **OR** Respiratory rate (RR) less than 20 breaths per minute **OR** Tongue is blue	Respiratory Failure	• Call for help • Resuscitate baby with Ambu bag • Give oxygen • Keep warm • Arrange for admission in the neonatal unit
Heart rate more than 180 beats per minute Pallor Extreme lethargy Unconscious	Circulatory Failure	• Call for help • Give Oxygen • Establish an IV line • Infuse Normal Saline 10ml/kg body weight over 1 hour • Then infuse 10% Dextrose at the recommended volume for weight/ age • Keep warm • Check vitamin K administration
Glucose < 2.5 mmol/l	Hypoglycaemia	• Give 10% Dextrose IV as per recommended volume for weight and age
Hypothermia Temperature <36.5^{0}C	Hypothermia	• Rewarm Hypothermic Babies • Rewarm Rapidly if there is severe Hypothermia (<32^{0}C)

1.1.7 INFECTION PREVENTION AND CONTROL (IPC)

Neonates especially preterm neonates are at high risk of acquiring infections because of their immature immune system. Failure to follow the infection prevention and control routines will result in hospital acquired infections and deaths. Infections may be transmitted vertically from the mother or horizontally from caregivers and the environment

The following are standard precautions:

- Hand washing and antiseptic use
- Use of personal protective equipment (e.g. Gloves, gowns, aprons, masks and caps) when handling blood and other body fluids
- Appropriate handling and disposal of waste and soiled linen
- Cleaning of patient care equipment and the environment.
- Proper handling and storage of expressed breast milk
- Anti-microbial stewardship
- Neonatal Unit Organization to prevent infection

1.1.7.1 Hand washing

Hand washing is the simplest and most effective way to prevent transmission of infection.

According to the World Health Organization (WHO) there are five key moments when health care workers should perform hand hygiene (Figure 5):

- Before touching a patient
- Before performing a clean/aseptic procedure
- After body fluid exposure or risk
- After touching a patient
- After touching a patient's surroundings

In the neonatal unit, hand washing should also be carried out at the following times:

- Always wash your hands on entering and leaving the nursery; before and after touching a baby, and after handling soiled linen or instruments.
- Instruct mothers, healthcare workers and visitors to wash their hands before and after touching their neonates while in the neonatal unit

Figure 5: Handwashing cycle (Adapted from WHO)

There are two methods of hand hygiene.

Method 1: Hand wash with clean water and soap and drying hands with clean single use towel/tissue or air dry. Common towels must not be used as they facilitate transmission of infections.

- Wet hands thoroughly, apply soap and wash for at least 30-60 seconds, rinse under running water, air dry or use a clean disposable towel if available

Method 2: Hand rub with waterless antiseptic solution: Alcohol hand rubs are appropriate for rapid hand decontamination between patients. However, this is not a substitute for handwashing if hands are soiled. If alcohol hand rub not available: Mix alcohol and glycerin solution: 2ml of glycerine + 100ml of alcohol 70–90%. Then clean hands with 3-5mls of the solution.

1.1.7.2 Cleaning Equipment and the environment

- Equipment that can be dedicated to a single patient should remain at the bedside. For example, thermometers.
- Equipment that is shared must be cleaned between patients. Examples; Glucometers, Oxygen saturation monitor, stethoscope and weighing scale
- Use 0.5% Chlorine or 70% alcohol solution to clean surfaces and equipment and allow to dry before use on another patient Wipe stethoscope with alcohol swabs or D-germ (0.5% Chlorhexidine and 70% alcohol) between use
- Clean incubators with 70 % alcohol (or 0.5% chlorine if no alcohol) between use and allow to dry before using
- All surfaces in patient care areas should be cleaned daily including countertops and tables, medication cart.
- Environmental swabs for culture and sensitivity done monthly.
- Clean spills of blood with 0.5% Chlorine or 70% alcohol
- Wipe stethoscope, thermometer and weighing scale with alcohol between uses
- Wash cots and head boxes with soap and water between uses
- Clean incubators with 0.5% Chlorhexidine between use

NOTE: Chlorhexidine is intended for skin preparation or hand cleaning and not for cleaning equipment.

1.1.7.3 Cleaning oxygen tubing, and respiratory circuits

Use the following steps to clean oxygen tubing and respirator circuit (Four bucket system):

- Soak tubing in Hibiscrub (4% Chlorhexidine gluconate) or soapy water for 30 minutes, rinse with clean water
- Soak in 5ml Cydex (10% isopropyl alcohol) or in 0.5% chlorine solution mixed with a bucket of water for another 30 minutes.
- Using gloves, remove the tubing, rinse with tap water, drain the water, hang on an IV stand, and then blow dry with oxygen.

1.1.7.4 Cleaning Resuscitation Equipment

Step 1: Preparation

Wear complete personal protective equipment, clean the reprocessing area, label the reprocessing container with name of the solution used and the date and time it was prepared.

Step 2: Pre- Disinfection

Wipe the equipment with clean gauze soaked in 0.5% Chlorine solution. Disassemble the equipment completely and wash all parts with clean water and soap. Rinse in clean water and then soak in white vinegar to remove lime. Wipe dry with clean gauze or cloth

Step 3: Disinfection

For High Level Disinfection, soak in Chorine 0.5% or Glutaraldehyde solution (2.4%) for 20 minutes.

Step 4: Post – Disinfection

Re-assemble equipment and place it in a high-level disinfected plastic container. Laryngoscopes and Blades Laryngoscope blades must be thoroughly wiped with 70% alcohol daily and after each use. If a laryngoscope is used on a baby, remove the bulb, clean the blade with soap and water then dip it in 2% glutaraldehyde (CIDEX) for 20min then rinse it thoroughly and dry.

1.1.7.5 Proper handling and storage of cups, spoons and containers for expressed breast milk

Step 1: Clean containers used to express breast milk with soap and water

Step 2: Mix the Milton Solution (or similar 1% hypochlorite sterilising solution) according to manufacturer's guidelines.

Step 3: Soak containers in sterilising solution. Ensure all bottles and accessories are completely submerged in the sterilising solution and ensure that no air bubble is trapped inside the bottles.

Step 4: Close the lid and in just 15 minutes everything is ready to use.

Step 5: The sterilising solution should be changed every 24 hours.

STEP NUMBER	STEPS TO FOLLOW
Step 1: Waste Segregation	• Segregation consists of a clear identification of the different types of waste and the means of separation. • It should be done as close as possible to the place where the waste was produced. • Separation should be maintained during transport and in storage areas, especially for sharps waste. • Pedal-operated waste collection bins with liners should be available at point of use in healthcare facilities as the preferred choice. 
Step 2: Collection of Waste:	• Waste should be collected regularly, at least once a day. • Each type of waste will be collected and stored separately. • Waste collection staff should be made aware of sharps bins that have been closed by care staff. • Waste collection staff should wear gloves and handle waste with care.

Step 3: Transport of waste	• Transport should be carried out in a safe manner (using PPE and respecting passage areas). • The means used for the transport of waste can be of several kinds (wheelbarrows, containers on wheels, trolleys, etc.) and must meet the following requirements o Be easy to load and unload. o Do not have sharp edges or corners that could tear the bags or damage the containers. o Be easily cleaned (with a 0.5% active chlorine solution). o Be clearly identified according to waste type. • The route should be planned to avoid exposure to staff, patients and the public. Passage through clean areas (sterilisation), sensitive areas (operating theatre, intensive care) and public areas should be minimised.

1.1.7.6 Waste disposal and prevention of needle stick injuries

1.1.7.7 Environment cleaning in the neonatal unit

Environment cleaning is important. Preterm neonates in neonatal units are highly vulnerable to infections due to the immaturity (innate and adaptive immune systems.) Furthermore, these neonates undergo invasive procedures with a frequent use of medical devices. All these factors increase their risk for developing hospital acquired infections (HAI). Additionally, pathogen contamination of surfaces is a major source of infection in neonatal units. Personal materials such as mobile phones, jewellery are potential sources of contamination. Subsequent hand carriage of pathogens is associated with HAI.

Neonatal units are highly infectious; therefore, they require multiple cleaning and disinfection operations daily. There is evidence that environmental disinfection

reduces HAIs. Effective cleaning and disinfection can avoid the spread of micro-organisms and prevent HAIs.

Guidance for cleaning of the surfaces and the environment in the neonatal unit

- All surfaces including drug carts, tables, incubators should be cleaned with Alcohol 70% or Chlorine 0.5% daily in the morning
- The floor should be cleaned with soap, water and chlorine 0.5% daily
- Once in a week there should be scrubbing of the floor and the walls with water and soap
- Swabbing of the surfaces should be done on quarterly basis for isolation of the existing organisms in the unit
- High level disinfection of the unit with steam disinfectant should be done on quarterly basis

Guidance for cleaning cots and incubators

- Clean every cot/incubator daily with soapy warm water to remove visible soil (blood, milk, body fluids) and reduce microbial burden
- Clean & disinfect each cot/incubator after a neonate is discharged from it. Clean using soapy water and disinfect quaternary ammonium and chlorine compounds after each cleaning.
- Do extensive cleaning and disinfection once every week

1.1.7.8 Antimicrobial Stewardship (AMS)

AMS is a coordinated approach to reduce resistance, encouraging appropriate usage of antimicrobials. This is described in Table 2. "The ultimate goal of AMS is to achieve the best possible outcome for the patient". Give the right agent, at the right dose, at the right time, and for the right duration.

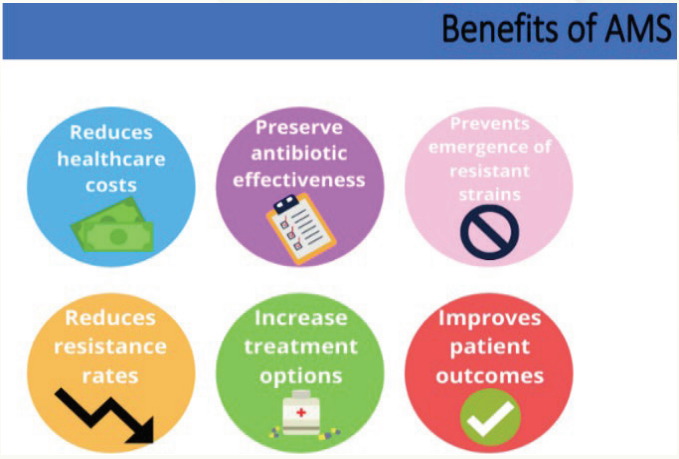


Table 2: Example of how to undertake antibiotic stewardship in the neonatal unit

STRATEGY	EXAMPLE
Prescriber audit & feedback	Review of microbiology results and patient record by (Pharmacist, Paediatrician, Neonatologist) anti-microbial stewardship team within 48-72hours of initial approval of meropenem, vancomycin A focal person from the Neonatal unit can work closely with pharmacist, and microbiologist to enforce antibiotic stewardship
Formulary restriction & prior authorization	Require prior authorization from the antimicrobial team prior to use of 3rd line antibiotics (Meropenem)
Education	Provide lecture series about stewardship principles & antibiotic options for treatment of gram-negative pathogens
Guidelines & clinical pathways	Develop consensus guidelines for the duration of treatment of presumed culture negative sepsis.

1.1.7.9 Neonatal unit organization to prevent and control infection

Layout to prevent and control infection

Adequate space should be available to prevent overcrowding and a standard unit may have the following areas:

- Kangaroo mother care area - to care to low birth weight and preterm neonates, who have been stabilized in standard inpatient care
- Observation ward: Where stable neonates with infection, Neonate of diabetes, vomiting, can be observed and receive treatment.
- Neonatal High care/ High Dependency: where the care of sicker neonates is done and includes those who require cardio-respiratory monitoring, oxygen therapy of more than 40%, Nasal prong CPAP, those who have recurrent apnoea and convulsions, or who may need an exchange transfusion.
- Neonatal intensive care is required for neonates who need mechanical ventilation, total parenteral nutrition, or who have a complex problem requiring further investigation and management or who have a neonatal surgical problem.

NB: The availability of the above spaces is dependent on the level of care. Preterm and referral neonates should not be mixed with the rest of the other neonates.

Healthcare worker's/ Attendant's practices to prevent and control infection

- Wear appropriate clothing (short sleeves)
- Remove all jewellery, clocks, nail extensions
- Adequate staff to ensure patient allocation and not task allocation.
- Isolation of neonates from home and those with infectious diseases like gastroenteritis
- Visiting: Avoid overcrowding, minimal visitors, mother, father, or an immediate guardian in case mother is dead and not around.

Personal attire: Staff of neonatal unit: Leave white coats outside unit and replace with unit specific coats

SECTION TWO

2.1 CLINICAL PROTOCOLS

2.1.1 MANAGEMENT OF PRETERM AND THE LOW BIRTH WEIGHT NEONATE

2.1.1.1 What is a preterm neonate

A preterm is a baby born less than 37 weeks completed weeks of gestation. A low birth weight is a baby born with a weight less than 2.5 kg.

A preterm baby / Low birth weight is classified into the following 3 (three) categories based on birth weight;

a) Low birth weight (LBW) is one who is between 1.5 and 2.5 Kgs

b) Very low birth weight (VLBW) is one who is less than 1.5 Kgs

c) Extremely low birth weight (ELBW) is one who is less than 1.0 Kgs (1000 grams)

A preterm can also be classified into three categories based on gestational age

a) Extreme preterm less than 28 weeks

b) Very Preterm – 28 to 32 weeks

c) Moderate preterm 33- 36 6/7

In absence of an accurate last normal menstrual period (LMNP), use the New Ballard score to determine the gestational ages for all preterm neonates (Appendix).

2.1.1.2 Admission criteria for preterm neonates / Low Birth weight

- **Extremely low** birthweight (<1000g) neonates
- and **very low** birth weight (1000-1499g) neonates must be admitted in high dependency area where they will need close monitoring.

- **Low birth** weight neonates (1500 – 1999g) need to be admitted in the neonatal unit for assessment and care, monitoring, feeding support and KMC.
- **Low birth** weight neonates (2000g – 2499g) range can be kept with their mothers unless there is a reason for them to have special care in the Neonatal Unit. Alternatively, they can do Kangaroo care in the KMC unit.

2.1.1.3 Determine gestational age

It is essential to know the gestational age of all low birthweight (LBW) neonates as their management may be influenced by both weight and age. It can be established by: weeks of Amenorrhea (WOA), Ultra sound by 22 weeks, Scoring the physical and neurological appearance of the baby after delivery using a New Ballard score

2.1.1.4 Observations

These should be done and recorded: Heart rate, Respiratory Rate, temperature, oxygen saturations, blood glucose, feeds and fluids and recorded in the Chart.

2.1.1.5 Apnoea prevention in preterm neonates

Neonates with a birth weight of <1.5 kg or a gestational age <34 weeks are prone to apnoea of prematurity and should be commenced on oral/IV theophylline e.g (Aminophyllline) or caffeine (Doses in Formulary). Once neonate reaches 34 weeks, stop the theophylline/caffeine and monitor the neonate for apnoea and do not discharge a baby until he / she has been apnoea free for more than 48 hours.

2.1.1.6 Oxygen therapy in a preterm neonates

Neonates with respiratory rate > 80bpm, severe chest in-drawing OR grunting OR blood oxygen
Saturation less than 90%.

- Note:
  - Silverman Anderson Score (SAS) of 1-3; commence free flow oxygen

- SAS of 4-6; Commence on CPAP
- SAS of 7-10; Support the baby with Mechanical Ventilation. (Appendix Silverman Anderson score)

It is preferable to use warm and blended oxygen if its available for all preterm neonates.

Whenever administering oxygen to preterm neonates, monitor oxygen saturations continuously. Ideally oxygen saturations should be 90-95% to reduce the risk retinopathy of prematurity and subsequent childhood blindness.

2.1.1.7 Thermal care in a preterm neonate

Temperature regulation immediately after birth and throughout the neonatal period is very critical for the survival of the neonate. The normal temperature range for neonates is 36.5 - 37.5°C. Small or sick neonates are particularly at an increased risk of hypothermia (low body temperature).

Hypothermia causes increased oxygen and energy consumption. It can also lead to hypoxia, metabolic acidosis, hypoglycaemia, apnoea, bleeding, neonatal cold injury, failure to gain weight and even mortality.

2.1.1.7.1 Prevention of hypothermia in a preterm neonate

Step1: Ensure labour suite/ theatre temperature is 25-28°C by closing windows, doors and putting off fan or air conditioner. Pre-warm the radiant warmer and warm the baby's clothing and sheets.

Step2: Dry the baby immediately after birth, take away the wet cloth and place the baby on the mother's chest, apply a cap on baby's head then cover the baby with another dry cloth. If skin to skin cannot be done, like in theatre, place the baby under a warmer. For preterm neonates below 30 weeks of gestation wrap the baby's torso in a polythene bag and put under radiant warmer to continue with the resuscitation.

Step 3: Ensure skin to skin contact after delivery and during transfer to post-natal ward. Ensure the mother is warm, well covered and temperature is above 36.5°C.

Step 4: Ensure breastfeeding is initiated within 1 hour of birth for all stable neonates.

Step 5: Postpone bathing until after the first 24hours. Weigh the baby while wrapped then check weight of wrapper and subtract from total weight.

Step 6: Ensure the baby is appropriately covered with dry linen. As a rule; a neonate baby needs 1 or 2 more layers than the adult.

Step 7: Always keep the mother and baby together (rooming in). Take and record the baby's temperature.

Step 8: Ensure warm transportation of baby through skin to skin or a pre-warmed embrace bag.

Step 9: Warm resuscitation through warm surface, extra heat source and expose only face and chest

Step 10: Raise awareness among staff and parents.

2.1.1.7.2 Management of Hypothermia

Mild hypothermia (36-36.4°C)

- Ensure room is warm (by closing windows, doors and putting off fan, etc.)
- Ensure baby has been fed
- Re-warm by skin to skin contact or place in incubator with air temperature set at 32-35°C in manual mode. For Servo controlled mode set the temperature at 36.5°C, ensure skin probe is fixed securely to skin and properly plugged in the incubator. Set the humidity at 70%.

Moderate hypothermia (32-35.9°C)

- Place in incubator with air temperature set at 35-36°C in manual mode. For Servo controlled mode set the temperature at 36.5°C, ensure skin probe is fixed securely to skin and properly plugged in the incubator. Set the humidity at 70%.

- Where the incubator or radiant warmer is not available re-warm the baby using skin to skin contact.
- If there is evidence of severe disease, then treat for severe hypothermia
- Measure the blood glucose & feed the baby
- Measure the temperature every hour. The temperature should increase by 0.5^{0}C every hour
- If baby is stable, introduce Kangaroo Mother Care (KMC)

Severe hypothermia (<32^{0}C)

- Place the baby on a Radiant warmer or incubator. The air temperature is set at 35–36°C and rapidly rewarmed. Once baby's temperature reaches 34°C the rewarming process is slowed down.
- If using a servo-controlled incubator, set skin temperature at 36.5°C, ensure skin probe is fixed securely to skin and properly plugged in the incubator. Set the humidity at 70%. If using a manual mode, recommended incubator temperatures are shown in Table 3.
    - Measure temperature after 30 minutes and then hourly until normal
    - The temperature should increase by more than 0.5°C every hour
    - Treat for sepsis
    - Give IV fluids and monitor blood glucose, keep on nil by mouth until re-warmed
    - Give oxygen by nasal prongs until the baby's temperature is normal
    - Continually reassess for emergency signs. The baby is at risk for cardio-respiratory failure
    - Once the baby is warmed & stable, consider KMC

Table 3: Recommended incubator temperatures for weight and age

Birth weight	Age in days and recommended incubator temperature						
	0 -4	5 -9	10 -14	15 -19	20 -24	25 -29	30
1000g	35.5	35.0	35.0	34.5	34.0	33.5	33.0
1500g	35.0	34.0	33.5	33.5	33.0	32.5	32.5
2000g	34.0	33.0	32.5	32.0	32.0	32.0	32.0
2500g	33.5	32.5	32.0	31.0	31.0	31.0	31.0
3000g	33.0	32.0	31.0	30.0	30.0	30.0	30.0

(Adopted from the guidelines of management of the sick newborn in Hospitals and Health centers South Africa 2014)

*This is applicable for incubators on manual mode, we should monitor axillary temperature every 6 hours if we are using the manual mode to ensure that the temperature is maintained in normal range.

When using the servo-controlled incubators, the temperature should be set at 36.5^{0}C, the temperature should be replaced every six to 12 months.

2.1.1.7.3 Kangaroo Mother Care (KMC)

KMC is a means of providing the small baby with warmth and nutrition by continuous skin to skin contact on the mother's chest (Figure 6). KMC is one of the important strategies that can be used to reduce mortality. According to WHO KMC should be started immediately after birth for babies between 1.0 to 1.8Kg even unstable. This should be started where infrastructure for Mother NICU is available. Below in Table 4 are the details about implementation if immediate KMC cannot be implemented.

Table 4: Kangaroo Mother Care,

When to start KMC in a baby	Intermittent skin to skin contact is commenced when the baby is in the neonatal unit and stable enough to come out of the incubator. The baby should no longer have respiratory distress, apnoea or haemodynamic instability. For small neonates who are stable, KMC should be started immediately after birth
How to position the baby in KMC	Dress the baby in a dry nappy, stockings, and cap. Place baby in upright position against the mother's bare chest between her breasts and inside her blouse. Cover both mum and baby with warm blanket and tie if room is cold. The baby must be secure enough to allow mother to walk around without needing to hold the baby with her hands.
Feeding baby while in KMC	Neonates who are unable to suckle should be fed on expressed breast milk via nasogastric tube or cup. Allow them to suckle and cup feed once their suckling and rooting reflexes are developed
Care and monitoring in KMC	Monitor at least 6-hourly; heart rate, respiratory rate and effort, temperature, activity, colour, intake and output for the best results. The mother should be encouraged to monitor for all these parameters (except for the heart rate). Evaluate the mother and the baby once a day using the KMC Score sheet
KMC discharge	**The neonates should be discharged once they have a KMC score of more than 20, and they have weight of 1.2kg-1.5kg and 34-35weeks.** Do not discharge neonates too early, it may be difficult for them to come back quickly if they have a problem. Allow father and other people deemed appropriate by the parents to help with KMC while at home.

Figure 6: Correct positioning for kangaroo mother care (KMC)

2.1.1.8 Fluids and feeds in preterm neonates

In Neonates <1500g and sick neonates, consider small trophic feeds of 1-2ml. every 2-3 hours by nasogastric or orogastric tube until the neonate is stable.The stable neonates greater than 1.5Kg should start breast feeding immediately. Most neonates between 1500-2000g need top-up feeds of expressed breastmilk (EBM) with a cup and spoon. Health workers should offer lactation support to improve breast milk production.

2.1.1.9 Antibiotics in preterm neonates

Give antibiotics to the following groups of neonates:

- Neonates from a potentially infected environment e.g. born to mothers with prolonged rupture of membranes
- Neonates with obvious signs of infection

- Neonates <37 weeks' gestation where there is no obvious reason for the preterm labour
- Give IV Ampicillin and IV Gentamicin. (See Drug Formulary for more details).
- When sepsis is suspected give antibiotics for 48 hours and stop them once baby is clinically stable and both CBC and CRP is normal.
- When there is an infection, treat for 5 days and then stop if the baby is well However, they can be prolonged in the following conditions for 7-14 days
    - Necrotizing enterocoliitis
    - Neonatal meningitis
    - Neonatal pneumonia
    - Shock
    - Positive blood Culture

2.1.1.10 Multivitamin and iron

Should be given once the preterm baby has reached full feeds.

Iron should be started at two weeks of age.

2.1.1.11 Summary of care of preterm neonates

The special care required by preterm neonates is summarized in Table 5 and Table 6

Table 5: Care of the low birth weight or preterm neonates

	< 1Kg (ELBW)	1-1.5kg (VLBW)	1.5- 2kg (LBW)	2-2.5Kg (LBW)
Admission Criteria	Admit in the neonatal unit	Admit in the neonatal unit	Admit in the neonatal unit/KMC unit if the baby is stable.	Can stay with mother or can be taken to the neonatal unit if they need more monitoring. Admit neonates if they are not well
Warmth	Nurse the baby in an incubator, Set the incubator temperature according to the temperature chart. Put in Baby mode if using a servo control Incubator. Baby must be nursed in a transparent polyethene bag	Put baby in an incubator until stable Intermittent KMC if stable Where Mother Neonatal unit services are available start immediate KMC	Put baby in an incubator until stable, Once stable do continuous KMC Where M-NICU services are available start immediate KMC	Continuous KMC
Examination	Physical Exam including a Ballard score done within 24 hours	Physical Exam including Ballard score done within 24 hours	Physical Exam including Ballard score done within 24 hours	Physical Exam including Ballard score done within 24 hours

Fluids and Feeds	Day 1: Establish IV Line and give Only IV fluids Day 2: Start feeds. Give 2mls of Expressed breast milk every 3 hours through a naso/oral gastric tube. Day 3: Continue 2 hourly feeds via the nasogastric tube.	Establish an intravenous line and give IV fluids only for the first 24hrs. If the baby has no respiratory distress, you can start 3-hourly nasogastric feeds and Give only IV fluids for the first 24 hours. (Refer to feeding protocol	If baby can suckle, breast feed every 3 hours. If baby is unable to suckle, feed with Expressed Breast Milk using a cup or NGT every 3 hours	If baby can suckle, breast feed every 3 hours. If baby is unable to suckle, feed with Expressed Breast Milk using a cup or NGT every 3 hours
Observations	Continuous Patient monitoring is preferable. If not available; Monitor and record; ▪ respiratory and heart rate, temperature every 2 hours ▪ blood glucose every hours for the 1st 72 hours ▪ Peripheral oxygen saturation every hour for the 48 hours.	Monitor and record; ▪ respiratory and heart rate temperature every 2 hours ▪ blood glucose every 4-6 hours for the 1st 72 hours. ▪ Peripheral oxygen saturation every hour for the 48 hours. ▪ Fluid input and output	Monitor the following every 3 hours: • Respiratory rate • Heart rate • Temperature • Colour • Activity • Blood glucose • Oxygen saturation • Fluid input and output	Monitor the following every 3 hours: • Respiratory rate • Heart rate • Temperature • Colour • Activity • Blood glucose • Oxygen saturation • Fluid input and output

	▪ Fluid input and output	and heart rate every 2 hours		
Apnoea or prematurity	Start caffeine citrate or Aminophylline Discontinue when baby is 34 weeks of gestation (FOR more details refer to Apnea chart.) Once neonate reaches 34 weeks, stop the theophylline/caffeine and monitor the neonate for apnoea and do not discharge a baby until he / she has been apnoea free for more than 48 hours	Start caffeine or Aminophylline. Discontinue when baby is either 1.5kgs or 34 weeks of gestation	Caffeine or Aminophylline is recommended if the baby is less than 34 weeks	No need for caffeine or Aminophylline

Table 6: Management of the low birth weight or preterm neonate

	All preterm or LBW neonates
Oxygen	Neonates with a respiratory rate > 80 breath per minute or severe chest in drawing or grunting or oxygen saturation less than 90% or Cyanosis Neonates with respiratory rate > 80bpm, severe chest in-drawing OR grunting OR blood oxygen Saturation less than 90%. o Note: ▪ Silverman Anderson Score (SAS) of 1-3; commence free flow oxygen ▪ SAS of 4-6; Commence on CPAP. ▪ SAS of 7-10; support the baby with Mechanical Ventilation.
Antibiotics	Give antibiotics to the following groups of neonates: • Neonates less than 1.5kg • Neonates born to mothers with prolonged rupture of membranes or other risk factors for infection • Neonates with obvious signs of infection • Neonates who are < 37 weeks of gestation where there is no obvious reason for preterm labour • Neonates with respiratory distress Give IV Ampicillin and Gentamicin (refer to formulary for doses) If the baby is on antibiotics for risk factors only, and the blood culture and CRP are normal and the baby remains well at 48hours, then the antibiotics can be stopped Where CRP is not possible antibiotics should be continued for 5-7 days if the baby is symptomatic.
Vitamins	Give 0.6ml of multivitamin drops (Must have Vitamin D 400 IU/day) Give 0.6 ml of ferrous sulphate once baby is on full feeds and there is no evidence of infection. Encourage administration after day 14 or if they can tolerate at least 150ml/kg/day Encourage fortification of breast milk for neonates less than 32 weeks or 1.5 Kgs if available Formula milk should not be fortified.

Measurement	Measure and record the following on the baby's chart; • Alternate day weight • Weekly head circumference if head is enlarging too quickly then refer (plot this on a percentile Chart) • Haemoglobin to check for anaemia of prematurity at 21-28 days and when clinically indicated. • Serum sodium at 21-28 days • Phosphorous, Calcium and Alkaline Phosphatase (ALP) at day 21-28 to check for metabolic bone disease.
Discharge	Discharge if baby is KMC score of 20 , least 1.2- 1.5kg Kg or 34- 35 weeks of gestation AND cup feed well and first immunisations have been given (Check in the discharge Protocol)
Follow up	Follow up all preterm neonates every week until they are 1.5kgs and twice monthly/every 2 weeks until they are 2.5kg During the follow up, assess for weight gain, volume of feeds, duration of the KMC, and ask if mother is giving Vitamins, any sign of infection, immunization

2.1.1.12 Protecting the preterm neonate's skin

A neonate's skin has many functions including acting as a barrier to prevent infection, regulating water and heat loss and sensing different types of touch inputs. The skin of a premature Neonate is more easily damaged because it is thinner and has fewer fat layers than a full-term Neonate. Also, the nerves that sense touch information are closer to the surface so the preterm neonate can be more easily overwhelmed by touch input. Positive touch can be calming, but negative touch can create stress.

How to protect the Skin:

- Reduce unnecessary exposure to any products placed on the skin. Use water and a soft cloth to remove products from the skin as needed.
- Monitor areas at risk of injury from pressure or rubbing such as knees, elbows, scalp, nares (nostrils) and areas in contact with medical equipment like pulse oximeter probes, nasal prongs, temperature probes, IV lines and giving sets.
- Monitor skin folds and areas of skin-to-skin contact (e.g., behind ears, between fingers, in groin area) for signs of breakdown or irritation.
- Change diapers every two to four hours to avoid diaper rash, use water and soft cloths to clean skin, part gently to remove stool and dry thoroughly.
- To remove tape or transparent dressing, hold surrounding skin in place and slowly pull at a very low angle, parallel to the skin surface (rather than straight up at a 90° angle).
- Limit heel sticks and attempt to combine lab testing when possible.

2.1.1.13 Ensuring best nutrition for the neonate

Breast milk provides the best nutrition for a preterm neonate and therefore breastfeeding must be promoted and encouraged whenever possible **(refer to section on breastfeeding.)**

2.1.1.14 Developmental care

Neurodevelopmentally supportive care is a type of caregiving that helps support the neonate's maturing brain and nervous system to enable the Neonate to cope with the environment outside of the mother's womb.

It includes the following:

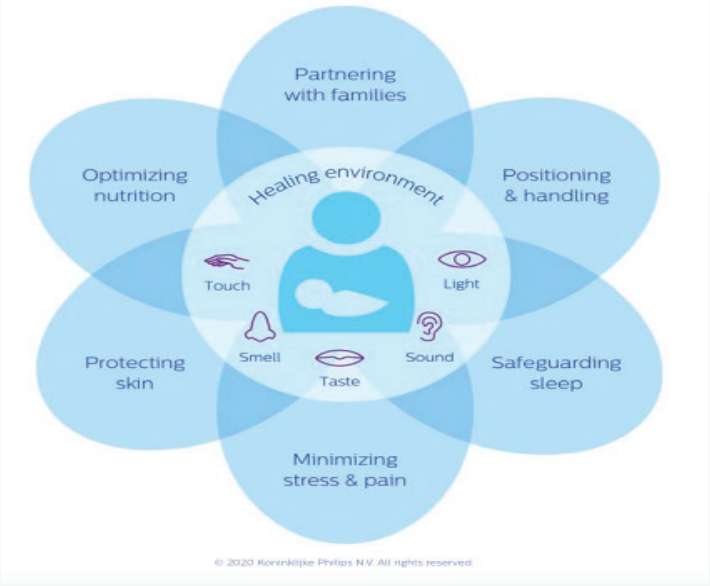
- Protecting sleep (allowing the neonate uninterrupted sleep periods except during scheduled feeding)
- Assessing and managing the neonate 's pain and stress
- Proper positioning and handling of the neonate
- Protecting the neonate 's skin
- Ensuring the best nutrition for the neonate
- Family-centred care

Protecting Sleep

The goal of neurodevelopmentally supportive care is to monitor the sensory stimulation in the environment around the Neonate, provide positioning support of the Neonate's body, and allow adequate time approximately 2-3 hours between caregiving/assessments, which help the Neonate maintain a prolonged sleep state. Cluster care and minimise noise (alarms set at low volume and phones in silence) and light in the NICU.

Assessing and managing the neonate's pain and stress

The preterm neonate 's has an immature brain and sensory systems and care activities such as diaper changes, taking the neonate 's temperature and position changes can be just as painful and/or stressful as heel prick and inserting IV lines.



Components of Developmental care

How to reduce: pain and stress

- Encourage comforting through maternal presence, touch and KMC.
- Observe the neonate for signs of stress (e.g., unstable vital signs, arching of back, finger splaying, extended extremities, grimacing, irritability). Stop intervention for a time or modify handling and caregiving to help the neonate regain a calmer state.
- Offer containment to support the neonate during procedures or caregiving. Place one open hand on the top of the neonate 's head and another on the lower body to achieve a curved, flexed (tucked) position; parents can offer this support while assessments or procedures are performed.
- Use (and teach parents to use) constant gentle touch or pressure on the neonate instead of stroking and rubbing.
- When possible, minimize frequency of lab or glucose testing; combine blood draws, when possible.
- Encourage non-nutritive sucking using a clean or gloved finger, or empty breast, if the neonate 's condition allows, during stressful or painful procedures.
- When a neonate's condition allows, offer breast milk drops in the mouth and/or breastfeeding as tolerated.
- Cover the neonate's eyes with a mask or cloth if bright lights are used during care procedures.

Proper positioning of the neonate and handling

Positioning and handling a neonate in the neonatal unit should be designed to support the neonate's body as closely as possible to the position of a neonate within the womb figure 7,8,9,10. Not only does this help with the best development of the Neonate's bones and muscles, but optimal positioning can also affect the neonate's ability to maintain a calm state, regulate their body temperature and sustain a sleep state. The goal of neurodevelopmentally supportive care is to support the neonate's body with optimal positioning and handling during caregiving, sleeping, position changes and when being held by a caregiver.

Figure 7: Containment of infant for support (Image credit: L. Adams)

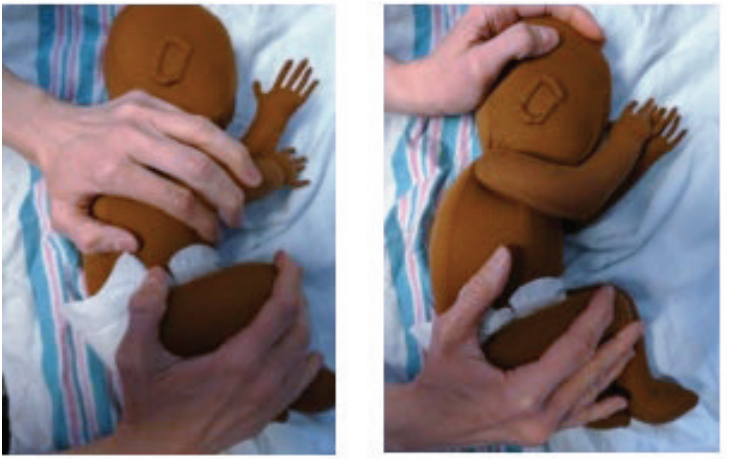


Figure 8: Support for infant lying on stomach (Image credit: L. Adams)

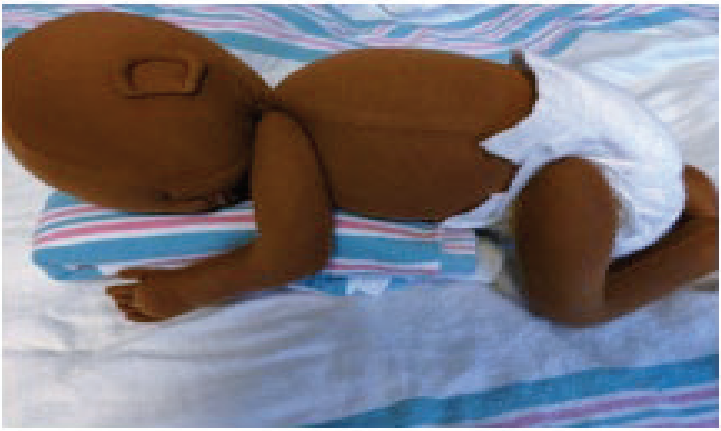


Figure 9: Support for infant lying on back (Image credit: L. Adams)

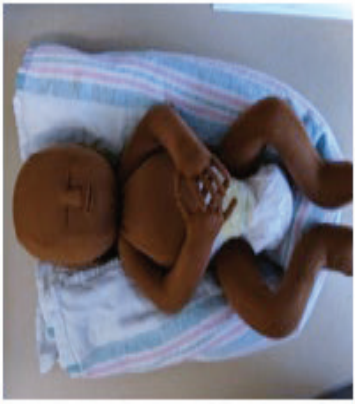


Figure 10: Support for infant lying on side (Image credit: L. Adams)

2.1.1.15 Family Centered Care

Parents being present in the neonatal unit, learning how to care for their neonate is essential support for the development of the neonate . The goal of neurodevelopmentally supportive care is for the medical team to establish an active partnership with families. This includes teaching developmentally appropriate care and encouraging the parents to participate in decision-making to ensure that the family is the central and most important part of their Neonates' lives (Table 7).

Table7: Key procedures in family centered care and their rationales

	Procedure	Rationale
1.	Create an environment that is welcoming and supportive where mothers / caregivers feel respected. The neonatal unit should be a place where parents are encouraged to take part in the care of their neonate, like changing diapers and feeding the baby, be a part of the decision-making process e.g inserting a nasogastric tube and feel comfortable asking questions about their care.	• Family-centred care can provide many benefits including decreased length of stay in the hospital, improved parent–neonate bonding, improved outcomes of preterm neonates and greater patient and family satisfaction.
2.	Demonstrate and encourage parents to participate in neonate care including comforting the neonate and providing positive touch experiences.	• Parents may only want the medical and nursing staff to provide care or may feel scared to participate in the care of their neonate. Parents also may not know that preterm neonates have special needs.
3.	Offer education and experiences when parents show an interest and readiness to learn.	• Parents may be frightened by having a preterm neonate and may not know what to do.
4.	Help parents recognize and respond to the neonate's unique needs; encourage their growing expertise as caregivers.	• Parents must learn about their neonate and learn what is best for them, so they can protect them and speak for them when necessary.
5.	Encourage frequent, (kangaroo mother care or KMC), as tolerated by the neonate and parent.	• KMC establishes and improves emotional attachment between the parent and neonate.

2.1.1.16 Respiratory Problems in Newborn Period

2.1.1.16.1 Oxygen administration

2.1.1.16.1.1 Overview of oxygen therapy

Oxygen therapy is one of the most common therapies used in the neonates, especially in the preterm population. Supplemental oxygen has been shown to improve survival and neurodevelopmental outcomes.

However, in preterm neonates, exposure to higher oxygen saturation for prolonged periods is associated with an increased incidence of retinopathy of prematurity (ROP), bronchopulmonary dysplasia (BPD), cerebral palsy, periventricular leukomalacia and necrotizing enterocolitis (NEC).

Continuous pulse oximetry allows the clinician to monitor oxygen saturation and titrate oxygen therapy to target levels within a defined range.

Evidence for oxygen saturation target ranges in the term neonates is limited. Although term neonates (>1.5kg) are not at risk of ROP, hyperoxia may have harmful effects on cerebral perfusion and exacerbate oxidative stress in the event of hypoxic ischemic injury.

Oxygen saturations should be targeted within the range of 90-95%, when receiving oxygen therapy, in both preterm and term neonates.

2.1.1.16.1.2 Concentration of Oxygen

The concentration of oxygen in room air is 21% (FiO_2 0.21) and the concentration of pure oxygen is 100% (FiO_2 1.0) like that from the oxygen cylinder.

As described above, too much or too little oxygen increases the risks to the neonate. Use supplementary oxygen to keep the neonate's oxygen saturation between 90 and 95%. Give the minimum oxygen required to maintain this range by mixing oxygen and air where possible using a blender (If available).

2.1.1.16.1.3 Monitoring of neonates on oxygen therapy

- Neonates receiving oxygen therapy should have their SpO_2 measured continuously by pulse oximetry.
- Care should be taken to monitor skin beneath the probe site frequently and rotation of probe placement should be attended to at minimum 2 hourly to prevent burns and pressure injury.
- Multiple reported cases exist of significant burn and pressure injury due to pulse oximetry. The risk of burn is increased in preterm neonates with immature, thin dermis.

2.1.1.16.1.4 Methods of Oxygen Delivery

Oxygen can be delivered using the routes of administration shown in Table 8. The indications and methods for each route are also described in the same table.

Table 8: Methods of oxygen delivery in neonates

Route	Indication	Method	Flow / and Concentration
Nasal Prongs 	Mild respiratory distress • No nasogastric tube in situ - baby may have an orogastric tube	Place the prongs just below the baby's nostrils. Use 1mm prongs for preterm/LBW neonates Use 2mm prongs for term neonates Secure the prongs with tape	1-2 Litres per minute • Concentration ~30%

Bubble continuous Positive Airway Pressure (bCPAP) 	• For neonates with moderate-severe respiratory distress, e.g. respiratory distress syndrome, pneumonia, pulmonary oedema • Apnoea of prematurity	• Apply special nasal prongs to the baby • Connect the bCPAP machine • Start with a pressure of 5cm of water • When weaning the oxygen, reduce the oxygen percentage (FiO_2) to maintain saturations 90-95% Reduce the pressure by 1-2cm when there is mild respiratory distress	Oxygen and air mixed through a blender

2.1.1.16.1.5 Indications for use of oxygen in neonatal period

The key indications for use of oxygen in the neonatal period are described in Table 9. The table describes the clinical indication, the patient group and the monitoring required.

Table 9: Indications for the use of oxygen in neonates

Clinical indication	Patient group	Method of oxygen delivery	Monitoring required	Other considerations
Resuscitation at birth	Term and > 32 weeks' gestation	Begin positive-pressure ventilation with bag and mask using room air. Where possible, adjust oxygen concentration to achieve time-specific oxygen saturation targets after birth	Initiate pulse oximetry if heart rate <60 after initial ventilation with room air	Non-humidified, unheated gases may be used for short periods

Clinical indication	Patient group	Method of oxygen delivery	Monitoring required	Other considerations
Resuscitation at birth	Preterm (< 32 weeks Gestation, VLBW)	Begin positive-pressure ventilation with bag and mask using 30% oxygen. Use air if blended oxygen is not available. Adjust oxygen concentration after 30 seconds of adequate ventilation with 30% oxygen to achieve time-specific oxygen saturation targets after birth.	Initiate pulse oximetry monitoring during resuscitation	Non-humidified, unheated gases may be used for short periods
Mild hypoxemia (SAS less than 3)	Term	Provide oxygen by nasal Prongs Adjust oxygen flow rate to	Monitor with pulse oximetry at least twice daily during	Non-humidified, unheated gases may be used at flow < 1 L/min, although drying and

Clinical indication	Patient group	Method of oxygen delivery	Monitoring required	Other considerations
		achieve oxygen saturation > 90%	oxygen therapy.	nasal mucosal injury may occur at higher flow rates.
Mild hypoxemia (SAS less than 3)	Preterm	Provide oxygen by nasal cannula. Adjust oxygen flow rate to achieve oxygen saturation 90-95%	Monitor with pulse oximetry continuously if feasible. Monitor at least twice daily if continuous monitoring not available	All neonates born <32 weeks' gestation or <1500g who received oxygen should be screened for ROP at 4-6 weeks of age.
Moderate respiratory Distress (SAS 4-6)	Term and preterm	Provide oxygen therapy with continuous positive airway pressure (CPAP). Adjust oxygen concentration (FiO_2) to achieve oxygen	100% oxygen should never be used with CPAP. Monitor with pulse oximetry or continuously if feasible, if not the monitor at least twice daily	Non-humidified, unheated gases may result in airway mucosal drying and injury.

Clinical indication	Patient group	Method of oxygen delivery	Monitoring required	Other considerations
		saturation 90% -95% Adjust pressure to support respiratory distress CPAPs with blenders are preferable such as Vayu		
Severe respiratory Distress (SAS >7)	Term and preterm	Ideally care for neonates with severe respiratory distress should be provided in facilities where intubation, ventilator care, surfactant, blood gas analysis, neonatal nursing and continuous monitoring are available.	Surfactant replacement therapy recommended for intubated and ventilated newborns with respiratory distress syndrome in advanced settings.	

2.1.1.16.2 Apnoea of prematurity

What is it?

Stopping breathing 15-20 seconds and may be associated with bradycardia or hypoxia or cyanosis

What are the causes?

- Most common in preterm neonates. Usually presents after 1-2 days and before 7 days in neonates less than 32-34 weeks. It is usually related to the immaturity of the central nervous system and is called **Apnoea of Prematurity**.
- It may either be **central** resulting from absence of inspiratory effort, **obstructive** where inspiratory effort persists or **mixed** type in which central or obstructive may precede.
- Apnoea of prematurity is a diagnosis of exclusion because it is associated with other diagnoses.
- Apnoea can also be due to secondary causes, the most common of which are:
    - Hypoglycaemia
    - Hypothermia
    - Sepsis
    - Temperature instability
    - Hypoxic ischaemic encephalopathy
    - Gastro-oesophageal reflux
    - Anaemia
    - Patent ductus arteriosus (PDA)
    - Intraventricular haemorrhage (IVH)
    - Necrotizing enterocolitis (NEC)

How is apnoea of prematurity prevented?

- All preterm neonates with birthweight <1.5kg or <34/40 weeks should be started on prophylactic caffeine. This is preferred to Aminophylline.
- Very low birthweight (<1.5kg) neonates should receive prophylactic aminophylline or caffeine until they reach 34 weeks corrected gestational age, or 1.5kg if gestational age is unknown.
- Caffeine dosing:
    - Loading dose caffeine citrate 20mg/kg iv infusion or oral when taking enteral feeds
    - Maintenance caffeine citrate 10mg/kg iv OD infusion or oral when taking enteral feeds
- Aminophylline can be used if caffeine is not available.
- Aminophylline dosing:
    - Loading dose 6mg/kg
    - Maintenance 2mg/kg 12 hourly
- If suitable preterm neonates should be cared for in Kangaroo Mother Care to help prevent apnoea of prematurity (refer to KMC Guidelines)
- Consider starting CPAP at a pressure of 3-5cm H_2O if available, particularly if apnea is already present. It will help prevent aponea
- Monitor these neonates carefully and educate the caregivers to inform staff immediately if they observe an apnoea.
- Ideally all these neonates should be on continuous pulse-oximetry to monitor carefully
- Ideally all preterm neonates should be monitored for aponea for 48 hours after caffeine or aminophylline treatment is stopped

Apnoea is unusual in *term* neonates.
If apnoea is seen in *term* baby you **MUST** consider sepsis / seizure
If apnoea is seen in a preterm baby who didn't have apnoea before or is already on caffeine or aminophylline you **MUST** consider secondary causes

What is the management of apnoea?

Resus

- Stimulate the baby by rubbing his chest or feet for 10 seconds
- If the baby does not breathe immediately, position head in a neutral position and ventilate using a bag and mask.
- If oxygen saturations <90% give oxygen via CPAP, if not available give via nasal prongs until oxygen saturations >90%.
- Keep warm

Clinical features

- Not breathing for 15-20 seconds
- Features of prematurity may be present
- Other signs of secondary causes (listed above) may be present

Invest-igations

- Check blood glucose and if low (<2.5mmol/L) or you are unable to check treat
- Check temperature
- Consider investigations for other causes, especially in term baby or a preterm baby that has not had apnoea before or a preterm baby who is already on aminophylline or caffeine (Section 4.2)

Treatment

Preterm:

- Position baby in nuetral position and enusre airway is open
- Start Caffeine or Aminophylline (If already on aminophylline, increase dose to 3mg/kg 12 hourly)
- Consider treatment for reflux
- KMC should be continued or started as per KMC Guidelines
- Consider CPAP at a pressure of 3-5cm H_2O if available, particularly if there is persistent apnoea
- Treat for secondary causes including sepsis/seizures
- Consider changing to secondline antibiotics if already on 1st line antibiotics

Term:

- Apnoea is unusual in term neonates. Observe and monitor for further apnoea or seizures
- If 2nd apnoea investigate and treat for sepsis/seizures or any other secondary causes

Monitor

- All very low birthweight neonates should be monitored for apnoes even if on caffeine or aminophylline
- Ideally all preterm neonates should be monitored for apnoeas for 48 hours after caffeine/ aminophylline treatment is stopped

2.1.1.16.3 Respiratory Distress Syndrome (RDS)

What is it?

- A syndrome seen in preterm neonates who don't have enough surfactant in their lungs.
- Surfactant reduces the surface tension in the alveoli to prevent the alveoli from collapsing on expiration.
- If there is not enough surfactant the alveoli collapse when the neonate breaths out and it takes even more effort to breath in again.
- RDS increases with decreasing gestation.
    - 50% of all Neonates born at 26 – 28 weeks will have RDS
    - 25% of all Neonates born at 30 – 31 weeks will have RDS

What are the risk factors?

- Increasing prematurity
- Lack of or inadequate antenatal corticosteroids
- Male
- Maternal diabetes
- Hypothermia

What are the protective factors?

- Antenatal Steroids i.e. Dexamethasone IM
- There is NO evidence to support giving steroids to the neonate

What are the clinical features?

- Neonates with RDS present within 4 hours of birth with signs of respiratory distress
- Severity can be evaluated using Silverman Anderson Score (Appendix)
- A neonate with RDS will get worse before they get better

- The respiratory distress gets worse over the next 24 – 36 hours due to the disappearance of the small amount of surfactant present
- At 36 – 48 hours of age the neonate starts to produce its own surfactant and symptoms may improve

What is the management of RDS?

Resus

- Stabilise using Emergency ABC approach.

Clinical features

- Features of prematurity
- Birthweight usually <1.5 kg
- Gestational age usually <34/40
- Signs of respiratory distress (severity assessed using Silverman Score)

Invest-igations

- It is hard to diffentiate RDS from sepsis or pneumonia
- The baby should be investigated for sepsis - CRP, CBC, blood culture
- Where expertise and equipment are available consider the use of bedside lung ultrasound to differentiate RDS from other causes

Treatment

- Give oxygen by nasal cannula if signs of mild respiratory distress (Silvermann RDS score is ≤3) and SpO_2 < 90% or if unable to measure SpO_2
- If signs of severe respiratory distress (Silvermann score 4-6) are present or SpO_2 < 90% even with oxygen therapy, start bubble CPAP if available as soon as possible
- If signs of severe respiratory (Silvermann score ≥7) start bubble CPAP Such as VAYU if available as soon as possible and consider safe referal to a level 3 neonatal unit if no improvement
- Use the lowest amount of oxygen needed to keep the oxygen saturation 90-94%
- A side effect of too much oxygen (SpO_2 >95%) is retinopathy of prematurity (ROP) which can cause blindness
- Start first line antibiotics. These can be stopped if CRP is normal.
- If severe respiratory distress keep nil per os (NPO) and start IV maintenance fluids only
- If baby is stable and only minimal distress start IV fluids PLUS small NGT feeds e.g.EBM 25ml/kg/day in 2 hourly feeds. This can be increased gradually over subsequent days.

Monitor

- Pneumothorax
- Chronic lung disease
- Preterm neonates will need longterm neurodevlopmental follow-ups

2.1.1.16.4 Meconium Aspiration Syndrome

What is it?

If the foetus becomes hypoxic before delivery the anal muscles can relax and the neonate will pass meconium. If the hypoxia continues, the fetus then starts to gasp and it may breathe in the meconium. The meconium causes lung damage by blocking part of the airways and by causing chemical damage. Pulmonary hypertension can also occur causing hypoxia secondary to a right-to-left shunt. It is estimated that about 15% of neonates have meconium-stained liquor at birth. Meconium Aspiration Syndrome (MAS) occurs in about 5% of these neonates.

What are the risk factors?

- Term or post term baby
- Foetal distress
- Meconium seen before or during delivery
- Obstructed labour

What is the management?

Resus

- Stabilise using the emergency ABC approach
- Latest evidence is to commence resuscitation immediately, **evidence does not support the need to suction** before begining ventilation. However, you can position the baby on the left lateral position to prevent aspiration
- Suction is only required if large amounts of meconium are obstructing the airway and preventing adequate ventilation

Clinical features

- Term or post-term baby
- History of meconium stained liquor before or during delivery
- Severe respiratory distress
- Increased Antero-posterior (AP) diameter of the chest
- Meconium staining of the Neonate including nails, umbilical cord and skin

Invest-igations

- Check blood glucose and if low/unable to check treat with 2.5ml/kg 10% dextrose IV
- CRP
- CBC
- Where expertise and equipment are available consider the use of bedside lung ultrasound to differentiate meconium aspiration syndrome from other causes

Treatment

- Admit, these Neonates can get much worse before they get better
- Aim for oxygen saturarions >98%
- If signs of moderate respiratory distress (Silvermann score 4-6) are present or SpO_2 < 90% even with oxygen therapy, start bubble CPAP if available
- If signs of severe respiratory distress (Silvermann score ≥7) start bubble CPAP if available and consider safe referal to a level 3 neonatal unit if no improvement
- If signs of severe respiratory distress (Silvermann score ≥7) and expertise and equipment are available, consider administration of surfactant
- Start first line antibiotics
- If there moderate/severe respiratory distress keep NPO, insert an NGT for aspiration and start IV maintenance fluids only (Section 3.6)
- If there is only mild respiratory distress start IV fluids and small NGT feeds e.g. 20-30ml/kg/day 2-3 hourly feeds. This can be increased gradually over subsequent days.
- Sildenafil must only be used after confirming diagnosis of pulmonary hypertension (using 10% diference of oxygyen circulation between the right Arm and left arm/left leg) and used where inotropes are avaiable. (should be used at level III neonatal units)

Monitor

- Pneumothorax
- Persistent Pulmonary Hypertension
- Chronic Lung Disease

2.1.1.16.5 Transient Tachypnoea of the New born(TTN)

What is it?

In foetal life the lungs are filled with liquid - this is essential for normal lung development. During labour and delivery, the concentration of adrenaline increases in the neonate this stops fluid in the lung being produced and starts absorption of the fluid. Some fluid is squeezed out of the lungs during delivery. If the liquid absorption is delayed, then the neonate can get "wet lungs" or TTN

What are the risk factors?

- Caesarean section especially elective operations
- Male
- Family history of asthma

What are the clinical features?

- Neonates have fast RR 100 – 120 breaths per minute
- They may have mild respiratory distress but NEVER have moderate or severe respiratory distress
- They may have overinflated chest clinically
- Occasionally these neonates also have peripheral oedema
- Usually resolves within 24 hours

What is the management?

- TTN is self-limitingand should get better on its own but the neonate might need oxygen
- In practice it may be difficult to differentiate clinically from other causes of respiratory distress so investigation and treatment for sepsis is normallyneeded
- Admission and close monitoring should be undertaken until other causes have been ruled out

2.1.1.16.6 Neonatal Pneumonia

What is it?

Infection of the lungs in a neonate. It may be part of a generalized sepsis syndrome

What are the risk factors?

- Any gestational age
- History of chorioamnionitis
- BBA
- History of prolonged rupture of membranes (PROM) >18 hours

What are the clinical features?

- Respiratory Distress
- Features of Sepsis (Refer to section on sepsis)

What is the management of neonatal pneumonia?

Resus

- Stabilise using ABC approach (Section 1.3)
- If oxygen saturations <90% give oxygen immediately

Clinical features

- Fever
- Respiratory distress
- Other signs of sepsis may be present

Invest-igations

- Blood glucose
- CRP
- CBC
- CXR if available

Blood culture if febrile

Treatment

- Grade the severity using the Silverman score to the determine the level of respiratory support
- If unable to measure oxygen saturations and signs of respiratory distress give oxygen
- If signs of severe respiratory distress present or SpO_2 < 90% even with oxygen therapy, start CPAP if available
- If there is severe respiratory distress keep nil per os (NPO) and give IV maintenance fluids (Section 3.6)
- If baby is stable and only minimal distress start IV fluids AND small NGT feeds as appropriate for weight/gestation
- Start 1st line antibiotics i.e. ampicillin AND gentamicin for 7-10 days
- If the neonate is not improving clinically after 48 hours or still has fever/hypothermia after 48 hours consider changing to second line antibiotics

Summary of Respiratory Disorders in the neonatal period

Features	Possible Diagnosis	Specific Treatment
Preterm; Gestational age < 37 weeks CXR: Small lung volumes, granular opacities in the periphery	Respiratory Distress Syndrome	• Start CPAP • Give antibiotics • Then review CRP, if normal stop the antibiotics
Born at or before term, often by Caesarean section • Mild respiratory distress resolves in 72 hours • Over Inflated chest clinically • +/-CXR- areas of collapse and consolidation	Transient tachypnea of the newborn	• Give oxygen • Maintain normal temperature and glucose • Give Antibiotics for 48 hours • Review CRP at 48 hours, if normal stop antibiotics
• Any gestational age • History of PROM or Chorioamnionitis or Born Before Arrival (BBA) • Develops Respiratory distress after birth • +/-CXR -	Pneumonia	• Oxygen and supportive treatment • CRP / Blood culture • Antibiotics
• Term or post term • History of meconium stained liquor • +/- CXR Hyper-inflated, areas of consolidation	Meconium aspiration	• Oxygen – CPAP • Maintain normal temperature and Glucose • Antibiotics • May need referral for ventilation if not coping on CPAP

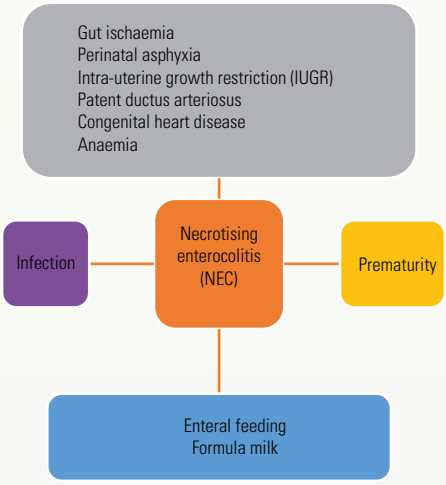
2.1.1.17 Gastrointestinal Problems

2.1.1.17.1 Necrotising Enterocolitis (NEC)

What is it?

A condition where part of a baby's bowel undergoes necrosis mainly in preterm Neonates. The cause is often unknown but can sometimes be linked to sepsis or using formula milk.

What are the risk factors?



What are the clinical features?

- Usually presents in 2nd or 3rd week of life in a preterm
- Presents in first few days in term Neonates
- Temperature instability
- Apnoea

- Lethargy
- Poor feeding or not tolerating feeds or increased reflux
- Bilious aspirates
- Vomiting
- Abdominal distension
- Absent bowel sounds
- Blood in stool

Staging of NEC (After Bell et al.)

Stage I: suspected

- Signs – as above
- When available an abdominal x-ray shows distension, mild ileus

Stage II: confirmed

- Signs – as stage I, plus abdominal discoloration
- When available an abdominal x-ray shows significant distention, bowel wall oedema, pneumotosis intestinalis and portal vein gas

Stage III: advanced

- Signs – as stage II plus deterioration of vital signs, hypotension and shock, marked GI haemorrhage
- When available an abdominal x-ray shows pneumoperitoneum

How is it managed?

Resus

- These neonates can be very sick
- Stabilise first using Emergency ABC approach

Clinical features

- Clinical diagnosis in most cases, especially when abdominal x-ray is not available
- Can present with any combination of the clinical features listed above including bilious aspirate and/or vomiting, abdominal distension, blood in the stool, signs of sepsis

Investi-gation

- Blood glucose, if <2.5mmol/L give dextrose 10% (D10) bolus
- CBC - monitor platelets and haemoglobin
- Clotting profile if available
- CRP
- Blood culture if available
- Abdominal x-ray if stable enough and available

Treatment Stage I

- Nil per os (NPO)
- Commence IV maintenance fluid
- Insert nasogastric tube (NGT)
- Aspirate NGT 2 hourly and note the colour and amount of aspirate
- If vomiting or abdominal distension leave NGT on free drainage with empty syringe attached
- Start second-line antibiotics
- After 48 hours if signs of NEC have resolved treatment can be stopped. If signs persist or signs have escalated continue treatment

Treatment Stage II and III

- These neonates may require ventilatory support with CPAP or mechanical ventilation (Level 3)
- Nil per os (NPO)
- Commence IV maintenance fluid . Where Total Parenteral Nutrition is not available, consider supplementation with amino scids.
- Fluid boluses and inotropic support (level 3) may be required
- Insert nasogastric tube (NGT)
- Aspirate NGT 2 hourly and note the colour and amount of aspirate
- If vomiting or abdominal distension leave NGT on free drainage with empty syringe attached
- Start second-line antibiotics for 7-14 days
- Consider using meropenem if already on second-line antibiotics
- After 48 hours if signs resolved treatment can be stopped. If signs have continued or escalated continue treatment
- After 5 days if signs of NEC have resolved, feeds can gradually be re-introduced starting at 25ml/kg/day
- Consider blood transfusion, platelet transfusion and FFP as indicated
- Consider referral to higher level facility if need for ventilation or inotropic support

2.1.1.17.2 Gastroschisis

What is it?

Gastroschisis (Figure 11) is a congenital defect of the abdominal wall resulting in intestinal herniation from the abdominal cavity. In contrast to omphalocele, there is no sac covering the intestines in gastroschisis.

It occurs in 1 in 4000 live births and the incidence is increasing worldwide.

It can be diagnosed antenatally on an anomaly scan at 20 weeks.

Figure 11: Gastroschisis

What are the risk factors?

- maternal age <20 years
- male sex of neonate
- smoking

What are the clinical features?

- Paraumbilical full thickness abdominal wall defect associated with protrusion of the bowel through the defect.
- Rarely associated with syndromes
- A membrane does NOT cover the exposed bowel

- Gut may be matted, dilated and covered in fibrinous inflammatory tissue
- Can be associated with intestinal stenosis and atresia
- Associated with intrauterine growth restriction

How Is it managed?

If antenatal diagnosis is made, a trial of vaginal delivery is supported. Immediately after the neonate is delivered the following management should begin as soon as possible.

In many cases, the diagnosis is made postnatally.

Ventilation

- Maintain airway
- Check oxygen saturations
- If saturations are <90% on air, give free flow O_2 via nasal prongs

Fluids

- Check blood glucose and give D10 bolus 2.5ml/kg IV if hypoglycaemic
- If tachycardic (HR>180) give Normal Saline (NS) bolus 10ml/kg IV
- Give maintenance fluids as per fluid protocol. This should be **MULTIPLY BY TWO until silo is placed** e.g. Day 1 120ml/kg/day, and Day 2 150ml/kg/day

Feeds

- Keep neonate NPO
- Pass an NGT and aspirate. Note and record the colour of aspirate in the file
- Ask mother to keep aspirating every 1-2 hours. Note and record in the file any stool that is passed

Antibiotics

- Give first line antibiotics

MANAGEMENT OF GUT

- Put on sterile gloves
- Wash gut carefully with Normal Saline (NS)
- Place the gut in the **MIDLINE** on top of neonate's abdomen to limit ischaemic damage
- Wrap with a clean catheter bag or use clean Food Wrap all the way around from front to back, like a belt, or cover the gut with an opened catheter bag and secure with strapping.
- Refer Neonate to a level III neonatal unit with the ability to do Paediatric Surgery

Other

- Keep the baby warm

2.1.1.17.3 Exomphalos (omphalocele)

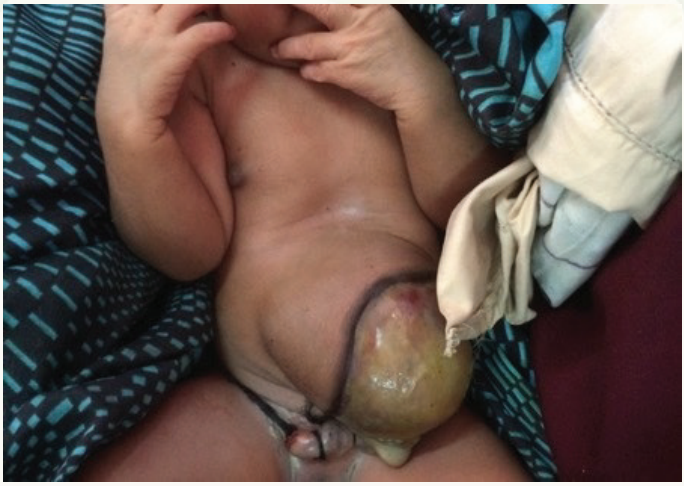
What is it?

Exomphalos (Omphalocele) Figure 12 is a congenital defect of the abdominal wall resulting in intestinal herniation from the abdominal cavity. In contrast to gastroschisis, there is peritoneum covering the intestines.

It can be an isolated finding but is more frequently associated with other anomalies and syndromes such as Beckwith-Wiedemann syndrome, trisomy 13, 18, 21. In occurs in approximately 1 in 5000 live births.

The survival rate is close to 80% and it is directly related to the severity of the associated anomalies.

Figure 12: Exomphalos (omphalocele)



What are the risk factors?

- maternal age <20 years
- male sex of neonate
- smoking
- alcohol
- obesity

What are the clinical features?

- Paraumbilical full thickness abdominal wall defect associated with protrusion of the bowel through the defect.
- Gut is covered with a membrane.
- The omphalocele can be small with only a few loops of intestines in the defect, or large containing several abdominal organs, or giant when the defect is ≥5cm
- Associated with other syndromes

What is the management?

Ventilation

- Maintain airway
- Check oxygen saturations
- If saturations are <90% on air, give free flow O_2 via nasal prongs

Fluids

- Check blood glucose and give D10 bolus 2.5ml/kg IV if hypoglycaemic
- If tachycardic (HR>180) give Normal Saline (NS) bolus 10ml/kg IV
- Give maintenance fluids as per fluid protocol.

Feeds

- Pass an NGT and aspirate. Note and record the colour of aspirate in the file
- Ask mother to keep aspirating every 1-2 hours
- Note and record in the file any stool that is passed
- If there is no aspirate and the Neonate is passing stool you may allow them to breastfeed, if there are signs of intestinal obstruction keep Neonate NPO

Antibiotics

- Give first line antibiotics

Management Of Gut

- If available initiate sclerosing therapy with zinc oxide or gentian violet and surgical spirit
- Once baby is stabilised refer Neonate to a facility with the ability to do Paediatric Surgery

Other

- Keep the baby warm

2.1.1.17.4 Oesophageal atresiaand trachea-oesophageal fistula

What is it?

Oesophageal atresia is a congenital abnormality where the oesophagus ends in a blind upper pouch. It can occur in isolation or there may be one or more fistulae between the abnormal oesophagus and the trachea (tracheo-oesophageal fistula).

Neonates born with OA/TOF need to have intensive neonatal care prior to corrective surgery, normally within days of birth.

What are the clinical features?

Antenatal diagnosis: There may be maternal polyhydramnios and a small/absent stomach bubble may indicate oesophageal atresia, the condition is rarely definitively diagnosed before delivery.

Postnatal presentation includes:

- respiratory symptoms
- frothing at mouth
- dribbling of saliva,
- coughing/choking during feeds
- inability to pass a nasogastric tube (NGT) into the stomach.

What is the management?

Resus

- These neonates can be very sick
- Stabilise first using Emergency ABC approach

Clinical features

- Respiratory distress
- Frothing at mouth
- Excessive saliva
- Coughing/choking during breastfeeding
- Inability to pass a nasogastric tube (NGT) into the stomach.

Investi-gation

- Chest and abdominal x-ray. Insert a nasogastric tube prior to X-ray.
- Observe the position of the end of the NGT on x-ray
- Also observe for the gastric bubble and other intestinal atresias (N.B. duodenal atresia and imperforate anus) may lead to distension which will be highlighted on x-ray, and may mandate more urgent surgical intervention.

Treatment

Ventilation

- Clear oral secretions using penguin suction device
- nurse Neonate tilted head up at all times.
- Avoid mask ventilation if at all possible
- If mask ventilation is required, apply minimal pressures
- Use free-flow oxygen to maintain oxygen saturations >90%
- Use CPAP is signs of respiratory distress

Feeding

- Keep nil per os (NPO) and aspirate 1-2 hourly
- Initiate maintenance intravenous fluids

Referral

- If the X-ray confirms the diagnosis of oesophageal atresia, refer to a facilty where paediatric surgery is available

2.1.1.17.5 Pyloric stenosis

What is it?

In pyloric stenosis, hypertrophy of the pyloric sphincter results in narrowing of the pyloric canal. It is the most common cause of gastric outlet obstruction in the 2- to 12-week-old age group, and leads to progressive and projectile milk vomiting.

Pyloric stenosis may also be referred to as hypertrophic pyloric stenosis (HPS).

What are the clinical features?

- Pyloric Stenosis usually presents between 2 and 6 weeks of chronological age
- Vomiting:
  - Recurrent and progressively more forceful. May be projectile
  - Soon after feeding
  - Non - bilious (milk)
  - Blood stained in up to 10% of cases
  - Often Neonate is hungry afterwards
- Weight loss or inadequate weight gain
- Dehydration
- Visible gastric peristalsis (may be more obvious following a feed)
- Pyloric mass
  - Located in the right upper quadrant at the lateral edge of the rectus abdominis muscle
  - May be difficult to palpate. May require repeated examinations or to wait for several minutes with hand on abdomen to feel

What are the risk factors?

- Male
- Firstborn
- Parental history of pyloric stenosis (especially if mother affected)

How Is it managed?

Resus

- These neonates can be very sick
- Stabilise first using Emergency ABC approach

Clinical features

- Projectile milk (non-bilious) vomit.
- Weight loss
- Dehydration
- Pyloric mass

Investi-gation

- Random blood sugar to check for hypoglycaemia
- Abdominal ultrasound to confirm (95% sensitive in the diagnosis of HPS)
- Check electrolytes if available

Treatment

Feeding

- Keep nil per os (NPO)
- Pass NGT and aspirate 1-2 hourly

Fluids

- Give fluid bolus if shock or severe dehydration (10ml/kg normal saline)
- Initiate maintenance intravenous fluids

Referral

- If the abodminal USS confirms the diagnosis of HPS, refer to hospital with paediatric surgical capacity once Neonate is stablised

2.1.1.17.6 Hirschsprung's disease

What is it?

A congenital condition characterized by partial or complete colonic functional obstruction associated with the absence of ganglion cells. Because of the aganglionosis, the lumen is contracted, causing a functional obstruction. The aganglionic portion of the colon is always located distally, but the length of the segment varies.

What are the clinical features?

Majority of patients present in the neonate period up to 1 year of age.
Vomiting
Intermittent explosive passage of liquid and foul stools
Intermittent abdominal distension
History of delayed passage of meconium at birth

What are the risk factors?

Downs syndrome
Male sex

How is it managed?

Resus

- Stabilise first using Emergency ABC approach

Clinical features

- Vomiting, usually faeculent
- Intermittent explosive passage of liquid and foul stools
- Abdominal distension associated with constipation
- History of delayed passage of meconium at birth

Investi-gation

- If available perform abdominal x-ray, which may show dilated large bowel
- Likely a barium enema will be required at the paediatric surgical hospital to confirm diagnosis.

Treatment

Feeding

- Keep nil per os (NPO) if acute signs of intestinal obstruction
- Pass NGT and aspirate 1-2 hourly

Fluids

- Give fluid bolus if shock or severe dehydration (10ml/kg normal saline)
- Initiate maintenance intravenous fluids

Referral

- If clinical suspicion of hirschsprungs and/or the abdominal x-ray suggests hirschsprungs, refer to a hospital with paediatric surgical capacity once Neonate is stablised

2.1.1.17.7 Intestinal atresia

What is it?

There are various atresia that affect neoantes including duodenal, ileal and anal atresia.

What are the clinical features?

Depending on the level of atresia the following may be seen:
Vomiting bile or faeces
Abdominal distension
Constipation or failure to pass stool

How is it managed?

Resus

- Stabilise first using Emergency ABC approach

Clinical features

- Vomiting, usually bilious, may be faeculent in anal atresia
- Abdominal distension in lower atresias
- Failure to pass stool

Investi-gation

- If available perform abdominal x-ray, which may loops of dilated bowel
- Likely a barium enema will be required at the paediatric surgical hospital to confirm diagnosis.

Treatment

- **Feeding**
  - Keep nil per os (NPO) if acute signs of intestinal obstruction
  - Pass NGT and aspirate 1-2 hourly

Fluids

- Give fluid bolus if shock or severe dehydration (10ml/kg normal saline)
  - Initiate maintenance intravenous fluids

Referral

- If clinical suspicion and/or the abdominal x-ray suggests intestinal obstruction, refer to a hospital with paediatric surgical capacity once Neonate is stablised

2.1.1.18 Neurological Problems

2.1.1.18.1 Neonatal encephalopathy (NE)

What is it?

Neonatal encephalopathy is abnormal neurological function in a neonate

What are the clinical features of neonatal encephalopathy?

These neonates may have required resuscitation at birth and continue to have difficulty with respiration, poor sucking, abnormal tone and reflexes, reduced consciousness and seizures.

What is the commonest cause of neonatal encephalopathy?

- Hypoxic-ischaemic encephalopathy.

What are the other causes of neonatal encephalopathy?

- Sepsis and meningitis
- Maternal anaesthesia (especially general anaesthesia) or pain relief
- Hyperbilirubinaemia
- Hypoglycaemia
- Congenital brain malformations
- Neonatal stroke
- Intracranial haemorrhage
- Metabolic disease and electrolyte imbalances
- Drug withdrawal

Note that in neonates who were normal at birth, and develop abnormal neurological signs after 3 days, tetanus should be considered.

2.1.1.18.2 Neonatal seizure

What is it?

A seizure is caused by abnormally excessive activity of a group of nerve cells in the brain. Neonatal seizures, also known as "fitting" or "convulsions", are the most common neurologic condition to occur in neonates. Neonatal seizures can be mild or severe and are sometimes difficult to detect in Neonates. Neonatal seizure activity is often a symptom of a brain injury and is one of the strongest risk factors for negative outcomes in neonatal care. Neonatal seizures should therefore receive immediate care.

How does a neonatal seizure present?

Symptoms of neonatal seizures may look like normal movements and behaviours seen in healthy neonates. Therefore, it can be difficult to tell the difference between seizures and normal movements. Neonates can be awake or unconscious during a seizure

- Subtle signs
- Eyes:Staring, eyes moving from one side to the other, eyes rolling up, blinking or rapid movement of the eyelids
- Mouth: Chewing or sucking motion, lip smacking (noisy parting of lips)
- Limbs: Pedalling/cycling of arms and/or legs
- Twitching of any part of the body (e.g.a hand), one side of the body, or the whole body
- Sudden, abnormal crying followed by abnormal movements
- Sudden change in vital signs e.g respiratory rate and pattern, SpO2, tachycardia or bradycardia
- Focal: tonic or clonic May involve one limb or one side of the body jerking rhythmically
- Cycling motion swimming, or circling motion of arms or legs,
- Arms, legs or body remain stiff for a period of time.

- The head may be turned to one side or the other.
- Generalized: whole body involvement with multifocal rhythmic jerking, generalized posturing or myoclonic.
- Status epilepticus: continuous seizures lasting 30 minutes or recurrent seizures with no recovery in between.

What are the causes of neonatal seizures? They are similar to those that cause neonatal encephalopathy (See above)

Table 10 below provides additional guidance on the aetiology of seizures depending on the clinical presentation.

Table 10: Aetiology of neonatal seizures

Cause	Time of onset		Relative Frequency	
	< 3 days	≥ 3 days	Preterm	Term
Hypoxic Ischaemic Encephalopathy (HIE)	+		++	+++
Intracranial Haemorrhage	+	+	++	+
Intracranial Infection	+	+	++	++
Developmental Defects	+	+	++	++
Hypoglycaemia	+		+	+
Hypocalcaemia	+	+	+	+
Other metabolic	+	+		
Epileptic Syndromes	+	+		+

Initial Investigations for neonatal seizures

- Metabolic: Blood Glucose
- If infection suspected: CRP, Complete Blood Count, Blood culture, and Lumbar puncture for CSF analysis

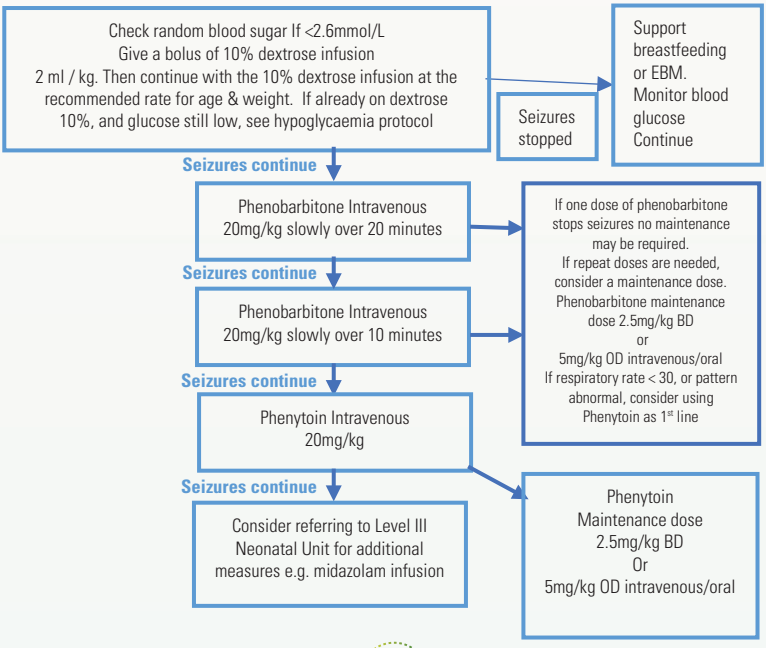
Additional investigations for neonatal seizures when available

- Metabolic: Serum sodium, potassium, magnesium, Calcium, Urea and Creatinine
- Imaging: Cranial ultrasound scan, EEG

Management of neonatal seizures

Acute seizures should be controlled as soon as possible as shown in Figure 14

Figure 14: Flow chart showing the management of neonatal seizures



Phenobarbitone

- Phenobarbitone loading dose: 20 mg/kg IV slow push (over 20 minutes).
- If possible, use a syringe driver. If unavailable, put the phenobarbitone in 20ml of Normal saline and give with a burette at 1ml/minute
- Subsequent Doses: May repeat 20 mg/kg every after 20- 30 minutes if seizures continue up to a total **maximum dose of 40mg/kg/day**
- If seizures re-occur after the first dose of phenobarbitone, then start a maintenance dose 24 hour after the first loading dose of phenobarbitone
- Maintenance dose of phenobarbitone is 2.5mg/kg BD or 5mg/kg/day IV/PO

Phenytoin

- Phenytoin can be used as second additional agent on top of phenobarbitone if seizures persist after the loading dose of phenobarbitone:
- Loading dose: 20mg/kg/dose IV over 30 minutes
- If administering phenytoin, IV tubing containing glucose must be flushed with normal saline before and after to prevent precipitation and loss of IV access
- Initiate maintenance phenytoin 5 mg/kg OD or 2.5mg/kg BD IV/PO

Discontinuation of anticonvulsants

After 48 hours without seizures in a baby on a maintenance dose of anticonvulsants try discontinuation of therapy to determine whether the neonate will require longer term, outpatient anticonvulsant therapy. Always discontinue the second anticonvulsant first (if the neonate is on more than one anticonvulsant) and monitor for 48 hours. If seizures re-occur, re bolus with the loading dose and then re-start the maintenance dose. If no seizures, stop the phenobarbitone and monitor for another 48 hours.

Anticonvulsants can cause apnoea, always give slowly and monitor closely when administering. If respiratory rate becomes <20 breaths per minute stop immediately.

2.1.1.18.3 Hypoxic Ischaemic Encephalopathy (HIE)

What is HIE?

Hypoxic Ischaemic Encephalopathy (HIE) is abnormal neurological function in a neonate less than 3 days old, following a significant hypoxic event immediately before or during labour and delivery. The brain has a high oxygen requirement, and is therefore particularly susceptible to hypoxia and ischaemia. However, all organs can be affected particularly kidneys, heart, lungs and gastrointestinal tract. It is a common neonatal problem and contributes significantly to neonatal morbidity and mortality. Perinatal asphyxia is the commonest cause of HIE.

What is perinatal asphyxia?

It is an insult to the foetus or neonate due to lack of oxygen (hypoxia) and or lack of perfusion at birth or delivery. Perinatal asphyxia may be suggested in the presence of the following:

- Foetal bradycardia
- Meconium-stained liquor
- Prolonged second stage
- Need for resuscitation at birth
- 5-minute APGAR score of less than 7

What are the risk factors for perinatal asphyxia?

- Poor placental perfusion e.g. maternal hypertension or hypotension
- Impaired gas exchange across the placenta e.g. prolonged contractions, placental abruption, uterine rupture
- Impaired umbilical cord flow e.g. cord prolapse, shoulder dystocia,
- Increased oxygen requirements for the foetus e.g. anaemia, infection,

- Intrauterine growth retardation (IUGR)
- Macrosomia (Birth weight >4kg)

How to identify neonates with possible Hypoxic Ischaemic Encephalopathy

If a baby is less than 3 days old and cannot suckle, and has a history of perinatal asphyxia, failure to cry/breathe at birth or an APGAR score of less than 7 at 5 minutes consider treating for HIE.

What are the clinical features of HIE?

Those neonates who required resuscitation at birth and continue to have difficulty with respiration, poor sucking, abnormal tone and reflexes, reduced consciousness and seizures.

HIE can be classified broadly as mild, moderate or severe. The key clinical signs and the associated outcomes for this classification are outlined in Table 11 below.

Table 11: Classification of Hypoxic-Ischemic Encephalopathy

Classification	Clinical Signs	Course
Mild	• Jittery, Hyper-alert • Increased muscle tone • Poor feeding • Normal or fast breathing	Features usually last for 24 h – 48 hours and then resolve spontaneously
Moderate	• As above, plus • Lethargy • Feeding difficulty • Occasional Apnoeas /Convulsions	It resolves within one week, but long-term neuro- developmental problems are possible

Severe	• As above plus • Floppy/ Unconscious • Unable to feed • Convulsions common • Severe apnoea	The baby may or may not improve over several weeks. If neonates survive permanent brain damage may occur (cerebral palsy or mental impairment)

How is HIE managed?

Initiate adequate resuscitation within one minute of birth, the "Golden Minute". Infants who have required resuscitation may later deteriorate. Post resuscitation care should be in an environment in which close monitoring can be provided as described in Table 12.

Table 12: Management of Mild, Moderate and Severe HIE

	MILD HIE I	MODERATE AND SEVERE HIE II and III
Ventilation	• Monitor breathing and oxygen saturations	• Consider using an oropharyngeal airway (Guedel) to support airway • Maintain oxygen saturations >90% using free-flow oxygen • If moderate/severe respiratory distress consider using CPAP if available
Feeds and Fluids	• Allow them to breast feed if not on CPAP and able to suckle • If the baby is unable to suck, give the feeds by nasogastric tube	• Gain IV access • Give bolus of normal saline (10ml/kg) if evidence of shock • Keep nil per os for 12-24 hours • Restrict the fluid intake to 40ml/ kg/day for 72 hours • Monitor the urine output: If the baby passes urine < 6 times per day or produces no urine, do not increase the fluid volume on the next day, when the amount of urine begins to increase, increase the volume of fluid intake gradually, regardless of the

	MILD HIE I	MODERATE AND SEVERE HIE II and III
		baby's age – i.e., progress from 60 ml/kg to 80 ml/kg to 100 ml/kg to 120 ml/kg. • Only start to give breastmilk if the NGT aspirates are clear. Introduce feeds slowly, and increase by 12- 24 ml/kg per day on the second and third day and subsequently faster according to clinical state. • When the baby is able to suck and swallow safely , start breastfeeding • If baby able to swallow but not suck consider cup/spoon feeds with EBM
Glucose	• Check blood glucose and treat if low or unable to check give D10 2.5ml.kg intravenously	• Check blood glucose • If low or unable to check give D10 2.5ml.kg intravenously • If possible the blood glucose should be checked every 12 hours for 3 days
Seizures	• Monitor for seizures, if occur, manage as Moderate/severe HIE • There is currently NO role for prophylactic phenobarbitone	• Monitor for seizures, if any give Phenobarbitone • If they continue, load with phenytoin • There is currently NO role for prophylactic phenobarbitone
Temperature	• Maintain normal temperature • Therapeutic hypothermia should only be considered if level 3 care and a neonatologist are available.	

	MILD HIE I	MODERATE AND SEVERE HIE II and III
Management of sepsis	• Prophylactic antibiotics are recommended because of the increased risk of infection (Ampicillin and Gentamycin) • Discontinue antibiotics after 48 hours if sepsis unlikely • Consider LP if the history or investigations suggest sepsis	
Family Centered Care	• Encourage the mother and father to hold their baby • Explain the clinical condition and prognosis • Document the parent's version of events. • Explain the management needed and encourage family involvement. • Prepare them for a potential poor outcome if investigations and signs are suggestive.	

2.1.1.18.3.1 Spina bifida

What is it?

Spina bifida is one of the most common congenital anomalies and is a cause of chronic disability. . In spina bifida, the neural tube doesn't close completely and some of the bones of the spine do not close in the back. This can result in an opening anywhere along the spine and may cause damage to the spinal cord and nerves. There are four types of spina bifida: occulta, closed neural tube defects, meningocele, and myelomeningocele

How is it managed?

- Ensure that the neonate is stable and the mother is able to travel with her baby before referring to a paediatric surgical centre
- Ideally refer within 24 - 48 hours if the mother and neonate are stable
- Initiate antibiotics Cefotaxime and Ampicillin (High dose) Or Ceftriaxone

- Ensure the defect is kept clean with daily cleaning with sterile gauze and normal saline.
- Dress the site with sterile gauze made damp with normal saline.
- Evaluate the neonate's ability to suck and swallow and support feeding with expressed milk using a spoon or nasogastric tube as necessary.

2.1.1.18.3.2 Congenital Hydrocephalus

What is it?

Congenital hydrocephalus is one of the commonest congenital anomalies of the central nervous system. It is characterized by extensive accumulation of cerebrospinal fluid within the ventricles of the brain due to an imbalance between synthesis and absorption of cerebrospinal fluid.

How is it managed?

- Ensure that the neonate and the mother are stable and able to travel before referring to a paediatric surgical centre.
- Evaluate the neonate's ability to suck and swallow and support feeding with expressed milk using a spoon or nasogastric tube as necessary.
- Ideally refer within 24 - 48 hours if the mother and neonate are stable
- If evidence of sepsis or meningitis initiate antibiotics
- Cefotaxime and Ampicillin (High dose) Or Ceftriaxone
- For neonates with overt hydrocephalus monitor for signs of raised intracranial pressure (e.g vomiting, high pitched cry, respiratory depression). If occur, refer urgently.

2.1.1.19 Neonatal Jaundice

What is it?

Jaundice is the yellow discolouration of the skin, which develops when the neonate has too much bilirubin. When red cells die, their haemoglobin is changed into a yellow pigment called unconjugated bilirubin.

Unconjugated bilirubin is **NOT** water-soluble and cannot pass out of the body in the urine. First it must travel to the liver to be conjugated. Once it is conjugated, the bilirubin becomes water-soluble and is secreted into the bile and then into the intestine.

Why do we worry about jaundice?

Unconjugated bilirubin can cross the blood-brain barrier. Severe unconjugated bilirubinaemia may progress and cause acute bilirubin encephalopathy (ABE), if not treated this can progress to chronic bilirubin encephalopathy (CBE) and kernicterus. Timely and appropriate treatment with phototherapy and/or exchange transfusion are effective in treating excessive unconjugated bilirubin levels in the affected neonates.

Severe unconjugated bilirubinaemia is a significant risk factor for mortality in neonates. Survivors may develop CBE and acquire long term sequelae such as cerebral palsy, sensorineural hearing loss and neurodevelopmental impairment.

When is jaundice an emergency?

- Any jaundice that starts in the first 24 hours of life
- Severe Jaundice (using bilirubin level graphs or jaundice involving palms and soles)
- Any jaundice associated with pale stool and dark urine (obstructive jaundice)

- Prolonged jaundice (after 14 days in term baby, or 21 days in preterm)

What are the types of Jaundice?

Jaundice can be physiological or pathological as described in Table 13.

Table 13: Features of physiological and pathological jaundice

Physiological Jaundice	Pathological jaundice
Physiological jaundice is common. It usually starts on day 3 and normally resolves by day 14 Total serum bilirubin (TSB) rises by < 85 umol/l per day Maximum intensity by 4^{th}-5^{th} day in term and 7^{th} day in preterms Be otherwise well Treatment is rarely needed in term babies	Appears within 24 hours of age Increase of bilirubin >85 umol/l per day Serum bilirubin above the phototherapy treatment line Prolonged jaundice after 14 days Pale coloured stools Direct bilirubin >20% of TSB or >34 umol/l Preterm <1.5Kg with any signs of jaundice

What are the risk factors for jaundice?

There are many risk factors for jaundice, as described in the table below, and it is important to treat BOTH the jaundice and the underlying cause.

Table 14:Risk factors for developing jaundice

	Increased breakdown of red blood cells	Difficulty conjugating in the liver	Blockage of bile from the liver
Caused by	Hameolytic jaundice • ABO incompatibility (Particularly if mother blood group O) • Rhesus disease (Mother negative and baby positive) Polycythaemia Birth trauma e.g cephalohaematoma Thalassemia B Red cell abnormalities e.g. spherocytosis	Physiological Preterm Hepatitis Intrauterine infection (TORCH – toxoplasmosis, rubella, cytomegalovirus, herpes simplex) Hypothyroidism Sepsis	Biliary atresia Bowel atresia Cholangitis

What is breastfeeding jaundice?

Occurs due to insufficient breast milk or poor feeding leading to reduced gut transit and increased enterohepatic circulation. There will be abnormal weight loss and the baby can be lethargic.

What is breast milk jaundice?

Breastmilk jaundice occurs in 2% of breastfed neonates. There is no significant weight loss and normal stool and urine colour and output. Occurs after 7 days and may last for several weeks. It is associated with the presence of a breastmilk inhibitor but responds to phototherapy. The neonate should continue breastfeeding.

Investigations for neonates who are jaundice

Ideally all neonates with jaundice should have a total serum bilirubin (TSB) level.

How to examine for jaundice when total serum bilirubin (TSB) is not available?

All neonates should be examined for jaundice in the first 24 hours of life.

- Check the skin of the naked baby in bright and preferably natural light.
- The sclera and/or gums may also be yellow.
- Kramer zones (Figure 15) can be used to guide you though it may not be very accurate in dark skinned neonates.
- Blanche the skin for by pressing the skin gently for 3 seconds on the 5 zones to look for jaundice
- Always check palms and feet for jaundice
- Use the table to estimate the serum bilirubin level (SBR) level

Figure 15: Clinical assessment of jaundice using Kramer zones

Area of body and Zone	Bilirubin umol/l
Face – Zone 1	100
Chest – Zone 2	150
Abdomen – Zone 3	200
Arms and lower legs – Zone 4	250
Palms and soles – Zone 5	>250

ALWAYS assess for jaundice in natural light without a yellow background. Make sure baby is naked. Blanche skin.

If Kramer zones 4 or 5, then assess for bilirubin induced neurological dysfunction using the following table:

Table15: Scoring of bilirubin induced neurological dysfunction (II)

Table S3. Bilirubin-Induced Neurological Dysfunction (BIND) II SCORING		
CLINICAL SIGN (score most severe sign)	**SCORE**	**SEVERITY**
MENTAL STATUS		
0 Normal	0	None
0 Sleepy but arousable 0 Decreased feeding	1	Mild
0 Lethargy 0 Poor suck and/or 0 Irritable/jittery with short-term strong suck	2	Moderate
0 Semi-coma 0 Apnea 0 Seizures 0 Coma	3	Severe
MUSCLE TONE		
0 Normal	0	None
0 Persistent mild hypotonia	1	Mild
0 Moderate hypotonia 0 Moderate hypertonia 0 Increasing arching of neck and trunk on stimulation without spasms of arms and legs and without trismus	2	Moderate
0 Persistent retrocolis 0 Opisthotonos 0 Crossing or scissoring of arms or legs but without spasms of arms and legs and without trismus	3	Severe
CRY PATTERN		
0 Normal	0	None
0 High-pitched	1	Mild
0 Shrill	2	Moderate
0 Inconsolable crying or 0 Cry weak or absent in child with previous history of high pitched or shrill cry	3	Severe
OCCULOMOTOR / EYE MOVEMENTS / FACIES		
0 Normal	0	None, Mild
0 Sun-setting 0 Paralysis of upward gaze 0 Disconjugate eye movements 0 Blank stare 0 Aimless eye movements	3	Severe
TOTAL BIND II (ABE SCORE)		

Notes: Scores of 1-4 are consistent with **mild ABE** but cannot be differentiated from sepsis or other neonatal illnesses without ancillary testing, such as ABR and/or MRI.
Scores 5 to 8 are consistent with **moderate ABE**
Scores ≥ 9 are consistent with **severe ABE**

The BIND score may include different stages for different categories, for example scores of 4 or 5 might represent the sum of one for cry and two for muscle tone and/or arousal state.

Adapted from:

1. Johnson L, Bhutaini VK, Karp K, Sivieri EM, Shapiro SM. (2009) Clinical report from the pilot USA Kernicterus Registry (1992 to 2004). *J Perinatol* 29; Suppl 1:S25-45.
2. Slusher T, Olusanya B. (2012) Neonatal Jaundice in Low-Middle Income Countries: In: Stevenson D, Maisels M, Watchko J, editors. Neonatal Jaundice Transient Unconjugated Hyperbilirubinemia of the Newborn. New York. McGraw Hill.

2.1.1.19.1 JAUNDICE ON DAY 1 (ALWAYS PATHOLOGICAL)

How is Jaundice on Day 1 managed?

Resus

- Stabilise using Emergency ABC approach

Clinical features

- Any level of jaundice on day 1
- Look for signs of infection, if present treat for neonatal sepsis
- Ask about symptoms of obstructive jaundice (pale stool, dark urine), if present refer to a neonatal unit with access to paediatric surgery
- Look for signs of bilirubin encephalopathy (seizures, lethargy, abnormal tone). USe the BIND score to evaluate the severity bilirubin encephalopathy
- Look for anaemia suggestive of haemolysis e.g. resus disease or ABO incompatability

Investigations

- Check blood glucose, treat if low/unable to check
- CBC, check haemoglobin (Hb) level in case of haemolysis
- Total serum bilirubin (TSB) level and direct bilirubin level if available
- Check mothers blood group
- Check baby's blood group
- Coombs' test if available
- Consider liver function tests (AlkP, AST, ALT, GGT)

Treatment

- Start phototherapy immediately
- Plot TSB on the bilirubin chart If TSB above threshold for exchange transfusion/ has features of bilirubin encephalopathy, refer to level III unit
- Check TSB every 12-24 hours if available
- When TSB is 50umol/L below the phototherapy line you can stop phototherapy
- Watch for rebound jaundice over the next 24 - 48 hours
- Consult senior if TSB keeps rising, baby may need exchange transfusion
- If conjugated hyperbilirubinaemia (Direct bilirubin >20%), pale stool or dark urine refer to a unit with paediatric surgery

2.1.1.19.2 JAUNDICE DAY 2 – DAY 14

How is Jaundice on Day 2 - 14 managed?

Resus

- Stabilise using emergency ABC approach if needed

Clinical features

- Any visible jaundice in a preterm neonate
- Jaundice Kramer zone 4 or above in term neonate
- Signs of infection
- Look for signs of bilirubin encephalopathy (seizures, lethargy, abnormal tone). Use the BIND score to evaluate the severity bilirubin encephalopathy.

Invest-igations

- If Kramer zone 4 or above or preterm:
- Check blood glucose, treat if low/unable to check
- If pathological jaundice suspected consider:
- CBC, check haemoglobin (Hb) level in case of haemolysis
- Total serum bilirubin (TSB) level and direct bilirubin level
- Liver function tests (AlkP, AST, ALT, GGT)
- Check mothers blood group
- Check baby's blood group
- Coombs' test

Treatment

- If Kramer zone 4 or above or preterm:
- Plot TSB on graph If TSB above threshold for exchange transfusion/ has features of bilirubin encephalopathy, refer to level III unit
- Start phototherapy and plot TSB on the graph if availible
- Ideally check TSB 24 hourly. If unavailible, use Kramer levels and clincal assessment
- When SBR is 50umol/l below the line (or clincally not jaundiced) you can stop phototherapy
- Watch for rebound jaundice over next 24 hours
- Refer to levle III if SBR keeps rising, baby may need exchange transfusion
- If conjugated hyperbilirubinaemia, pale stool or dark urine refer to centre with paediatric surgery

2.1.1.19.3 PROLONGED JAUNDICE

What is prolonged jaundice?

- Jaundice after 14 days in term baby
- Jaundice after 21 days in preterm baby

Management

- Full history and examination as you consider the following diagnosis:

Table 16: Investigations and management

Diagnosis	History and examination	Investigation	Management
Sepsis (particularly UTI)	See SECTION on sepsis	Urine dipstick, culture and sensitivity	See SECTION on sepsis
Hypothyroidism	Large tongue, umbilical hernia, dry skin, slow pulse	Thyroid Function Test	Refer to paediatric centre
Biliary atresia	Pale stools, dark urine, large liver	Liver function tests USS abdomen	Refer to paediatric surgeon
Congenital infections	Maternal fever IUGR, rash at birth, cataracts, large liver and spleen, lymphadenopathy, microcephaly	Syphilis, HIV and hepatitis screening on mother Cranial USS	

2.1.1.19.4 Phototherapy

- Phototherapy refers to the treatment of jaundice using a machine that produces a special blue light with a wavelength of 450-460nm.
- Phototherapy should be given 24 hours a day using a conventional phototherapy machine

- Phototherapy acts on the unconjugated bilirubin and makes it more water-soluble. This allows it to pass out of the body in the urine and prevents it from crossing the blood-brain barrier.
- Phototherapy is not suitable for conjugated hyperbilirubinemia.
- The neonate should be nursed naked under phototherapy. The baby's eyes should be covered using a suitable opaque blindfold. The baby's genitalia should be covered using a nappy or cloth.
- Sun-light exposure is not recommended for treatment of jaundice.

Ensure that the baby is placed in the centre of the light source, no more than 30cm from the light source.
Encourage breast feeds/ EBM
Minimise amount of time out of the lights e.g no KMC.
Monitor weight and ensure adequate urine output. Monitor vital signs and temperature at least 4 hourly to ensure the neonate doesn't overheat.

Ensure that the phototherapy unit is turned off during collection of blood for TSB levels, as both conjugated and unconjugated bilirubin are affected when exposed to phototherapy.

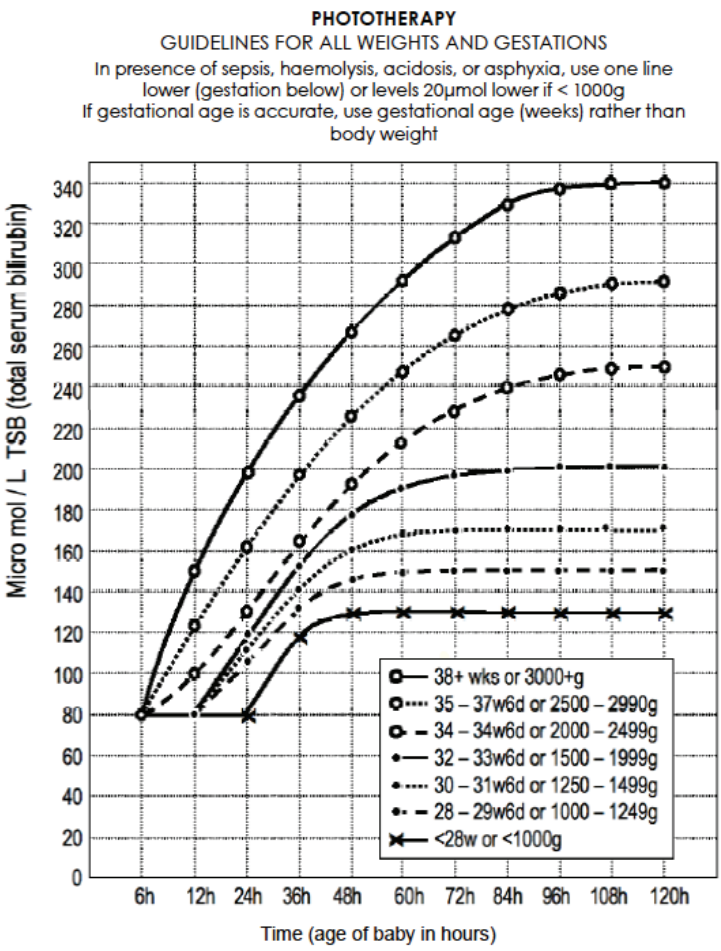
Potential Complications of phototherapy

- Overheating – monitor neonate's temperature
- Dehydration
- Diarrhoea (Can be a normal part of clearing the bilirubin)
- Rash
- Retinal damage
- 'Bronzing' of neonates with conjugated hyperbilirubinemia
- Interferes with maternal-Neonate interactions/ bonding

2.1.1.19.5 PHOTOTHERAPY THRESHOLDS

- Total Serum Bilirubin (TSB) level is the most accurate way to assess jaundice
- Remember 1mg/dl = 17 umol/L
- **If the result is in mg/dl, you must convert into umol/L before using the chart**
- Plot the TSB result on the graph for the correct gestation and age of the baby in hours
- If the level is 50umol/L below the photo-line for the neonates weight/age stop phototherapy

Total serum bilirubin levels to guide the initiation of phototherapy at different weights and gestations.



Neonates under phototherapy: Check SBR at ideally 12-24 hourly
STOP phototherapy: If SBR is >50umol/L below the line. Recheck in 12-24 hours

2.1.1.19.6 EXCHANGE BLOOD TRANSFUSION (EBT)

An exchange blood transfusion can be done at a level 3 neonatal unit to rapidly lower the total serum bilirubin (TSB) concentration when the bilirubin levels are above the exchange blood transfusion line.

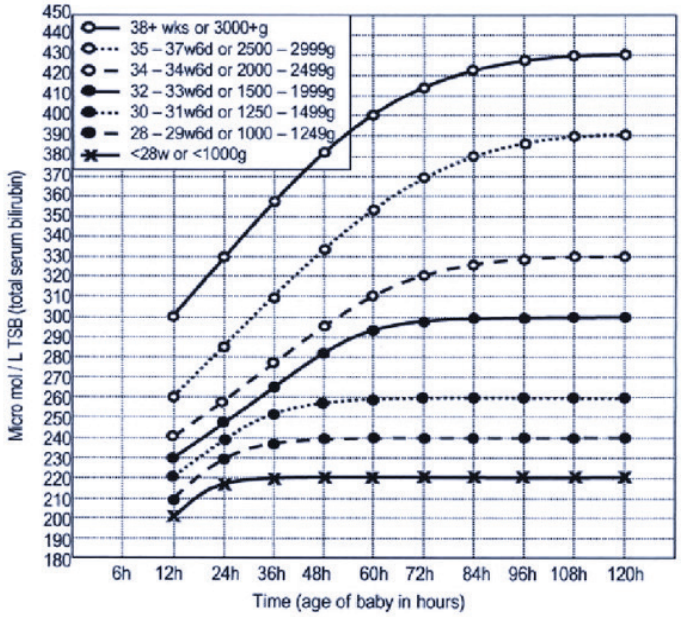
Other times to consider an exchange blood transfusion are:

- Clinical signs of Acute Bilirubin Encephalopathy (ABE) or Bilirubin Induced Neurological Dysfunction (BIND)
- Rapidly rising bilirubin levels of more than 5mg/dl/day or 85 micromol/L/day
- Severe haemolysis causing significant anaemia Management
- If an exchange blood transfusion is indicated, refer the neonate to a level III neonatal unit.

Total serum bilirubin levels to guide the need for exchange blood transfusion at different weights and gestations.

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) than body weight

Note: 1. Infants who present with TSB above threshold should have Exchange done if the TSB is not expected to be below the threshold after 6 hrs of intensive phototherapy.
2. Immediate Exchange is recommended if signs of bilirubin encephalopathy and usually also if TSB is >85 µmol/L above threshold at presentation
3. Exchange if TSB continues to rise >17 µmol/L/hour with intensive phototherapy



2.1.1.20 Bleeding in the neonatal period

2.1.1.20.1 Etiology of bleeding in the neonate

Clotting factor deficiencies

- Haemorrhagic Disease of the newborn (Transient deficiency of vitamin K dependent factors (II, VII, IX, X))

- Disseminated intravascular coagulation (DIC), shock, necrotizing enterocolitis (NEC), and renal vein thrombosis
- Inherited abnormalities of clotting factors: haemophilia or Von Willebrand disease (VWD)

Platelet disorders

- Maternal drug use (phenytoin, phenobarbital, or salicylates)
- Thrombocytopenia
- Alloimmune thrombocytopaenia

Vascular causes

- Arteriovenous malformations
- Capillary haemangiomas)

Other:

- Bleeding from poorly tied cord
- Birth trauma causing intracranial or extracranial bleeding
- False tooth extraction
- Circumcision in the community

2.1.1.20.2 Haemorrhagic disease of the newborn (HDN)

What is it?

Vitamin K is a vitamin that helps the blood to clot. All neonate are at risk of vitamin K deficiency which can lead to severe bleeding.

ALL NEONATES should be given vitamin K at birth

- Give 1mg vitamin K IM if >1.5kg
- Give 0.5mg vitamin K IM if <1.5kg

What are the risk factors for HDN?

- Preterm Neonates

- Low birth weight Neonates
- Neonate born to epileptic mother
- Neonate born to mother on TB medication
- Neonates with sepsis
- Neonates who did not receive Vitamin K

Clinical manifestations of HDN

Early disease (1st day of life)

- Occurs in infants born to mothers taking oral anticoagulants or anticonvulsants (e.g., phenytoin or phenobarbital).
- Infants often have serious bleeding (intracranial hemorrhage).
- Mother should receive vitamin K_1 10 mg IM 24 hrs before delivery.

Classic disease (day 2-7 of life)

- Occurs when the infant is not given vitamin K_1 prophylaxis at birth.
- Bleeding may be cutaneous, CNS, GI, or circumcision bleeding. Bruising may be seen around the nose or the umbilical cord.

Late onset disease (between 2nd week and 6th month)

- Associated with biliary atresia, hepatitis, chronic diarrhoea, and prolonged antibiotic therapy.
- Infants may have cutaneous, GI or intracranial hemorrhages.

Laboratory findings

- Normal platelet count & prolonged PT & APTT

Management

Prophylaxis

- Vitamin K_1 0.5mg <1.5kg; 1 mg >1.5kg (IM) given at the time of delivery.

- Infants receiving TPN or antibiotics for >2 weeks should be given 0.5-1 mg vitamin K_1 IM or IV weekly since antibiotics reduce the bacterial content of the gut, which reduces the production of vtamin K.

Treatment

- Vitamin K_1 (1-2 mg slow IV daily for 3 days
- Vitamin K_1 1mg IM on day 1 for future prophylaxis
- If severe: Consider FFP administration (10 -15 ml/kg IV) over 30 - 60 minutes if available and/or Fresh blood transfusion for serious bleeding (20ml/kg)

2.1.1.20.3 Disseminated intravascular coagulation (DIC)

What is it?

Disseminated intravascular coagulation (DIC) is an acquired syndrome characterized by systemic activation of coagulation resulting in both thrombosis and haemorrhage.

Risk factors

Neonatal sepsis, acidosis, hypoxia, hypotension, RDS, prolonged hypothermia or massive haemolysis

Clinical manifestations

Sick neonate, petechiae, GI bleeding, oozing from v108enipuncture sites, bleeding from body orifices and CNS manifestations.

Laboratory findings

- ↓ platelet count, prolonged PT and APTT.

- Fragmented RBCs in blood smear, ↓fibrinogen, and ↑FDP'S & D-dimers

Management

- Treat the underlying cause.
- Vitamin K_1 (1 mg slowly IV daily for 3 days).
- Platelet transfusion to keep platelets >50,000/µL. (15ml/kg)
- FFP administration 10-15ml/kg over 30-60 minutes
- If bleeding persists, consider referral to a level III unit the following:
  - Transfusion with fresh whole blood (20ml/kg)
  - Repeated platelets, packed RBCs, or FFP transfusions
  - Cryoprecipitate (10 ml/kg)
  - If DIC is associated with thrombosis and neonate is not bleeding give heparin IV infusion (10-15 units/kg/hr)

2.1.1.20.4 Neonatal Thrombocytopenia

What is it

Platelet count <150,000µL in a term infant and <100,000µL in a preterm infant

Classification

Neonatal thrombocytopaenia can be early (≤72 hours) or late (>72 hours)

Clinical manifestations

- Generalized petechiae and purpura.
- Mucosal & spontaneous haemorrhage (if <20,000µL).
- Intracranial hemorrhage may occur in severe cases.

Diagnosis

The diagnostic Approach to Neonatal Thrombocytopenia is shown in Table 18 below.

Table 18: Diagnostic approach to neonatal thrombocytopaenia.

Sick Infant		Healthy Infant	
Normal PT, APTT	**PT, APTT**	**Normal Mother's Platelet Count**	**Mother's Platelets**
• Infection (without DIC) • Hypersplenism • Bone marrow infiltration • NEC	• DIC • Sepsis • Hypoxia • Acidosis • Cold Stress • Severe liver disease	• Alloimmune thrombo-cytopenia • Neonatal drugs • Hemangioma • Congenital thrombo-cytopenia • Maternal ITP in remission	• Maternal ITP • Maternal drugs • Familial

DIC: disseminated intravascular coagulopathy, NEC: necrotizing enterocolitis, ITP: immune thrombocytopenic purpura

Management

- Treat the underlying cause.
- Platelet transfusion (15ml/kg) through a peripheral vein, when indicated as shown in Table 19.
- Transfuse over 30 min using the platelet giving set that accompanies the platelets.
- Furosemide is not routinely administered

Table 19: Transfusion thresholds for thrombocytopaeania

Platelet count (x 109 / l)	Non-bleeding neonate	Bleeding neonate	*NAITP (proven or suspected)
<25	Transfusion in all patients is recommended	Transfuse	Transfuse with **HPA compatible platelets
25-49	Do not transfuse if clinically stable. Consider transfuse if: • Hypotension requiring inotropic support • Previous major bleeding tendency e.g. Grade 3-4 IVH • Concurrent coagulopathy • Seizures within last 72 hrs • Requires exchange transfusion • Pre surgery (within 24 hrs) • Post-surgery (within 5 days)	Transfuse	Transfuse with **HPA compatible platelets
50-99	Do not transfuse	Transfuse	Transfuse with **HPA compatible platelets if major bleeding present
>99	Do not transfuse	Do not transfuse	Do not transfuse

***NAITP: neonatal alloimmune thrombocytopenia

****HPA: human platelet antigen

2.1.1.20.5 Alloimmune thrombocytopenia

What is it?

Neonatal alloimmune thrombocytopenia (NAIT), also referred to as fetal and neonatal alloimmune thrombocytopenia (FNAIT), occurs when fetal platelets

contain an antigen inherited from the father that the mother lacks. During pregnancy, the mother forms immunoglobulin G (IgG)-class antiplatelet antibodies against the "foreign" antigen, which cross the placenta and destroy fetal (FNAIT) and neonatal (NAIT) platelets that express the paternal antigen.

Clinical features

The clinical presentation is highly variable and may include asymptomatic thrombocytopenia; mild bleeding in the form of petechiae, haematomas, small visceral bleeds, transient haematuria, or bloody stools; or severe bleeding, including major organ bleeds and intracranial haemorrhage.

Management

- Platelet transfusion: if the infant has bleeding or has a platelet count <20,000μL, use mother's platelets (collected 24 hrs before delivery).
- If not previously collected, mother's whole blood or platelets from HPA-1a- negative platelet donor can be used.
- Ideally, washed platelets should be used to remove plasma (not currently available in Uganda)
- IVIg (1g/kg/day for 2 days or 0.5 g/ kg/ day for 4 days).
- Prednisolone (2 mg/kg/day), with continued low platelet counts.
- Cranial ultrasound to rule out intracranial bleed.

2.1.1.20.6 Diagnostic work-up of a bleeding neonate

In all neonates who are bleeding abnormally, a complete blood count (CBC) and clotting profile should be performed. The platelet count, PT and APTT should be evaluated as per Table 20.

Table 20: Laboratory Evaluation of Bleeding in a Newborn

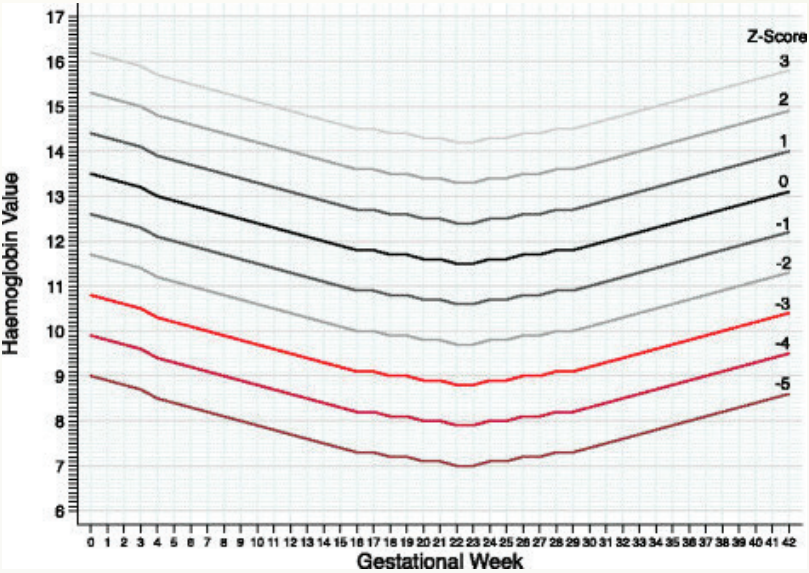
Condition	Platelet Count	PT	APTT
Well Neonate			
• Vitamin K deficiency	Normal	↑	↑
• Thrombocytopenia	↓	Normal	Normal
• Hemophilia	Normal	Normal	↑
• Localized cause	Normal	Normal	Normal
Sick Neonate			
• DIC	↓	↑	↑
• Liver disease	Normal -↓	↑	↑
• Infection	Normal -↓	Normal	Normal-↑

2.1.1.20.7 Anaemia in the neonatal period

What is it

Neonatal anaemia is defined by a haemoglobin or haematocrit concentration of greater than 2 standard deviations below the mean for postnatal age.

Graph: Normogam with theoretical Z-scores curves of haemoglobin (Hb) in relation to the mean curve through gestational weeks



Many neonates are born with a physiologic polycythemia due to relative hypoxia in utero. Normal hemoglobin for a newborn is 15-18 g/dl, normal hematocrit for newborn: 45-55%. (Conversion: Hemoglobin x 3 = Hematocrit).

Over the first weeks of life, neonates develop a physiological anaemia because erythropoietin and fetal haemoglobin production decreases in response to relatively rich oxygen supply. The nadir results in insufficient oxygen delivery to tissues, prompting a rise in erythropoietin levels rise and adult hemoglobin production, and rarely requires treatment.

Term newborns typically reach a physiologic nadir with hemoglobin of 9-11g/dL at 6-12 weeks of age. Preterm neonates typically have an earlier and more severe physiologic nadir, reaching a hemoglobin of 8-10 g/dL at 5-10 weeks of age.

Risk factors for neonatal anaemia

Some of the common causes are listed below:

- Obstetric blood loss: early cord clamping, placental abruption, placenta previa, placental laceration during caesarian section
- Feto-placental bleeding, twin-to-twin transfusion syndrome
- Neonatal blood loss: cephalohaematoma, subgaleal hemorrhage, intracranial hemorrhage, bleeding into abdominal organs, poor cord clamping
- Haemolysis
- Immune (ABO, Rh or minor blood group incompatibility)
- Hereditary red blood cell disorders (G6PD deficiency, red blood cell membrane defects, hemoglobinopathies (e.g thalassemia)
- Acquired coagulopathy (infection, DIC)
- Diminished red blood cell production: iron deficiency, infection, medications
- Repeated phlebotomy
- Anaemia of prematurity

Diagnosis

Identify the cause. The following investigated can be considered

- Complete blood count, reticulocyte count, blood smear, Coombs test, Blood groups of mother and neonate, caranial USS
- Rule out sepsis.

Management

The indication for a red blood transfusion depends on clinical condition of the

neonate, aetiology of anaemia, hematocrit value. Suggested target concentration for red blood cell transfusion are given in Table 21.

Table 21: Suggested target Haemoglobin (g/dl) for newborns needing RBC transfusions

	Week 1	Week 2	Week 3	>Week 3
Neonate with respiratory support	11.5g/dl	10 g/dl	less than 10g/dl	Less than 10 g/dl
No respiratory support	10 g/dl	8.5	Less than 8	Less than 8

Transfusion Procedure

- Typical transfusion is 10 – 15 ml/kg of packed cells given over 2 to 3 hours
- May need second transfusion (preferably from same donor) if anemia not adequately corrected
- Wait at least 6 hours after completion of transfusion if post transfusion hematocrit needed in order to allow time for-reequilibration.
- Whole blood should be given to correct the anemia of rapid blood loss as 15-20ml/kg over 3 to 4 hours
- If clinically the neonate has severe anemia and haemoglobin/haematocrit is not available: give 10-15ml/kg of packed cells over 2 to 3 hours

Prevention of anaemia

- Delayed cord clamping
- Preterm infants: iron supplementation 2-4 mg/kg/day once full enteral feed is achieved

- Folic acid (1-2 mg/wk for preterm infants & 50 µg/day for term infants)

2.1.1.20.8 Polycythemia

What is it

An abnormal elevation of circulating RBCs. Polycythaemia is defined as a venous haematocrit ≥65%.

Causes of polycythemia in neonates

The common causes of polycythaemia are given in Table 22.

Table 22: Causes of polycythaemia

Placental RBCs Transfusion	Placental Insufficiency – Intrauterine Hypoxia	Other Conditions
• Delayed cord clamping > 3minutes or forceful uterine before clamping • Cord stripping • Holding the neonate below the mother at delivery • Maternal-fetal transfusion • Twin-twin transfusion	• SGA • Maternal smoking • Maternal hypertensive disorders • Postmaturity • Maternal heart disease • Pregnancy at high altitudes	• IDM • LGA • Beckwith Wiedemann syndrome • Dehydration • Trisomy 21 • Maternal use of propranolol • Congenital thyrotoxicosis • Congenital adrenal hyperplasia

SGA: small for gestational age, LGA: large for gestational age, IDM: infant of a diabetic mother

Clinical presentation

- Infants can be asymptomatic or symptomatic
- Plethora (increased red coloration of the neonate)
- Cyanosis, tachycardia, tachypnoea,
- Abdominal distension
- Hypoglycaemia is commonly associated
- Hyperbilirubinaemia is a common finding
- CNS manifestations e.g. lethargy, irritability, hypotonia, seizures

Investigations

Haematocrit (Hct) level, serum glucose, bilirubin, calcium levels and platelet count

Treatment

- Asymptomatic infant and Hct 65-70%: increase fluid intake and observe
- Asymptomatic infant with a venous Hct > 70% should be referred to level 3 neonatal unit
- Symptomatic infant with Hct >65%: refer to a level 3 neonatal unit

2.1.1.20.9 Indications for FFP transfusion

Coagulopathies are common in the neonatal period, and fresh frozen plasma (FFP) transfusions should be considered as an intervention in the following neonates:

- If there is prolonged active bleeding
- If there is high risk of bleeding with abnormal coagulopathy e.g. sepsis and abnormal PT
- DIC with active bleeding
- Treatment of congenital deficiencies when the specific concentrate is not available and infant is bleeding
- Infants with coagulopathy and about to undergo an invasive procedure

2.1.1.21 Endocrine/Metabolic disorders

2.1.1.21.1 Hypoglycemia

What is it

The normal blood glucose level in a neonate is 2.6 – 7 mmol/l (46-125mg/dl). Hypoglycaemia is when the blood glucose level is below 2.6 mmol / l (46mg/dl) Severe hypoglycaemia is a blood glucose level of < 1.4 mmol / l (25mg/dl)

Dangers of hypoglycaemia

Hypoglycaemia is very dangerous to neonates. It can cause seizures, brain damage and development impairment.

Risk factors for hypoglycaemia

- Delayed Feeding
- Hypothermia
- Infants of a diabetic mother
- Infants with a birth weight > 4kg
- Preterm or low birth weight
- Infants with respiratory distress
- Infection
- Perinatal asphyxia

Prevention of hypoglycaemia

- Breastfeed the baby within one hour of birth
- Keep the baby warm
- If milk feeds are contraindicated start intravenous fluids immediately.
- Check and record regularly the blood glucose level of babies at risk of hypoglycaemia
- Small (birth weight less than 1.5kg) and sick babies every 6 hours until the blood glucose level is normal

- Babies of diabetic mothers, and babies weighing > 4kg birth, check after birth and every 3 hourly for the first 24 hours
- Babies who are hypothermic, every 3 hours until temperature normalizes, and then 6 hourly until the blood glucose level has been normal for 24 hours

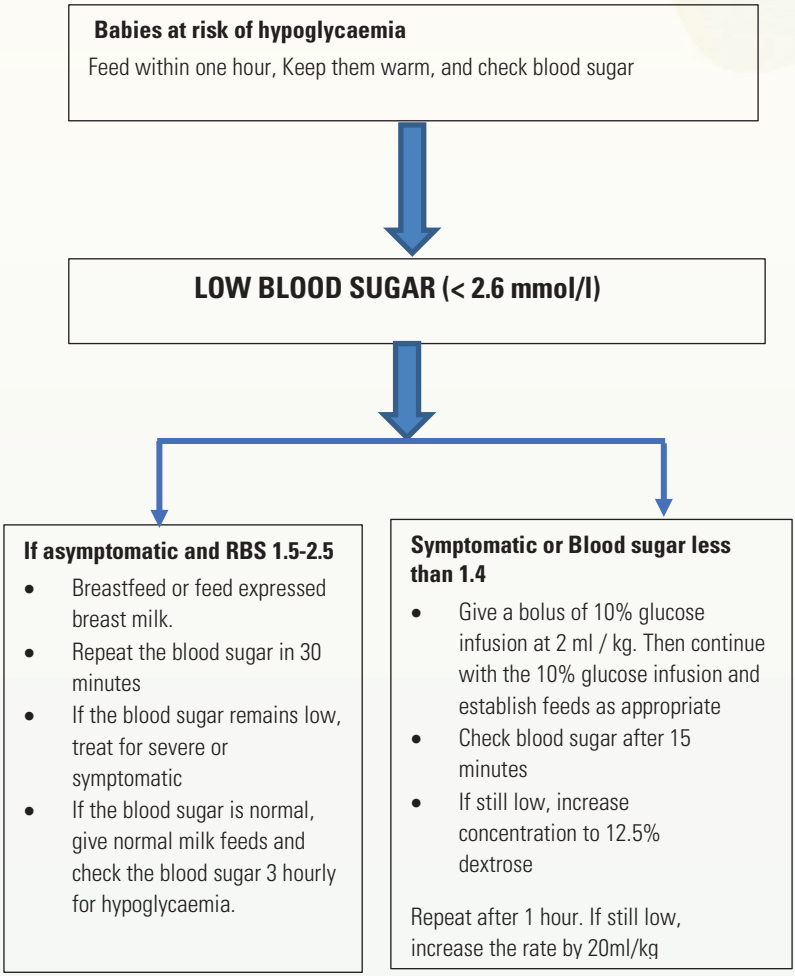
Clinical presentation

Note that a baby with hypoglycaemia may have NO clinical signs. All babies admitted to the neonatal unit should have Random Blood Sugar (RBS) taken on admission.

Common signs and symptoms include:

- Profuse sweating,
- Lip-smacking,
- Jitteriness,
- Irregular breathing
- Jerky movements
- Apnoea
- lethargy
- Pale
- Hypotonic (low muscle tone)
- Poor feeding
- Irritable
- Unstable temperature
- Seizures
- Unresponsive

Figure 13: Algorithm for Management of Hypoglycemia



***An infusion of 50% glucose, or large boluses of 5ml/kg, are contraindicated as it may lead to rebound hypoglycaemia**

Dextrose solutions of 15% or more are contraindicated in peripheral lines

If it is difficult to maintain the glucose levels in the normal range despite receiving glucose at 12– 15mg/kg/min, consider adding Hydrocortisone or Diazoxide. Consider referral to a level III unit.

2.1.1.21.2 Hyperglycemia

What is it

Whole blood glucose 7mmol/l (>125 mg/dl) or plasma glucose 8mmol/l (>145 mg/dl)

Risk factors

Exogenous parenteral glucose, drugs (e.g., steroids, theophylline), ELBW infants, sepsis, stress & neonatal diabetes mellitus

Treatment

Give 5% dextrose (instead of 10% dextrose)

Start feeding, if general condition of the infant allows.

Prepare drugs in normal saline or distilled water instead of glucose solutions.

For level 2 units able to give insulin by infusion/syringe pumps, Initiate continuous insulin infusion

- If blood sugar >11.1 -13.9 mmol/l despite lowering GIR.
- Add 15 units regular human insulin to 150 ml D10% or NS (final concentration=0.1 unit/ml). Flush the IV tubing with a minimum of 25 ml of this insulin solution.
- Rate: 0.01-0.2 unit/kg/hr (=0.1-2 ml/kg/hr). Start with low dose and titrate according to response

- Check blood glucose every 30 min until stable and adjust infusion rate:
- If blood glucose remains >10mmol/l (180 mg/dl): titrate in increments of 0.01 unit/kg/hr.
- If hypoglycaemia occurs: discontinue insulin infusion & give D10% IV bolus of (2 ml/kg x 1 dose).
- Monitor for rebound hyperglycemia.

2.1.1.21.3 Infant of a Diabetic Mother (IDM)

What is it

Infant born to a mother with diabetes or gestational diabetes. The neonate has received high levels of glucose inutero, and has high insulin levels. At birth, this constant source of high glucose is discontinued and the baby is at risk of severe hypoglycaemia.

Complications

- Hypoglycemia: the onset is frequently within 1-2 hours of age.
- Hypocalcemia: it becomes apparent 48-72 hours after birth.
- Hypomagnesemia: serum magnesium level <1.5 mg/dl

- Birth injuries: fracture clavicle, Erb's or phrenic nerve palsies.
- Congenital malformations: cardiac (e.g., TGA & VSD), neurological (e.g., open meningomyelocele), skeletal (e.g., caudal agenesis syndrome), renal (e.g., agenesis) & GIT (e.g., small left color syndrome or situs inversus).
- Perinatal asphyxia
- Cardiorespiratory: RDS, TTN & hypertrophic cardiomyopathy
- Polycythemia & hyperviscosity
- Hyperbilirubinemia
- Renal venous thrombosis

Clinical features

- May be asymptomatic. Blood glucose must be monitored at least 3 hourly for 24 hours.
- LGA or SGA
- Puffy and plethoric face.
- Tremors and hyperexcitability
- IDM may show hypoglycemia, lethargy with poor feeding, apnea or jitteriness (first 6-12 hrs after birth), respiratory distress or heart failure, and congenital anomalies.

Investigations

Laboratory Studies

- Glucose level (blood/ serum) 3 h hourly
- Serum calcium level: check on D3 or if infant is jittery, has persistent seizures or appears sick. If low, obtain serum magnesium level.
- Hematocrit: check at 1 and 24 hrs of age.
- Serum bilirubin levels: as indicated by physical examination.
- If cardiac lesion suspected, do echo
- If birth trauma suspected, x-ray affected area

Management

Admit all infants of diabetic mothers to NICU for at least 4 hours
Check RBS within 1 hour after birth, then 3 hourly
In case of hypoglycaemia see FIGURE 9 on Hypoglycaemia in 5.7.1
Initiate feeding early

*1mmol/l = 18mg/dl

2.1.1.21.4 Oliguria

What is it

Defined as a urine output of <1 ml/kg/hr.

If a neonate has less than 4 wet nappies a day or no urine for an 8 hour period, consider need for catheter and investigations or oliguria.

Risk factors

Prerenal Failure	Intrinsic Renal Failure	Postrenal Failure
• Shock • Dehydration • CHF	• ATN (prolonged ischemia, drugs, toxins) • DIC • Renal vein thrombosis • Malformations (polycystic, agenesis, dysplastic)	• PUV • Neuropathic bladder (e.g after birth asphyxia, spina bifida) • Prune-belly syndrome

CHF: Congestive heart failure, ATN: acute tabular necrosis, DIC: disseminated intravascular coagulopathy, PUV: posterior urethral valve

Diagnosis

History

- Poor breastfeeding (dehydration)
- Maternal diabetes (renal vein thrombosis)
- Birth asphyxia (ATN or retention)
- Oligohydramnios (Potter Syndrome)
- Absent or reduced force of urinary stream (PUV)
- Nephrotoxic drugs (e.g., aminoglycoside, indomethacin)

Physical examination

- Signs of dehydration (dry mucous membranes, depressed fontanelle, delayed capillary refill time, increased heart rate & reduced blood pressure)
- Evidence of heart failure
- Signs of acute renal failure (volume overload; as edema, CHF, hepatomegaly, and pulmonary edema)
- Abdominal masses, ascites, or congenital anomalies.
- Suprapubic bladder mass.

N.B.: If urinary catheter is in place, confirm the absence of obstruction or leakage around the catheter.

Investigations

- Urine analysis
- Electrolytes
- BUN, plasma creatinine & BUN/creatinine ratio
- Cardiac echo
- Fluid challenge test (to rule out hypovolaemia)

  Give 2 normal saline boluses of 10ml/kg/hr after exclusion of CHF; dopamine (1-5 µg/kg/min) may be given.
  - If no response (still oliguric) and the BP is adequate, and the cardiac size is adequate in the chest x-ray film (cardiothoracic ratio = 0.6), induce diuresis with furosemide 2 mg/kg IV.
  - If no response, do an abdominal ultrasonography to define renal, urethral and bladder anatomy.

Management

- Prerenal oliguria: correct dehydration, manage shock, or congestive heart failure as needed
- Postrenal obstruction: refer to level III neonatal unit
- Intrinsic renal failure:

- Consider referral to a level III neonatal unit
- Daily weight, input, output, BUN, creatinine & electrolytes.
- Restrict fluid intake to insensible water loss of (30 ml/kg/day) + urine output + other measured losses.
- Correct metabolic acidosis, only if pH <7.2 (unless PPHN).
- Withhold K^+ intake unless hypokalemia develops.
- Discontinue nephrotoxic drugs (e.g Gentamycin), choose drugs with minimal or no renal toxicity, adjust dosage and interval of administration of drugs with renal elimination according to the degree of dysfunction & monitor serum drug levels.

2.1.1.22 Feeding

2.1.1.22.1 Overview

The main methods of feeding a neonate include breast-feeding, spoon-feeding, cup-feeding and nasogastric tube (NGT) feeding. Intravenous fluids are also used in very small and sick babies.

Intravenous (IV) fluids

- For babies who need to be nil per os (NPO)
- To supplement oral and nasogastric feeding whilst establishing feeds

Babies to be kept nil per os (NPO)

- A baby with seizures
- A baby with moderate or severe respiratory distress
- A baby with a distended abdomen
- A baby with bilious or blood-stained vomiting/aspirate e.g. necrotising enterocolitis
- A baby with HIE until bowel sounds heard and aspirates are clear
- Surgical babies pre-operatively and post-operatively

2.1.1.22.2 Breastfeeding

The World Health Organization (WHO) and UNICEF recommend early initiation of breastfeeding within one hour of birth and exclusive breastfeeding for the first six months of life. After six months, infants should receive safe and nutritious foods to meet their evolving nutritional requirements while continuing to breastfeed for up to two years or longer.

Breastfeeding reduces morbidity and mortality by optimising growth, development and protecting against infection for the neonate.

Early breastfeeding can also be life-saving for mothers by increasing uterine contractions and reducing bleeding after delivery.

2.1.1.22.2.1 Indications for breastfeeding

- Babies who are stable and have a safe suck and swallow.

2.1.1.22.1.2 Neonates who cannot safely breastfeed

Some babies may be unable to breastfeed due to illness, prematurity or orofacial defects. In these situations, mothers can be asked to express breast milk to give to their baby. Expressed Breast Milk (EBM) can be given by cup, spoon or nasogastric tube as described below.

Encourage mothers of small and sick babies to express regularly every 2-3 hours from Day 1 to initiate and increase their milk supply.

- **DO NOT** encourage mothers to give formula milk unless there is a medical reason (see Formula Milk below).
- **DO NOT** allow mothers to give other fluids including cow's milk, sugar syrup and water etc.

Positioning and Attachment while breast feeding:

Positioning for the mother

The mother should be comfortable to ensure adequate feeding duration. There are many different positions and the mother should be encouraged to choose

Positioning for the Baby

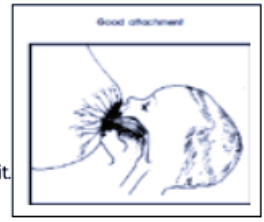
For successful attachment, the baby should be positioned as follow

- The head and body should be in a straight line
- Face opposite the nipple of the breast
- Upper lip or nose opposite the mother's nipple
- Held or supported very close to the mother's body
- Whole body supported if mother sitting

Attachment for the Baby

Signs of good attachment;

- Mouth wide open
- Tongue forward in the mouth
- Lower lip turned outwards
- Chin touching the breast
- More areola is visible above the baby's mouth than below it.



2.1.1.22.1.3 Maternal highly Infectious Diseases and Breastfeeding Respiratory illness e.g COVID-19

WHO recommends that mothers with suspected or confirmed COVID-19 should be isolated with their baby. They should be encouraged to initiate or continue to breastfeed. Mothers should be counselled that the benefits of breastfeeding substantially outweigh the potential risks for transmission. Mother and infant should be enabled to remain together while rooming-in throughout the day and night and to practice skin-to-skin contact, including kangaroo mother care.

Viral Haemorrhagic Disease

If a mother is suspected, or confirmed, to have a viral haemorrhagic disease, breastfeeding should be stopped and an alternative method of feeding used. REFER to MIYCAN guidelines

2.1.1.22.3 How to cup or spoon feed

What equipment is required?

- Large cup for expressing milk into
- Small cup or spoon for feeding the baby
- Ideally these should be metal and autoclaved/boiled between uses otherwise soap and hot water may be used
- Air-dry cups and spoons rather than using a towel
- New syringe to measure the milk every day
- Tray or bucket for equipment to dry on and for storage of the equipment

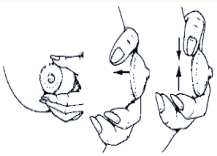
Support the mother to express her milk

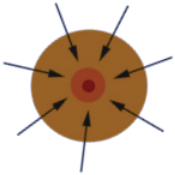
- Explain clearly to the mother how to express her milk and if possible, stay to help her on the first occasion or ask a member of staff to do so.
- Use the posters to aid explanation to the mother
- Ask the other mothers who are already expressing to support her

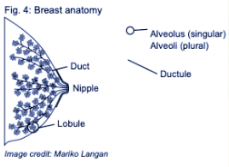
How to express milk by hand

- Wash the cup with hot water and soap, rinse well with hot water and allow to air dry.
- Wash your hands with soap and water and clean your breasts.

Hand expression anatomy and method







- Hold your breast between your thumb and first 2 fingers in a C-shape about 3 cm away from the nipple
- Gently squeeze. Pull your thumb and fingers toward your chest and roll your fingers together.
- It should not be painful
- Release the pressure and squeeze again and again
- When the milk stops coming try a different area of your breast. When the milk stops coming completely swap to the other breast.
- Only a few drops may appear the first few times, make sure you give them to your baby!
- Instruct the mother to express for 15 minutes on each breast – even if NO breastmilk is seen
  Keep practicing and each time more and more milk will come

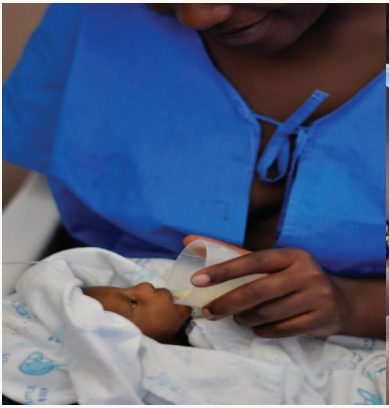
Indications for cup and spoon feeding

- Babies who can not yet breastfeed or can not breastfeed sufficiently to gain weight e.g.
  - Preterm babies >34 weeks require top up with expressed breastmilk (EBM)
  - Preterm babies 1500g -2000g require top up with expressed breastmilk (EBM)
  - Babies recovering from neurological damage i.e. HIE, kernicterus, meningitis

- Babies who **can not** suck but can safely swallow

How to give milk by cup and spoon

- Use a syringe to draw up the amount of milk prescribed by the neonatal team
- Use a new syringe every day
- Place a small amount of milk in the feeding cup or spoon
- Wrap the baby so the milk will not be knocked over by the baby's hands.
- Support the baby in a semi-upright sitting position.
- Support the head in a straight line, not turned to the side, bent backwards or forwards.
- Place the edge of the cup/spoon at the outer corners of the upper lip, resting gently on the lower lip with the tongue inside the cup.



- Tip the cup/spoon so the milk is just touching the baby's lips. Do not pour the milk into the baby's mouth.
- The infant usually laps the milk, or may sip it.
- Allow time for the infant to swallow
- Let the infant pace the feedings, but limit the length of the feeding to a

maximum of 30 minutes to minimize fatigue. Give the remaining feeds Ng if amount prescribed is not completed

- Do not attempt to cup or spoon feed an infant who is not alert or who is excessively sleepy or lethargic
- **POUR AWAY** any milk that is expressed but not used during that feed (unless there is a breastmilk bank available)
- Wash the cups and syringe as described.

2.1.1.22.4 Storage of Breastmilk

Freshly expressed breastmilk can be stored for the mother's own baby as follows:

- Room temperature for up to 4 hours (at 25°C or below)
- Fridge up to 24 hours (2-8 °C)
- Freezer up to 6 months (-18 °C). Thawing can be done in the fridge or countertop. DO not use microwave as reduces the quality of the milk. DO not refreeze.
- Breastmilk b ecan used cold or at room temperature. If warming requires, a bath of warm water can be used.

Breastmilk should be stored in bag with a ziplock, or a container with a secure lid. It should be labelled with the mother's name and date of expression. The breastmilk fridge should be within the neonatal unit but with restricted access.

Breastmilk banking for donation should be reserved for level 3 units.

2.1.1.23 Feeding with a nasogastric tube (NGT)

2.1.1.23.1 Indications for nasogastric Tube feeding

- Babies who cannot suckle or who cannot suckle sufficiently to gain weight

Usually, preterm babies <1500g or <34 weeks will need Ng feeds initially, then breastfeeds cup and spoon feeds can be introduced as per the baby's feeding cues and sucking ability.

- Babies with neurological impairment i.e. HIE, kernicterus, meningitis
- Babies who have moderate or severe respiratory distress
- Babies on CPAP can have nasogastric or orogastric tube feeding

Although it is usually a very safe procedure, there is a very small risk that the NGT may accidentally be misplaced into the lungs. If this happens milk or medication can be administered into the lungs. Orogastric tubes (OGT) are used mainly in babies in respiratory distress on CPAP or with structural abnormality of nasal cavity i.e. cleft palate. Nasogastric tubes are used short term for all other neonates until full oral feeding is achievable.

2.1.1.23.2 How To Insert an NGT

Equipment

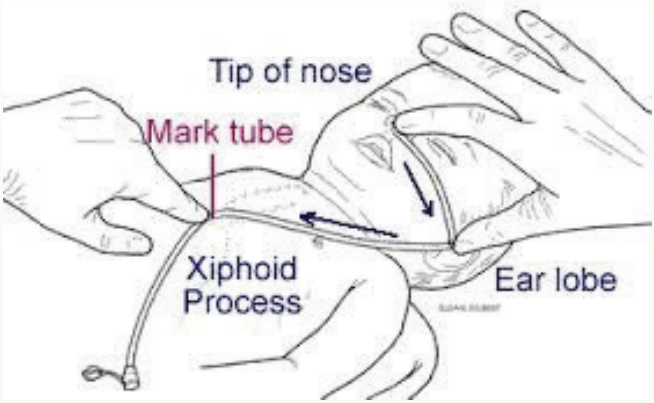
- 2ml syringe
- Nasogastric tube of appropriate size
  - 5G <1.5kg
  - 6-8G >1.5kg
- Permanent pen for marking
- pH testing strips if available
- Tape for securing
- Examination gloves
- Lubricant (KY Jelly or breastmilk)
- Stethoscope

Take time to talk to mother

- Explain the procedure
- Explain the need for the NGT
- Explain it will **NOT** hurt baby

Procedure

- Measure the length of the nasogastric tube required with the patient in the supine position
- Measure from the bridge of the nose, to the ear lobe and then to the xiphoid process (See diagram below)
- Mark the length required using the permanent pen



Insertion of nasogastric tube

- Insert the nasogastric tube in a backward direction into one nostril
- If resistance is felt, remove the tube, gently clear the nostril and reattempt
- If still unable to pass easily attempt the other nostril
- Pass the tube slowly
- Once the mark is reached secure the tube across the cheek using the tape

Check the position using pH testing strip (If available)

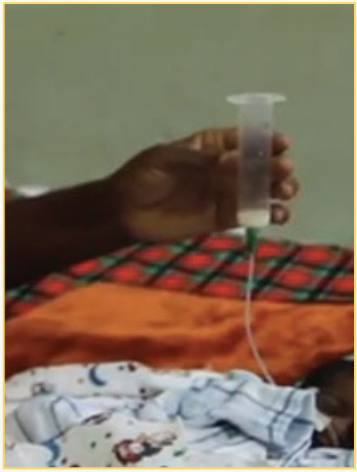
- Aspirate from the nasogastric tube using the 2ml syringe
- Put aspirate on the pH testing strip and check pH is 5.5 or below

Check the position if pH testing strip is NOT available

- Put 2ml of air in the syringe and attach to the nasogastric tube
- Place a stethoscope over the patient's stomach
- Inject the 2ml of air down the tube and listen over the stomach for a "whoosh" to confirm placement.

2.1.1.23.3 How to Give Milk by NGT

- Wash hands with soap and water
- Check Ng position by confirming the mark is in the correct place
- Fold NGT in half and open the top
- Attach the syringe to the end of the NGT
- Pour in the prescribed amount of milk
- Unfold the NGT, hold the syringe above the baby and allow milk to flow in under gravity



NEVER PUSH THE MILK DOWN THE TUBE WITH THE PLUNGER (if the milk won't flow, you may need to gently push to initiate the flow, then remove the plunger)

- When all the milk has flowed in, remove the syringe and wash
- Replace the top on the NGT
- Discard any milk that is not used
- Remember there is no need to rinse the NGT with water or dextrose as it increases the risk of infection

2.1.1.24 Fluids

Neonates who are too sick or too small to suck and swallow safely will need IV fluids. Oral feeds are gradually introduced as tolerated.

2.1.1.24.1 Fluids for sick babies

- Commence on IV fluids on the first day at 60mls per kg per day for those above 1.5kg
- Dextrose 10% should be used and no electrolytes should be added
- Very low birth weight babies (<1.5kg) require higher volumes of fluids, start on 80 ml/kg on day 1 if using an incubator
- If using an open warmer, start at 100ml/kg due to evaporation losses
- Extremely low birth weight (<1kg) start on 80-100ml/kg
- Calculate the total IV fluids required in 24 hours. Ideally this should be given as a continuous infusion.

Table 23: Suggested daily feeds for small and sick babies

Three hourly NGT EBM feeds and ONE hourly IVF for UNSTABLE NEWBORNS with birth weight less than 1500grams

Age	0.6kg		0.7kg		0.8kg		0.9kg		1.0kg		1.1kg		1.2kg - 1.3kg		1.4kg - 1.5kg		Total daily fluid/ milk volume
	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	
Day 1		2		2		3		3		4		4		4		5	80ml/kg/day
Day 2	2	2	3	2	3	2	3	3	4	3	4	3	5	4	5	4	100ml/kg/day
Day 3	5	2	5	2	6	2	7	2	8	3	8	3	9	3	11	4	120ml/kg/day
Day 4	7	1	8	1	9	2	10	2	12	2	12	2	14	3	16	3	140ml/kg/day
Day 5	9	1	11	1	12	1	14	1	16	1	16	1	19	2	22	2	160ml/kg/day
Day 6	11	0	13	0	15	0	17	0	20	0	20	0	23	0	27	0	180ml/kg/day
Day 7	14	0	16	0	18	0	20	0	24	0	24	0	28	0	33	0	180ml/kg/day

Day 1–Give 2mls/kg of colostrum every 3 hours as trophic feeds on Day 1 after A, B and C are stabilized – DO NOT SUBTRACT THIS FROM THE IVF, THUS IVF REMAINS AS SHOWN IN THE CHART 80mls/kg/day

Three hourly NGT EBM feeds and ONE hourly IVF for UNSTABLE NEWBORNS with birth weight 1500grams – 3000grams

Age	1.5 – 1.6kg		1.7 – 1.8kg		1.9 – 2.0kg		2.1 – 2.2kg		2.3 – 2.4kg		2.5 – 2.6kg		2.7 – 2.8kg		2.9 – 3.0kg	
	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr
Day 1		4		4		5		5		6		6		7		7
Day 2	6	3	7	4	7	4	8	4	9	5	10	5	10	6	11	6
Day 3	12	3	13	3	15	3	16	4	18	4	19	4	21	5	22	5
Day 4	17	2	20	2	22	2	24	3	26	3	29	3	31	3	33	4
Day 5	23	1	26	2	29	2	32	2	35	2	38	2	41	2	44	2
Day 6	29	1	33	1	37	1	40	1	44	1	48	1	52	1	55	1
Day 7	35	0	39	0	44	0	48	0	53	0	57	0	62	0	66	0

Day 1– Give 2mls/kg of colostrum every 3 hours as trophic feeds on Day 1 after A, B and C are stabilized – DO NOT SUBTRACT THIS FROM THE IVF, THUS IVF REMAINS AS SHOWN IN THE CHART 60mls/kg/day

Three hourly NGT EBM feeds and ONE hourly IVF for UNSTABLE NEWBORNS with birth weight 3100grams – 4000grams

Age	3.1– 3.2kg		3.3 – 3.4kg		3.5 – 3.6kg		3.7 – 3.8kg		3.9 – 4.0kg	
	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr	EBM 3hrly	IVF mls/hr
Day 1		8		8		9		9		10
Day 2	12	7	13	7	13	7	14	8	15	8
Day 3	24	5	25	5	27	6	28	6	30	7
Day 4	35	4	38	4	40	4	42	5	44	5
Day 5	47	3	50	3	53	3	56	3	59	3
Day 6	59	1	63	1	67	1	70	2	74	2
Day 7	71	0	75	0	80	0	84	0	89	0

Day 1– Give 2mls/kg of colostrum every 3 hours as trophic feeds on Day 1 after A, B and C are stabilized – DO NOT SUBTRACT THIS FROM THE IVF, THUS IVF REMAINS AS SHOWN IN THE CHART 60mls/kg/day

2.1.1.24.2 How to calculate the IV Fluid rate when using a Burette

- It is better to give the fluids as a continuous infusion using an infusion pump. If an infusion pump is not available, use a burette and divide the total fluids into four (4) equal volumes to run 6 hourly.
- Calculate the fluid volumes for a 6-hour burette using the baby's weight as described below

2.1.1.24.3 How to calculate the IV Fluid rate when using boluses

*It is not a safe practice to give fluid requirements as boluses BUT if no infusion pump and no burette, you may give the fluid by slow boluses every 3 hours at least over 30 minutes. Mortality has been shown to be lower when using a burette compared to boluses.

Whenever possible use a burette (60 drops/ml giving set)

Step 1: Calculate the volume of fluid the baby needs in 24 hours:

weight of baby (kg) x "ml/kg/day" = total for 24 hours

Step 2: Calculate the volume of fluid the baby needs in 6 hours:

$$\frac{\text{Total for 24 hours}}{4} = \text{volume needed in 6 hours}$$

Step 3: Calculate the volume of fluid the baby needs every hour:

$$\frac{\text{Volume every 6 Hours}}{6} = \text{volume per hour that the baby needs}$$

Step 4: Calculate drop rate when using 60ml/hour giving set:

Number of mls per hour = drops per minute (THEY ARE THE SAME!)

e.g. 8 ml per hour = 8 drops per minute

Step 5: Label burette with "baby's name", "type of fluid" and "drops per minute" prescribed

Step 6: Fill burette with 6 hourly volume of correct fluid and set drip rate.

Remember to:

- *Ask mother to inform you when burette is nearly empty*
- *Check the cannula site before refilling*
- *Refill the burette every 6 hours with the "6 hourly amount" of correct fluid*
- *Check to make sure the drip rate is still correct*
- *Document on the fluid chart*

If giving fluids/feeds every 2 hours:

$$\text{Total daily fluid} = \frac{\text{Weight of baby *Volume/kg}}{12} = \text{Amount of fluids every 2 hours}$$

If giving fluids/feeds every 3 hours:

$$\text{Total daily fluid} = \frac{\text{Weight of baby *Volume/kg}}{8} = \text{Amount of fluids every 3 hours}$$

2.1.1.24.4 Monitoring neonates on IV fluids

- Check random blood sugar at least twice a day while neonate is on IV fluids. **Target random blood glucose of 2.6-7mmols/l (47-126mg/kg)**
- Monitor urine output through establishing frequency of passing urine **(adequate output is at list 6 wet nappies per day)**
- If neonates is very sick and oliguric consider catheterizing bladder with a 6G catheter (use size 5 French feeding tube if catheter unavailable) to accurately monitor output **(adequate output is 0.5-1ml/kg/hour).**
- If neonate has no urine at any time **avoid IV fluids containing potassium**
- Observe IV site every time medication is being given or when fluids are being given, ensure line is patent and no swelling. Stop immediately if swelling is noticed and replace the cannula
- Encourage the caregiver or mother to also monitor the drip site regularly and report any redness or swelling
- Monitor for signs of fluid overload by recording vitals regularly (record initial respiratory and pulse rate and watch for increased difficulty in breathing, increased respiratory rate, swelling of face)
- Document on a fluid chart

2.1.1.24.5 How to calculate feeds in small and sick neonates

- On daily basis, establish readiness to start feeding. The best indicators for readiness to feed are; abdomen of normal fullness/volume and is soft, bowel sounds present, no vomiting and passing stool/meconium.
- Gradually introduce feeds by 25mls/kg per day, trophic feeds may be started even on day 1 in the very low birth weight
- Feed babies every 2-3 hours. If feasible, 2 Hourly is best
- Increase the feeds daily by 25ml/kg/d if there is no vomiting, apnoea, or abdominal distension (refer to the Table 24 below)

Feeds for neonates > 1.5Kgs and those that can take oral feeds but cannot suckle or have respiratory distress

- Initiate breast milk within the first hour of life.
- Use expressed breast milk given by cup and spoon
- If the baby is unable to take by cup and spoon consider nasogastric tube.
- Feed baby 2-3 hourly using volumes as shown in the table below.

Table 24: Three-hourly feeds for stable babies

Birth weight	Day1 60ml/kg/d	Day2 80ml/kg/d	Day3 100ml/kg/d	Day4 120ml/kg/d	Day5 150ml/kg/d	Maximum feeds 180ml/kg/d
1.5-2.0kg	13	17	21	26	32	39
2.1-2.5kg	17	22	28	33	42	50
2.6-3.0kg	20	27	34	41	51	61
3.1-3.5kg	24	32	40	48	60	73
3.6-4kg	28	37	46	56	70	84
>4.0kg	30	40	50	60	75	90

2.1.1.24.6 Suggested type of intravenous fluids for neonates.

Always start with dextrose in the first 24-48 hours. Electrolyte supplementation can begin after 48 hours once renal function is established. Transdermal water loss may be high in <1000g (extremely low birthweight ELBW) infants, therefore their fluid requirements are higher for the first 24-72 hours.

First 48 hours

- For the first 48 hours use 10% dextrose (D10)
- For babies <1kg use 5% Dextrose (D5) and monitor RBS

- Additives are generally not required for the first 48 hours
- Ideally 10% dextrose should be available
- If ready - made 10% glucose solution is not available: remove 100 ml of 5% dextrose from a 500 ml bottle or bag, then add 50 ml of 50% dextrose to the remaining 400 ml of 5% dextrose to obtain 450 ml of 10% dextrose solution

After 48 hours

- After 48 hours, in addition to 10% dextrose, sodium is also needed
- Ideally use pre -prepared IV fluids for neonates (neonatalyte)
- If unavailable, use 2 parts 10% dextrose to 1 part ½ SD (e.g 66ml 10% dextrose mixed with 34ml ½ SD to make 100ml of IVF)

2.1.1.25 Neonatal Infections

2.1.1.25.1 Neonatal Sepsis

What is it?

Neonatal sepsis can be divided into early neonatal sepsis (< 72 hours of age) and late neonatal sepsis (>72 hours of age). It can also be divided into hospital-acquired and community-acquired sepsis – the management is the same

What are the risk factors for early neonatal sepsis?

- Prolonged rupture of the membranes (PROM) > 18 hours and the mother has not received antibiotics > 4 hours before delivery
- Preterm baby <37 weeks
- Suspected or confirmed chorioamnionitis in the mother/ Foul smelling or purulent amniotic fluid
- Maternal fever >38°C (Not malaria) before delivery or last week of pregnancy
- Other infection in mother e.g. urinary tract infection, and the mother has not received antibiotics > 4 hours before delivery
- Mother has had previous neonatal deaths or early onset sepsis in previous baby

What are the risk factors for late onset neonatal sepsis?

- Unsafe cord cutting/cord care
- Prolonged stay on NICU
- Invasive procedures
- Lengthy Iv cannula duration
- Poor hand hygiene

What are the clinical signs of neonatal sepsis?

Signs of sepsis can be very non-specific, they include:

Fever

- Temperature of 38 °C on one occasion
- Temperature > 37.5 °C on two occasions separated by at least one hour
- This can cause difficulties in the hot season when the outside temperature is high. If the Infant has a fever > 37.5°C but less than 38 °C and looks well, unwrap the infant put in the coolest part of the room – DO NOT give paracetamol. Then recheck the temperature in 4 hours, if the fever is still present treat as neonatal sepsis.

Hypothermia

- Temperature <35.5 °C

Shock

- Cold hands and feet
- Capillary refill time >3s
- Tachycardic >180 beats per minute

Respiratory distress

- Tachypnoeic (Respiratory Rate > 60 breaths/min)
- Chest indrawing
- Tracheal Tug
- Sternal recession
- Head bobbing

- Nasal flaring
- Grunting
- Cyanosis or SpO_2 <90% on air

Apnoeas and slow breathing

- No breaths for 15-20 seconds; especially in a term baby or previously well preterm baby
- Respiratory rate <20/min
- Gasping

Gastrointestinal

- Refusal to breastfeed or poor feeding
- Abdominal distension
- Vomiting repeatedly
- Bilious vomiting
- Bilious aspirates from NGT

Neurological

- Lethargy or not waking for feeds
- Reduced activity
- Seizures
- Abnormal posture i.e. opisthotonus
- Floppy

Skin

- Jaundice - Yellow skin, sclera or mucous membranes
- Local signs of infection on the skin

Management of neonates at risk of Neonatal Sepsis

For babies with any of the maternal risk factors outlined above but who are clinically well , CRP and blood cultures should be performed and antibiotics should started.

- If the baby becomes clinically unwell, treat for 7 days as per sepsis protocol.

- If baby remains clinically well for 48 hours, consider stopping antibiotics.
- If CRP available, repeat CRP after 48 hours and if normal discontinue antibiotics.
- If CRP is elevated at any time (>10mg/dL) continue antibiotics for 7 days as per sepsis protocol.
- If blood culture has been taken and is positive change antibiotics according to the sensitivity and treat for 7 days as per sepsis protocol.

Management of neonates with clinical signs of sepsis

Resus

- Stabilise using Emergency ABC approach

Clinical features

- One or more of the clinical signs of sepsis listed above

Invest-igations

- Blood glucose
- Complete blood count (CBC)
- C-reactive protein (CRP)
- Blood culture
- Lumbar puncture
- Send CSF for microscopy (white cells, red cells, organisms), culture, protein and glucose
- If stable and respiratory signs are present consider chest x-ray to differentiate pneumonia from other causes
- Where expertise and equipment are available consider the use of bedside lung ultrasound
- Consider blood smear (BS) or Rapid Diagnostic Test (RDT) for malaria if mother has had malaria <7 days before delivery or poor response to antimicrobials

Treatment

- IV access
- Fluid bolus of normal saline 10ml/kg if signs of shock
- Dextrose 10% bolus 2ml/kg if hypoglycaemia
- Start first line antibiotics IV (Ampicillin 100mg/kg twice day 0-7, 8 houlry >8 day) and Genatmicin as per formulary). Add Cloxacillin/Vancomycin if signs of skin sepsis

Monitor

- If CRP testing is **NOT** available treat clinically for 7 days.
- If CRP testing is available: Inital AND repeat CRP after 48 hours are <10mg/dL AND neonate now well then consdier discontinuing antibiotics.
- If CRP is elevated at any time >10mg/dL continue antibiotics for 7 days.
- If condition does not improve after 48 hours or neonate is still febrile after 48 hours change to secondline antibiotics and consider referal to a higher level unit
- If blood culture has been taken and is positive change antibiotics according to the sensitivity

2.1.1.25.2 Neonatal Meningitis

What is it?

Neonatal meningitis is inflammation of the meninges (the membrane lining of the brain and spinal cord) usually due to bacterial infection

What are the risk factors for neonatal meningitis?

The same as neonatal sepsis

What are the clinical features of neonatal meningitis?

Initially the baby may present with general signs of neonatal sepsis (respiratory distress, apnoea, shock, irritability, lethargy, temperature instability and poor feeding)

Up to 25% of neonates with neonatal sepsis may also have neonatal meningitis.

Specific signs of neonatal meningitis may only be present in around 15% of babies and include:

- Full, tense or bulging fontanelle
- Seizures
- Opisthotonus posturing (exaggerated extension of the head and neck)
- Reduced consciousness
- Increased irritability
- High-pitched cry

Lumbar Puncture (LP)

- Ideally all neonates with signs of sepsis should have a lumbar puncture (LP) to rule out meningitis. This is because around 25% of neonates with general signs of sepsis will also have meningitis
- Any neonate with clinical features of meningitis above should have an LP if not contraindicated.

- Ideally the LP (and blood culture) should be done before starting antibiotics
- **Do not delay** starting antibiotics to undertake an LP. If an LP cannot be done **within 30 minutes** antibiotics must be started.
- Cerebral Spinal Fluid (CSF) should be sent for microscopy, culture, protein and glucose
- Abnormal findings in CSF include:
  - Positive gram stain and/or culture
  - White cell count >$10x10^6$/L
  - Any neutrophils in the CSF
  - Protein > 1.27 g/L
- Glucose <50% of serum glucose OR <2.5mmol/L[1]
- Even if the CSF culture is negative and one of the above findings are abnormal, **treat for meningitis**

[1] *Thomson et al. Cerebrospinal Fluid Reference Values for Young Infants Undergoing Lumbar Puncture. Pediatrics, 141, 3, 2018.*

How is neonatal meningitis managed?

Resus

- Stabilise using Emergency ABC approach

Clinical features

- One or more of the clinical signs of sepsis listed above
- Some babies may have specific signs of meningitis listed above

Invest-igations

- Blood glucose
- Complete blood count (CBC)
- C-reactive protein (CRP)
- Blood culture
- Lumbar puncture
- Send CSF for microscopy (white cells, red cells, organisms), culture, protein and glucose
- If stable and respiratory signs are present consider chest x-ray to differentiate pneumonia from other causes
- Where expertise and equipment are available consider the use of bedside lung ultrasound
- Blood smear (BS) or Rapid diagnostic test (RDT) for malaria

Treatment

- IV access
- Fluid bolus of normal saline 10ml/kg if signs of shock
- Dextrose 10% (D10) bolus is hypoglycaemia
- Start antibiotics IV as described below

Monitor

- Treatment of neonatal meningitis should be for a minimum of 14 days IV
- If blood culture or CSF culture in a baby with meningitis shows a gram negative infection, this should be increased to 21 days

Treatment of meningitis

If there are clinical features of meningitis start:

- High-dose ampicillin (100mg/kg 12 hourly for 1st 7 days and 8 hourly after 7 days) **and** Cefotaxime (50mg/kg 12 hourly)
- If Cefotaxime is not available start high-dose Ceftriaxone (100mg/kg once daily)

Once the CSF results are available, or if poor response to the above antibiotics, discuss the antibiotic regime and duration with a senior colleague and consider referral to a higher level unit.

Duration of treatment

This depends on the pathogens and the clinical response, usually 14 to 21 days

- Minimum of 14 days of antibiotics
- For gram negative meningitis at least 21 days of treatment

Follow-up

At least 6 moths of follow-up for neurodevelopmental and hearing outcomes is advised for neonates who had meningitis.

2.1.1.25.3 Omphalitis

What is it?

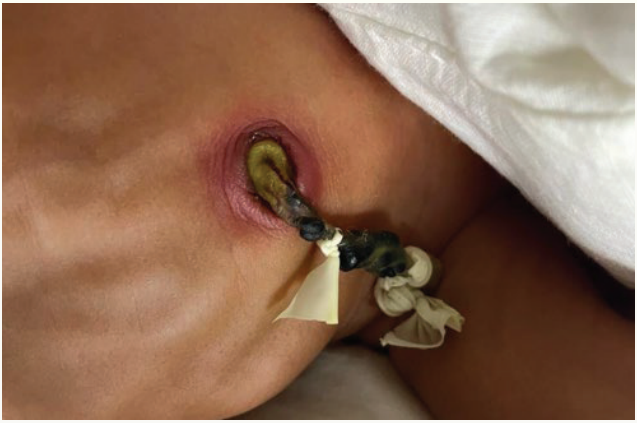
Omphalitis is infection of the umbilical cord. The umbilicus is an important portal of infection in the neonatal period; preventable with good cord care.

What are the risk factors for omphalitis?

- Home delivery
- Non-sterile equipment used for cutting the cord
- Poor cord care (e.g. applying dung, herbs, saliva etc)

What are the clinical features?

The presence of erythema (redness) and oedema (swelling) around the umbilical cord. If severe, there may be pus discharge and a foul smell associated.



Prevention

Cut cord with sterile equipment
Apply chlorhexidine 4% di-gluconate after birth
Daily cleaning with normal saline/cooled, boiled water
Minimal handling
Avoid applying anything to the cord after the initial chlorhexidine

Treatment

Clean the cord well with chlorhexidine 4% for 7 days.
Start 1st line antibiotics (doses as per Neonatal Formulary)

2.1.1.25.4 Congenital infections

What is it?

Congenital infections are infections acquired from the mother antenatally or at birth. They include syphilis, cytomegalovirus (CMV), rubella, toxoplasmosis, herpes, HIV.

What are the clinical features?

the following may be present with any of the congenital infections:

- Growth restriction
- Hepatomegaly
- Splenomegaly
- Jaundice (conjugated)
- Anaemia
- Thrombocytopenia
- Petechiae
- Microcephaly
- Chorioretinitis/cataracts
- Hydrops (non-immune)
- Skin rash
- Lymphadenopathy

Growth restriction alone with no other signs is NOT an indication for investigation

The following signs may point to specific infections:

- Rubella: PDA and cataracts
- Toxoplasmosis: Generalized intracerebral calcifications and hydrocephalus
- CMV: Periventricular calcifications and microcephaly
- Syphilis: Large pale placenta, rash on palms and soles, snuffles.

2.1.1.25.5 Syphilis

What is it

The most common congenital infection in our setting.

Investigations

Specific syphilis tests such as TPHA remain positive for life so are useful for helping to rule out, but do not diagnose syphilis.

An early negative RPR/VDRL does not exclude congenital syphilis – the test only becomes positive 2 months after infection and the rapid test has more false negative tests. Re-check the mother and consider sending a RPR/VDRL on the baby.

Specific treponemal tests such TPHA are of little use when testing the baby as this will pick up maternal antibodies.

False positive RPR results (usually low titre < 1:16) can occur with infections, SLE, lymphoma, connective tissue disease and pregnancy itself.

False negative results in rapid tests can be caused when the antibody titre is very high (prozone effect). Laboratory testing can include dilution in suspicious cases.

What is the treatment

Penicillin has been fully tested – should be continued even if other antibiotics are introduced. If the course is interrupted by more than 24 hours it should be restarted from the beginning. The doses are given below:

Symptomatic neonate	**10-day course:** Benzylpenicillin G (IV) 50,000 U/kg/dose 12 hourly day 0-7 of life, 8 hourly >7 days OR procaine pen (IM) 50,000 U/kg/day
Asymptomatic neonate + partially or untreated mother	**Single dose:** Benzathine penicillin G (IM) 50,000 U/kg

- Ideally test all mothers at delivery
- Maternal treatment must include adequate treatment with penicillin
- There is no need for routine lumbar puncture
- Congenital syphilis is a notifiable disease.

- Maternal contacts should be treated.
- All fully treated infants should ideally have their VDRL/RPR rechecked at 3 months to ensure the titre is decreasing.

2.1.1.25.6 Cytomegalovirus (CMV)

Investigations

CMV is one of the commonest causes of hearing loss in infants.
Send urine for CMV PCR. If this is positive in an infant less than 3 weeks of age, it confirms congenital CMV. IgM is only positive in 50%.

Treatment

- Recommended for symptomatic infants with either:
    - CNS disease: microcephaly, chorio-retinitis, periventricular calcifications
    - Severe organ disease: hepatitis, pneumonitis, bone marrow suppression
- Ganciclovir or valganciclovir improve survival, hearing and development if started before 30 days of life. Valganciclovir (oral) can be used in clinically stable infants.
    - Treatment is expensive with side-effects e.g., neutropaenia requiring monitoring
    - Treat for a minimum of 6 weeks – however 6 months is now recommended.

2.1.1.25.7 Toxoplasmosis

What is it

Congenital toxoplasmosis is rare. The placenta is the most useful for diagnosis. Serology especially IgA and IgM may be done but may need serial titres. PCR and imaging may also help.

Treatment

This should be discussed with an infectious disease expert as it is prolonged, involves multiple drugs.

2.1.1.25.8 Herpes

What is it

This is very rarely a true congenital infection and is usually acquired perinatally from the maternal genital tract. Do not rely on a history of herpes lesions from the mother as most of the transmission occurs in maternal primary infection and only 30% of mothers have a known history of herpes ulcers.

Disease usually develops 3-10 days after delivery and is more common in a preterm neonate.

Clinical features

Only 50% of infants will have any skin lesions and the infant may look as though they have bacterial sepsis. Fever and aseptic meningitis should increase your suspicion of herpes.

Investigation

Herpes IgM is very unreliable. Send blood/CSF/vesicle fluid for herpes PCR.

Treatment

High dose acyclovir (20 mg/kg 8 hourly) for 2 or 3 weeks.

2.1.1.25.9 Rubella

What is it

There may be a history of maternal rubella infection in the first trimester.

Investigations

Send urine for rubella PCR.

Management

Remember these babies are infectious but there is no specific treatment. Isolate from pregnant staff or caretakers.

Ophthalmology and hearing should be checked. Neurodevelopmental follow-up is essential.

2.1.1.25.10 Hepatitis B

What is it

Hepatitis B virus can be transmitted to the neonate during birth via blood and secretions.

Mothers who are carriers are hepatitis B surface antigen (HBsAg) positive.

Infected mothers are at a high risk of transmitting the virus to their babies if they are Hepatitis B e antigen (HBeAg) positive.

Chances of transmission

- HBsAg positive and HBeAg negative: 10%
- HBsAg positive and HBeAg positive: 80-90%
- Infants infected at birth have a 90% chance of chronic infection and 15-45% of these will develop cirrhosis and /or hepatocellular carcinoma as young adults.

Investigation

- The infants are asymptomatic at birth, with signs only presenting at 2-6 months. This usually consist of mild liver enzyme elevations. Rarely jaundice, hepatomegaly or liver failure can occur. Hepatitis B investigations should therefore not be part of the routine work-up of unexplained jaundice if the child is less than 6 weeks old.

Prophylaxis against Hepatitis B (as soon as possible but within 24 hours)

- If mother is positive, the neonate should receive Hepatitis B vaccine within the 1st 24 hours of life. (Active immunisation of **ALL** babies against Hepatitis B is now routine in Uganda (0.5 ml, 10 mg, IM into the thigh)
- For high-risk neonates, passive immunisation (immunoglobulin) can be given, 200 IU into the opposite thigh (2ml of the Heba gam formulation):
  - **i.** Mothers are HBeAg positive OR the HBeAg is not known
  - **ii.** Mothers have symptomatic acute disease
  - **iii.** All babies <1500g who are born to HBsAg positive mothers

Breastfeeding in neonates of hepatitis B positive mothers

- Breastfeeding should be continued
- Mothers whose nipples and/or surrounding areola are cracked and bleeding should take caution
- If mothers have symptomatic acute disease, breastfeeding should be done with caution

Follow-up

- Refer for follow-up at 9 months of age for HBsAg and surface antibody testing.
- If the infant is discovered to be Hep B infected, they should be referred to a specialist or paediatric clinic.
- If non-immune, then revaccinate.

2.1.1.25.11 Tuberculosis

What it is

An infant is considered TB exposed:

- If born to a mother with known TB who has received <2 months of treatment

- If the mother has been on treatment for > 2 months but is noncompliant or still has signs, symptoms or laboratory tests indicating persistent TB. MDR/XDR TB is then a greater possibility.

  One should check the sensitivities of the mother in all cases

N.B: Consult TB treatment TB team if MDR/XDR confirmed or suspected

Congenital TB

- True intra-uterine transmission of TB. This is fortunately rare but does occur
- This is by direct hematogenous spread via the umbilical vein or ingestion of infected amniotic fluid
- The infant who acquired TB congenitally may be born with a septic-like picture, hepato-splenomegaly, conjugated jaundice, ascites, pneumonia, fever, papules and petechiae

Perinatal TB

- TB acquired in utero (congenital, see above), intrapartum or during the early newborn period
- Mortality is high, varying from 2-60% depending on delay to presentation and other factors, such as prematurity and co-infection with HIV
- Complications include a high rate of miliary tuberculosis and meningitis, resulting in seizures, deafness and death
- Impairment of innate pulmonary defences place the infant at high risk of TB, and may result in miliary or cavitating disease
- Delayed-type hypersensitivity to purified protein derivative may be absent in up to 80% of cases therefore the Mantoux may be negative
- Most perinatal cases present after a few days to weeks with respiratory signs (tachypnoea present in over 80% of the cases). Fever, lethargy and hepatomegaly are also common.

- Over 50% of the infants have a miliary picture on CXR and 33% of the infants have CSF abnormalities

Management

Well TB exposed infant with no physical signs of perinatal TB

- No investigation if the baby is newborn (i.e not exposed postnatally)
- Start on prophylaxis of Isoniazid (INH)
- Baby must be referred to TB Clinic for continued prophylaxis and surveillance
- DO NOT give BCG vaccine – this is important as INH may kill the Mycobacterium bovis in the BCG. Also, BCG may confuse the interpretations of tuberculin skin tests if they are subsequently done diseaseto try and prove TB disease
- BCG vaccination should only occur at the completion of the TB prophylaxis regimen except in the case of HIV positive infants, who should not receive BCG
- If the baby is well enough to go to the mother, this may be done as long as the mother has started treatment and the baby is on prophylaxis.

Very recent maternal diagnosis (or suspicion of TB)

The mother should only have contact with her baby if she is wearing an effective mask (N95) and having been on TB treatment for at least 2 weeks.

Preterm neonates

In very preterm neonates (<32 weeks) who has feeding difficulties, prophylaxis can be deferred until the baby is on full feeds as long as the mother is thought to be a low infection risk (been on treatment for > 2 weeks and wearing a mask)

Unwell infant with TB disease

Refer to TB clinic for initiation treatment

Investigations

INVESTIGATIONS FOR TUBERCULOSIS	
Microscopy and culture: Placenta – histology for TB granulomata Gastric washings (x2) Tracheal aspirate (if intubated) CSF – Raised protein and lymphocyte predominance	Imaging: • Chest Xray: Miliary pattern, lymph nodes, cavitations • US abdomen: Can demonstrate enlarged lymph nodes indicating abdominal TB
	Skin Tests: Mantoux is the test of choice but is often negative

Treatment

Drug treatment should be initiated in conjunction with the TB clinic:

- Isoniazid (INH) 10 mg/kg/day (range 10-15 mg/kg/day) 6 months
- Rifampicin (RIF) 15 mg/kg/day (10-20 mg/kg/day) 6months
- Pyrazinamide (PZA) 35 mg/kg/day (30-40 mg/kg/day) 2months
- Ethionamide 15-25 mg/kg/day OR ethambutol 15-25 mg/kg/day) 2months

Monitor for liver toxicity – check ALT and monitor for jaundice.

2.1.1.25.12 Human immunodeficiency virus (HIV) exposed neonate

What it is

PMTCT has been extremely effective and to further decrease the transmission, one must be able to identify the high-risk infant.

High Risk Criteria

A mother with any of the following:

- Unknown maternal HIV status (pending results)
- Viral load > 1000 copies/ml or no viral load within 12 weeks of delivery
- Less than 12 weeks of effective ART before delivery

It is also important to note that PMTCT policies may change, as new data is available, although the same principles will apply.

2.1.1.26 Discharge criteria

2.1.1.26.1 Discharge planning

Deciding when to discharge a baby requires a full assessment of the baby in the following key areas: feeding, respiratory, temperature, neurology, and general assessment.

2.1.1.26.2 Discharge criteria

The following general criteria should be met before the neonate is discharged (Table 25). Guidelines for discharge procedures, including for specific clinical conditions, is described in (Table 26).

Table 25: General neonatal discharge criteria

Area	Discharge criteria checklist
Feeding	• Neonate does not require intravenous fluids. • Neonate tolerating at least 8 feeds per day (i.e. 3 hourly feeds) of a total of 150ml/kg/day or more or is breastfeeding well on demand. • Does not require an Ngt • Neonate has gained at least 15g/kg/day for at least 3 days if >7 days of life. • The mother/caregiver is confident to feed and look after the neonate. • Neonate is passing urine and stool normally.
Respiratory	• There are no signs of respiratory distress. • For preterm or low birth weight neonates, no apnoea for 3 days without caffeine or aminophylline.
Temperature	• Neonate can maintain own temperature 36.5–37oC without the use of incubator or radiant heater sources for at least 3 days.
Neurologic	• For those with HIE and treated with anticonvulsants, no convulsions for 72 hours off anti-convulsant therapy • Those with features of epilepsy, the seizures should be controlled
General	• Baby has no danger signs including fever, jaundice, convulsions, abdominal distension. • Mother/ Caregiver has been informed about the warning signs of illness. • Mother/Caregiver has been advised on safe methods of newborn care including sleeping on back (not side or stomach) and not covering the neonate's face with blanket or clothes. • Community support systems have been offered for HIV positive mothers, adolescent mothers, or single care givers.

Table 26: Discharge procedure for neonates admitted to the neonatal unit

Procedure	Condition	Plan
Discharge examination	Low birth weight or preterm neonate	Weight of greater than 1.5 kgs and corrected gestational age of >34/40 Cup feeding 150 ml/Kg in 24 hours • Doing KMC successfully/ KMC score >19 • Baby regulates body temperature at room temperature with the use of KMC • No apnoeas or bradycardia > 48 hours • Mother/carer competent and confident in caring for her baby Completed a course of anti-microbial treatment and baby well Feeding well and gaining weight
	Neonates with serious Infection	Completed treatment, Seizures controlled, baby has a feeding plan and is gaining weight
	Neonates with encephalopathy and seizures	No signs of respiratory distress. Off oxygen for 24 hours and feeding well Full assessment of the baby to detect abnormalities, and manage risk factors such as; HIV, any predisposition for jaundice,
	Respiratory problem	Screening for diseases such as sickle cell, pulse oximetry to detect congenital heart diseases
	Well baby on the postnatal ward	

Procedure	Condition	Plan
Give immunization according to the UNEPI schedules.	For all the neonates * For the VLBW or very small neonates start immunization as soon as they are stable and continue according to UNEPI schedules. *note VLBW neonates are at risk of apnoea for 24 hours post-immunisation and should be monitored carefully when possible	Give BCG and OPV 0, Hepatitis B 0 if less than 2 weeks of age. If mother Hep B positive give Hep B 0 within 24 hours of age regardless of weight If more than 2 weeks and baby has not yet received OPV0; Give BCG and Hep B 0 and leave out OPV0, and then at 6 weeks give OPV1, DPT-Hib-IPV1, HepB 1, PCV1, and RV1. Continue at 10 weeks with the UNEPI schedule. Use Chronological age to administer vaccines
Documentation of the information	For all neonates	Information is documented in the newborn section of the maternal record (mother baby passport) and the Road to Health Booklet.
Counsel mother and caregiver on good neonatal care	For all neonates	Counsel on exclusive breast feeding, hygiene, infection control, danger signs and vaccinations
Counsel mother and caregiver when to return immediately to the neonatal unit	For all neonates	Feeding poorly Convulsions Fever Cough with fast breathing Bleeding, diarrhoea

Procedure	Condition	Plan
		Pus draining from the eyes, skin pustules Cord stump red or draining pus Yellow hands and feet
Drugs or supplements to be prescribed or given to the mother/caregiver at discharge	For HIV exposed neonates	Ensure prophylaxis has been provided and follow up arranged including review of drugs and serology testing Prescribe Multivitamin (containing vitamin D, phosphorus and calcium) drops if not already started.
	Preterm/LBW neonates	Prescribe iron* (Fe) syrup for infants born at < 35 weeks or with BW < 2 kg from two weeks through 6 months of age. - If NOT anaemic, give preventive dose: 2 mg/kg/day of elemental Fe - If anaemic (based on laboratory testing or clinical symptoms of pallor, lethargy or increased HR), give treatment dose: 4 mg/kg/day elemental Fe for 3 months.
Document in the medical records	All neonates	- Document the following parameters on discharge: Contact details for follow-up Weight of baby at discharge Head circumference of baby at discharge Final diagnosis Drugs prescribed If newborn died, the cause of death.

* Iron in syrup form is available in several different salt forms and concentrations. Each salt (i.e. ferrous fumarate, ferrous sulfate) contains a different portion of elemental iron. The medication label should be checked carefully by health worker to confirm the concentration of elemental iron contained in the syrup for prescribing. Parents should be instructed on exact volume to administer since accidental overdose of iron can result in serious illness to infants.

2.1.1.26.3 Discharge planning for neonates

Table 27 summarizes the different conditions that the baby may have and counselling parents when to bring their back to hospital once discharged home.

Table 27: Discharge planning for neonates discharged from the neonatal unit

Condition	Clinic	When
ALL Babies	**Postnatal clinic**	Day 6 (Refer to guideline on outpatient care of newborns for details)
High Risk Babies Low birth weight 2.5 kgs or preterm babies < **35 weeks Gestation** Meningitis or sepsis Moderate to severe Neonatal encephalopathy Severe hypoglycaemia Severe Jaundice Necrotizing enterocolitis HIV positive mother/at risk of HIV infection Newborns with concern for feeding difficulty. Other concerns for vulnerability	**Preterm clinic / High risk clinic**	See after one week after discharge For preterm/LBW neonates, see weekly till 2.5 kgs For preterms and those at high risk of neurodevelopmental impairment review at 6 months and 12 months for neurodevelopmental assessment

Follow up schedule

Discharge weight <2.5kg:

- 1st visit after 1 week for 2 visits
- Every 2 weeks until 2.5kg
- Monthly until 6 months of age
- then 2 monthly until 1 year of age

- Increase frequency of visits if any concerns found
- If ongoing concerns, continue 3 monthly follow up to 2 years of age (refer to paediatrics following that if needed)

Discharge weight > 2.5kg

- 1 weeks after discharge
- Monthly until 6 months old
- 3 monthly until 1 year of age
- Increase frequency of visits if any concerns found
- If ongoing concerns, continue 3 monthly follow up to 2 years of age (refer to paediatrics ollowing that if needed)

Where possible, combine follow-up visits with vaccinations and other visits (e,g ROP screening) to minimise on travel time and costs.

Follow up activities

- Weight
- Head circumference
- Feeding habits
- Developmental assessment
- Vaccine schedule review
- Medication review including supplementation
- Ongoing education of care-giver
- Refer to family planning
- Liaising with other services/community workers

2.1.1.27 Neonatal transport and referral

2.1.1.27.1 Overview

Some neonates will require neonatal care at a more advanced level than is available at the facility they are admitted into. In these cases, neonates will require

a safe and timely referral to a higher level of neonatal care as well as within the facility.

2.1.1.27.1 Neonates who require referral from a HC I-III

- A baby with a neonatal danger sign - Seizures, respiratory distress, jaundice, poor feeding lethargy
- Babies whose weight is < 1500g

2.1.1.27.2 Neonates who require referral from a Level I neonatal unit

- Severe jaundice
- Apnoea
- Moderate or Severe respiratory distress requiring CPAP
- Persistent Vomiting / Bile-stained Vomitus
- Surgical Problems (refer directly to Level III)
- Persistent seizures

2.1.1.27.3 Neonates who require referral from a Level II neonatal unit

- Severe respiratory distress requiring mechanical ventilation or HFOV
- Exchange transfusion
- Advanced investigation e.g. metabolic disease, prolonged jaundice
- Requiring paediatric surgery
- ROP treatment

2.1.1.27.4 What to do before Referral

- Maintain airway
- Ensure oxygen saturations 90-95%
- Prevent Hypothermia: The neonate can be initiated on KMC or use other appropriate warmer if KMC not an option.
- Prevent Hypoglycemia
- Breastfeed when safe and appropriate to do so e.g. >1500g, no respiratory

distress, no seizures. Otherwise, if not contraindicated, insert a NGT tube for feeding and initiate express breast milk. Where it is not safe to give breastmilk, initiate IV dextrose 10% according to the guidelines (SECTION

- Apnea: For all Babies less than 1.5kg give a loading dose of Aminophylline OR Caffeine citrate
- Seizures: Give a loading dose of Phenobarbitone 20mg/kg
- Treat with antibiotics when indicated: (Ampicillin and Gentamicin) when indicated e.g. signs of sepsis, preterm <1500g
- Communication: Explain condition and reasons for transport to family. Communication with referral unit regarding condition of baby, approximate time of arrival, working diagnosis, what has already been done Complete a referral note mentioning reasons for transfer, medications given along with dose and timings to the referring facility above and order for transport.
- All referrals should be transported in an appropriate class B ambulance with an accompanying health care worker trained in basic/advanced newborn life support
- There is need for constant monitoring of the neonate while being transferred.
- On arrival, a clear handover should be given to the receiving unit

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