

NATIONAL GUIDELINES FOR NEWBORN CARE

VOLUME I

- Care of the normal newborn at birth and beyond
- Hypothermia and thermal control
- Breastfeeding
- Fluid management
- Low birth weight and preterm babies
- Hypoglycaemia

Ministry of Health
2020



Family Health Bureau



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STATEMENT OF INTENT

The main purpose of these guidelines is to improve the quality of clinical care provided by the health care providers at all levels. These parameters of practice should be considered recommendations only. The ultimate judgment regarding a particular clinical procedure or a treatment plan must be made by the clinician in light of the clinical data gathered from the patient and the diagnosis and treatment options available.

Designed by Ajith Kumara Jayamanne

Preface

Sri Lanka has a vision to have no preventable deaths of mothers, fetuses and newborns, where every pregnancy is planned and wanted, every birth celebrated, and women, babies and children survive, thrive and reach their full potential as per the Maternal and Newborn Health Strategic Plan 2017-2025. For the country to ensure reaching the set vision, goals and objectives evidence based updated guidelines for the use of staff caring for new-borns are essential.

This set of guidelines is updated based on the current updated global evidence in place. As per the previous National Guidelines for Newborn Care 2014, greater emphasis is on improving the quality of neonatal care services in the country with a view of further reducing neonatal morbidity and mortality in Sri Lanka. This is an attempt to improve the quality and uniformity of clinical care with efficiency, cost effectiveness and accountability.

We highly appreciate the contribution made by the Consultant Neonatologists and Consultant Paediatricians from the Sri Lanka College of Paediatricians and Consultant Community Physicians of the Family Health Bureau in updating, adopting and developing these guidelines. Further these guidelines are developed as per national policies, strategies and standards and considering the facilities and resources available in the country. As such this set of guidelines are national guidelines for the conditions described and all health care workers are requested to follow the same.

Dr Asela Gunawardena

Director General of Health Services
Ministry of Health
Sri Lanka

2020

Message from the President of Sri Lanka College of Paediatricians

Sri Lanka has set an example to many developing countries and reached a neonatal mortality rate of 6 per 1000 live births in 2015. However, this accounts for over 70% of infant mortality and regional and district disparities are observed. Reduction of mortality and morbidity remain a challenge despite continuous effort of health care staff, even with a lot of effort put into training of human resources and improving infrastructure. Focusing on the neonate specifically in these areas is a priority which remains unchanged. Simple interventions like preconception folic acid, antenatal corticosteroids for preterm delivery, preventing inadvertent oxygen administration and using a pulse oximeter for neonatal resuscitation, delayed cord clamping, delivery onto abdomen of the mother, using plastic bags for preterm babies, preventing hypothermia, simple inflation and ventilation breaths by the midwife or nurse in unexpected situations, passive head cooling for asphyxia, promotion of exclusive breast feeding on demand could be practiced in low resource settings and has a direct link to reduce neonatal mortality and morbidity. Furthermore, advanced newborn care such as treatment of infections, neonatal ventilation, extra care for premature newborns, surgical interventions, therapeutic cooling and NO therapy are performed with the aim of further reducing neonatal mortality and improving the quality of life of newborns.

A team of Consultant Neonatologists, Consultant Paediatricians and Consultant Community Physicians have been working on revising and updating these newborn care guidelines. These guidelines for newborn care will further go a long way to bring uniformity in standards of neonatal care across the country to further improve quality of care. The health care providers all over the country can utilize these guidelines and care for newborns in a uniform manner using the best standards of care.

I express my sincere gratitude towards all who worked hard to revise this document. I am certain that, these guidelines will have a great impact on improving the quality of care and reducing the mortality and morbidity among newborns in Sri Lanka.

Prof Vasantha Devasiri

President

Sri Lanka College of Paediatricians

Acknowledgements

Revising the existing national newborn care guidelines is a timely need in keeping with the new scientific evidence available globally, thus to improve quality survival of newborns via evidence based practices. Sri Lanka aims at reaching the sustainable developmental goals (SDGs) by the year 2030. Preventing all preventable deaths among newborns cannot be achieved without achieving quality of care. Sri Lanka is already on track to achieve the targeted neonatal mortality rate of 2 per 1000 live births in concordance with the SDG targets.

Quality coverage of newborn care provided at all levels is essential to ensure further reduction of neonatal mortality and morbidity. With 99.9% of births occurring in institutions, care given during birth and immediately after, lead to triple investment including reduction of neonatal deaths.

Publishing the updated National Guidelines for Newborn Care 2020 would not have been possible without the commitment and support from many individuals and organizations. We greatly appreciate the administrative support extended by Dr. Susie Perera, Deputy Director General, Public Health Services II, Ministry of Health.

The Family Health Bureau gratefully acknowledges contributions of all the technical experts of the guideline development committee and the Sri Lanka College of Paediatricians for updating the guidelines despite their busy schedules.

We are thankful to the UNICEF country office Sri Lanka for supporting this activity technically and financially.

Electronic version of these guidelines will be available for ease of reference for all health care workers. The heads of health institutions and technical supervisors are expected to ensure availability of this document in all neonatal units, postnatal units and labour rooms for easy access. We hope the updated national newborn care guidelines will help to improve quality of care for our newborns by adhering to the highest standard of care while maintaining uniformity of health services in Sri Lanka so all newborns may survive, thrive and transform to reach their highest growth potential.

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List of abbreviations

AA	Amino acid
AIDS	Acquired immunodeficiency syndrome
ALP	Alkaline phosphatase
ANS	Antenatal steroids
APH	Antepartum haemorrhage
BAT	Brown adipose tissue
BCG	Bacillus calmette-guerin
BFHI	Baby friendly hospital initiative
BG	Blood glucose
CBS	Capillary blood sugar
CDC	Centre for disease control
CGA	Completed gestational age
CHDR	Child health development record
CPAP	Continuous positive airway pressure
CRL	Crown rump length
DHS	Demographic health survey
DPT	Diphtheria, pertussis, tetanus
DT	Diphtheria, tetanus
EBM	Expressed breast milk
EmNOC	Emergency newborn and obstetric care
fIPV	Fractional dose of inactivated polio vaccine
GIR	Glucose infusion rate
HIV	Human immunodeficiency virus
IgA	Immunoglobulin A
IM	Intramuscular
IQ	Intelligence quotient

IUGR	Intrauterine growth restriction
IV	Intravenous
IVH	Intra ventricular haemorrhage
IYCF	Infant and young child feeding
JE	Japanese encephalitis
KMC	Kangaroo mother care
LBW	Low birth weight
MEN	Minimal enteral nutrition
MMR	Measles, mumps, rubella
MOH	Medical officer of health
NG	Nasogastric
NLS	Neonatal life support
NNS	Non nutritive sucking
OFC	Occipitofrontal circumference
OPV	Oral polio vaccine
PHM	Public health midwife
PMO	Pressure monitoring
RCOG	Royal college of obstetricians and gynaecologists
RDS	Respiratory distress syndrome
ROP	Retinopathy of prematurity
SCBU/NICU	Special care baby unit/ neonatal intensive care unit
SGA	Small for gestational age
UNICEF	United nations international children's emergency fund
VLBW	Very low birth weight
WHO	World health organization

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Introduction

Clinical guidelines are systematically developed statements which assist clinicians in making decisions about appropriate treatment for specific conditions based on the best scientific evidence at the time of development. Guidelines are not intended to limit the clinical freedom. However, clinicians are expected to follow these recommendations as the basis for their decision making. Availability of resources, the existing situations and the expectations of individual families under their care need to be considered by the clinicians.

These guidelines are developed by the group of consultants in the guidelines development committee. The sources of information that were used as references in preparing the guidelines included the UK NICE (National Institute for Clinical Excellence) guidelines, American Academy of Pediatrics guidelines, SDF Facility Based Care for the Sick Newborn manual, Roberton's Text book of Neonatology, WHO recommendations and relevant research papers from peer reviewed journals. The information from these sources were combined with our local expert opinion and knowledge of available technical facilities in the country when formulating the guidelines. The latest available scientific evidence based recommendations have been made as far as possible. The draft guidelines were presented to the wider forum of paediatricians and neonatologists, in order to obtain feedback after which a consensus was arrived at. The guidelines were then presented to the Technical Advisory Committee on Newborn and Child Health of the Ministry of Health and consensus was arrived at with the participation of a multidisciplinary team including medical administrators, provincial health authorities, representatives of the Sri Lanka College of Paediatricians and other relevant professional colleges and national programme managers and senior nursing officers.

Scope

The guidelines are intended to assist all health care professionals at all levels of institutions where newborn care is being provided, in the clinical management of normal and sick newborns

Disclaimer

These guidelines are based on current best available evidence and consensus opinion of the Consultants involved in the development of guidelines. They are neither intended to replace the process of critical evaluation of every case and nor is it intended to dictate an exclusive course of management or treatment. It must be interpreted with reference to individual patient needs, available resources and limitations unique to the institution and variations in local populations. This guideline on Neonatal Care has been developed based on the best available evidence at the time of preparation. It is the responsibility of the users of the guideline to keep updated with the latest evidence relevant to the management of patients under their care.

CARE OF THE NORMAL NEWBORN AT BIRTH AND BEYOND

Chapter 1

CARE OF THE NORMAL NEWBORN AT BIRTH AND BEYOND

1.1 Introduction

Birth is the crucial period of transition from in utero dependent life to ex-utero independent existence. Effective care at birth is needed for anticipation of problems with this transition and to provide support to ensure stabilisation. Majority of newborns would be in the postnatal ward, rooming-in with their mothers.

Newborns need to be monitored because they are at continued risk of hypothermia and infection. Signs of illness are very subtle and non-specific. Early detection avoids treatment delays and thereby minimises complications. They also need to be monitored to ensure that they establish breastfeeding during the first few days of life.

1.2 Aims of neonatal care immediately after birth

- Establishment of respiration (as per Newborn Life Support guidelines - Annexure 1)
- Prevention of hypothermia (refer Chapter 2)
- Establishment of breastfeeding (refer Chapter 3)
- Prevention of infection (refer Chapter 9)
- Detection of signs that require further assessment

1.2.1 Attendance by skilled health care professional

- There should be at least one skilled birth attendant who is responsible for providing standard care (Medical Officer/ Nursing Officer/ Midwife) available physically at the time of birth of all babies irrespective of risk status.
- The standard care at birth is the same irrespective of birthing place or person attending to birth.
- The available health care provider should have been trained in neonatal resuscitation.
- This health care provider must actually be present in the delivery room before the birth of the baby.

- The attending personnel should document the baby's details such as time of birth, weight, gender, Apgar score and any other relevant information in all cases.

1.2.2 *Ten steps in the immediate care of the newborn at birth*

1. Call out the time of birth
2. Deliver the baby onto the mother's abdomen
3. Dry baby with a warm clean towel; wipe eyes, while on the mother
4. Assess the baby's breathing while drying. Remove the wet towel and cover the baby with another dry towel
5. Clamp the umbilical cord at least 1 minute after (within 1 to 3 minutes – delayed cord clamping) the birth. If the baby is not breathing adequately and resuscitation is required clamp and cut the cord immediately
6. Keep baby covered with a warm towel while being in skin-to-skin contact with the mother
7. Put a hat on the baby's head
8. Allow the baby to remain on the abdomen or between mother's breasts for skin-to-skin contact until the first breastfeed is completed. Don't keep the baby on the warmer routinely
9. Place an identity label on baby
10. Encourage the first breastfeed as soon as possible after birth, when the baby shows hunger cues, within the first hour of birth

1.2.3 *Care of umbilical cord*

- Clamp the umbilical cord at least 1 minute after (between 1 to 3 minutes) birth provided the baby does not need to be resuscitated and the mother does not have a post-partum haemorrhage
- The sterile plastic cord clamp should be placed 2-3 cm (approximately 2 finger breaths) above the abdomen.
- Cut the umbilical cord with a sterile cord scissor, 1-2 cm above the cord clamp.



Figure 1.1 Clamping and cutting of umbilical cord
<https://www.google.com/www.todayparent.com/>

- The cord should be inspected frequently during the initial few hours after birth for early detection of any bleeding / oozing from the cord.
- Nothing should be applied on the stump (e.g. antiseptic)
- Keep the cord dry and clean (avoid being covered by nappy).

1.2.4 Baby identification marking

- Two discs containing the same number are used for this purpose.
- One is tied on the left wrist of the mother and the other on the newborn.
- The mother should be informed of the number on the disc.
- Pre-numbered baby tags can also be used for the purpose.

1.2.5 Initial weight recording

- The baby should be weighed only after the first breastfeed has been completed.
- Do not weigh the baby immediately after birth as it can cause hypothermia and colonisation of the baby's skin by harmful bacteria.
- All neonates should be weighed on a scale with at least 5 gram sensitivity. A digital scale measuring in kilograms to 3 decimal places is the preferred instrument

- A single-use paper towel or a sterile cloth towel should be placed on the weighing scale beneath the infant and tared before placing the baby.
- Weighing scale should be cleaned after each baby
- The weighing scale must be periodically (at least weekly) calibrated.

1.2.6 Initiation of breastfeeding

- Health professionals should assist the mother in initiating breastfeeding as early as possible, within one hour of birth. The time of initiation should be documented in the Neonatal Examination Format (Annexure 3.1).
- The mother and baby should be kept with skin-to-skin contact so that the baby can breastfeed when he/she is ready.

1.2.7 Vitamin K

- Vitamin K should be administered intramuscularly on the antero-lateral aspect of the thigh using a 26 gauge needle and 1ml syringe.
- Dose: birth weight $\geq 1500\text{g}$ – 1mg; $<1500\text{g}$ – 0.5 mg

1.2.8 Iron supplementation

- Iron supplementation is commenced along with complementary feeds at the completion of 6 months. Please refer the circular on iron supplementation (Annexure 2)

1.2.9 Clinical screening at birth

- Initial clinical screening should ideally be done while baby is still in skin-to-skin contact with the mother.
- Should be *quick but thorough* to identify any life-threatening congenital anomalies and birth injuries.
- Inspect the cut end of the cord for number of vessels - two umbilical arteries and one umbilical vein.
- If mother has a history of polyhydramnios or if baby has excessive frothing / salivation from the mouth the infant should

be examined for oesophageal patency by passing an orogastric tube.

- Rule out anal atresia by inspecting the anal opening at the normal site. Do not use a thermometer for this purpose.
- The oral cavity must be examined to exclude a cleft palate.
- Displacement of the heart towards the right side in association with respiratory difficulty and difficult resuscitation is suggestive of either diaphragmatic hernia or pneumothorax on the left side.
- Examine the back for any swelling or anomaly.

1.2.10 BCG vaccine

- BCG vaccine should be administered before leaving the hospital.
- BCG vaccine can be given while a baby is on antibiotics if child is systemically well.
- If a scar is not present 2nd dose could be offered after 6 months up to 5 years.

1.2.11 Stomach wash at birth

- Do not perform stomach wash in babies at birth.
- It is not useful even in babies born through meconium stained liquor.

1.2.12 Communication with the family

- The health care provider must communicate the time, birth weight, gender and condition of the infant to the mother and other family members.
- The infant should be shown to the family with particular attention given to the fact that family members get to know the gender and the identity tag on the infant.

1.3 Concept of golden hour

The concept of ‘golden hour’ is now used even for term healthy babies. By the end of the first hour the following should have been taken care of.

- Respiration and cardiovascular stability

- Maintenance of body temperature
- Breastfeeding
- Administration of Vitamin K
- Arranging transport if a transfer is necessary

Stabilisation within the first hour of life is vital to ensure the best possible outcome in newborns.

1.3.1 Identification of ‘at risk neonates’ needing management in SCBU/NICU

- Babies with birth weight < 1500g
- Babies with gestation < 34 weeks
- Other preterm and low birth weight babies should be assessed on an individual basis to decide whether admission is required
- Babies with major congenital malformations
- Babies who experienced hypoxic events requiring chest compressions at birth
- Babies with breathing difficulty

1.4 Care beyond birth

Babies in the postnatal ward should be assessed by a medical officer (MO) at least twice a day and by the nurse at frequent intervals. The baby should be observed for adequacy of breastfeeding, maintenance of temperature, jaundice, passage of urine/meconium, activity and danger signs.

1.4.1 Adequacy of feeding

Adequacy of feeding is best assessed by the weight gain / loss. Urine output is also helpful after the first few days of life.

1.4.1.1 Weight record

Most healthy term babies lose weight during the first few days of life. The weight loss can be up to 5 to 10 percent of the birth weight by day 5. The weight remains static during next one to two days and birth weight is regained by 10-14 days of life. Delayed feeding, poor feeding technique and unsatisfactory feeding schedule may be associated with excessive weight loss along with hypernatraemia.

- Any weight loss >5% per day is abnormal.
- However, preterm infants experience 2-3% weight loss daily up to a maximum of 10-15%. A preterm newborn should regain birth weight by 14-21 days of age.
- Average daily weight gain is 10g/kg/day in a term baby, after day 5.

1.4.1.2 Urine output

- The urine output varies according to the day of life in the first few days.
- In the first five days urine output should be a minimum of 1,2,3,4,5 times a day respectively according to the day of life.
- Babies may pass urine many times on the first day and less on day 2 and 3, but if the minimum requirement is met mother can be reassured regarding the urine output.
- Baby should not be discharged until urine has been passed
- Many babies pass urine after each feed during the first 3 months of life

1.4.2 Evaluation for jaundice

- All newborns must be examined for development and severity of jaundice twice a day in the first few days of life.
- Visual assessment in daylight is the preferred method.

1.5 Developmental variations/ physiological conditions

Knowledge of developmental variations, physiological conditions and their evolution in newborns are important for advising and reassuring the mother. Mothers observe their babies very carefully and are often worried by minor physical peculiarities, which may be of no consequence and do not warrant any therapy.

1.5.1 Mastitis neonatorum

- Breast swelling occurs in term babies of both sexes on the third or fourth day and may last for days or even weeks which is due to persistence of maternal hormones for some time.

- Local massage, fermentation and expression of milk **should not be done** as it may lead to infection. Mother should be reassured that this regresses on its own.

1.5.2 Vaginal bleeding

- Vaginal bleeding may occur in female babies about three to five days after birth which is because of withdrawal of maternal hormones. The bleeding is mild and lasts for two to four days.
- Additional vitamin K is unnecessary, provided it was administered at birth.

1.5.3 Mucoid vaginal secretions

- Most female babies have a thin, greyish, mucoid, vaginal secretion, which should not be mistaken for a purulent discharge.

1.5.4 Erythema toxicum or erythema neonatorum

These lesions are poorly demarcated erythematous macules, surmounted by central pale papules. It appears on the second or third day in term neonates, on the face and spreads down to the trunk and extremities in about 24 hours. This should be differentiated from pustules which need treatment.

It disappears spontaneously after two to three days without any specific treatment. The exact cause is not known.

1.5.5 Other normal phenomena in the newborn

- **Peeling skin:** Dry skin with peeling and exaggerated transverse sole creases are seen in all post term and some term babies.
- **Milia:** Yellow-white spots on the nose or face due to retention of sebum, are present in practically all babies and disappear spontaneously.
- **Stork-bite marks** (Salmon patches or nevus simplex): These are discrete, pinkish-grey, sparse, capillary haemangiomata commonly seen at the nape of neck, upper eyelids, forehead and root of the nose. Those on the face disappear after a few months while the ones on the nape of the neck get covered by hair.
- **Mongolian blue spots:** In babies of Asian and African origin irregular blue areas of skin pigmentation are often present over

the sacral area and buttocks, though extremities and rest of the trunk may also be affected. These spots fade considerably by puberty, but may remain the same through life.

- **Subconjunctival haemorrhage:** Semilunar arcs of sub-conjunctival haemorrhage are a common finding in normal babies after vaginal births. The blood gets reabsorbed after a few days without leaving any pigmentation.
- **Epstein pearls:** These are white spots, usually one on either side of the median raphe of the hard palate. Similar lesions may be seen on the prepuce. They are of no significance.
- **Sucking callosities:** The presence of these button like, cornified plaques over the centre of upper lip has no significance.
- **Tongue tie:** It may be in the form of a fibrous frenulum with a notch at the tip of the tongue. This generally does not interfere with sucking or later speech development.
- **Non-retractable prepuce:** The prepuce is normally non-retractable in all male newborn babies and should not be diagnosed as phimosis. The urethral opening is often pinpoint and is visualised with difficulty. The mother should be advised against forcibly retracting the foreskin.
- **Hymenal tags:** Mucosal tags at the margin of hymen are seen in two-third of female infants.
- **Umbilical hernia:** Umbilical hernia may manifest after the age of two weeks or later. Most of these disappear spontaneously by one or two years of age.
- **Benign pustular melanosis:** Transient vesicles and pustules with no erythema around the lesions. They rupture in about 48 hours and leave hyperpigmented macules which last several weeks. Usually present at birth in any of these stages. Seen on the chest, buttock, back, face, neck and at times on palms and soles.
- **Blocked lacrimal duct:** The lacrimal ducts drain tears from the eyes to the nose. In babies this duct may not be canalised at birth and it may take several months to resolve. The baby will have tearing from the eye and there would be a discharge but the conjunctiva would not be red and there would be no swelling around the eye unless there is an infection. Most of the time it resolves spontaneously. However, mother should be advised

to massage the area on either side of the nose adjacent to the medial canthus several times a day, after washing her hands and trimming finger nails.

- **Urate crystals in nappy:** orangish-pink colour stains on nappy can be due to urate crystal deposition with concentration of urine due to inadequate milk intake.

1.6 Possetting/ vomiting, passing stools, sleep and crying

1.6.1 *Possetting/ vomiting*

- Many normal babies regurgitate or spit out some amount of milk soon after feeds due to aerophagy. However, these babies will have a good weight gain and will be otherwise well. This regurgitation can be reduced by spacing the feeds with a minimum of 1½ hours between feeds, ensuring good attachment and burping the baby in the prone / sitting position after every feed. This would help to minimise air swallowing as well as expel the swallowed air.

Red flags in vomiting needing urgent medical attention

Bile stained

Blood stained

Projectile

Failure to thrive

Sick baby

Fever

Diarrhoea

Persistent vomiting

1.6.2 *Stool pattern*

- Any baby who has not passed meconium for 48hrs after birth needs to be evaluated. Baby should not be discharged home until meconium is passed.
- Transitional stools are passed by the third and fourth day after birth. The frequency is increased and these are often semi-loose and greenish-yellow. Delay in passage of transitional stools indicates inadequate milk intake.
- Breastfed babies pass frequent golden yellow, sticky, semi solid stools.

- Many babies pass stools while being fed or soon after a feed due to exaggerated gastrocolic reflex which may persist for a couple of weeks. These infants continue to gain weight satisfactorily & mother should be reassured.
- Passage of an increased frequency of breast milk stools, as the mother's milk flow increases in 2nd - 4th week after birth, is normal and should not be misinterpreted as diarrhoea.

Changes in the colour and consistency of a baby's stools

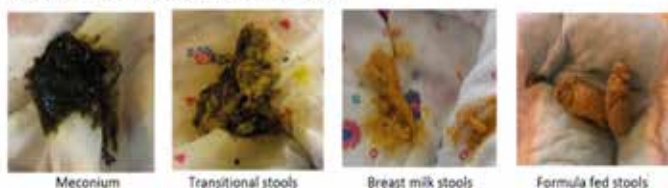


Figure 1.2 Changes in the colour and consistency of a baby's stool

- Some breastfed babies may pass stools infrequently (once every few days) in the second month of life; this is not constipation.
- Formula fed babies generally have more formed stools.

1.6.3 Sleep

- During the first few days of life babies sleep throughout the day and can be awake, noisy and troublesome during the night. It is only around 3 months of age that most babies sleep through the night.
- Different babies sleep different durations. Most babies will want to be fed on average once in 3 hours – but this can have a wide variation.
- If babies have sudden changes in their usual sleep patterns it may be due to a medical cause.
- Changing developmental statuses and degree of stimulation can also affect sleep.
- Babies should be allowed to fall asleep on their own and should not be put to sleep.

1.6.4 Excessive crying

- Babies cry when their early hunger cues have not been met or when they are in discomfort due to any other reason.

- Discomfort may be due to the unpleasant sensation of a full bladder before passing urine, painful evacuation of hard stools or mere soiling by urine and stool.
- An experienced mother or nurse can usually distinguish between the cry used as a signal for food and the cry of discomfort.
- Persistent crying needs examination and evaluation.

1.7 Newborn screening

Newborn assessment is conducted by a qualified medical officer within the first 24 hours of birth. This assessment includes a comprehensive neonatal examination which is a part of the screening process. Documentation of this is done in the Neonatal Examination Format (H1162 – Annexure 3.1) and the infant's Child Health Development Record (CHDR).

In addition to that there is universal screening of all newborns, prior to discharge from hospital, for the following three (03) conditions in Sri Lanka

- Congenital hypothyroidism (Annexure 4)
- Critical congenital heart disease (Annexure 5)
- Congenital deafness (Annexure 6)

Once the above screening tests are done, the discharge checklist (H-1162) should be duly completed.

1.8 Advice at discharge

1.8.1 *Maintenance of body temperature* (more details in Chapter 2)

- Keep the baby dry at all times.
- If the climate is cold, the linen and clothes of the baby should be pre-warmed before dressing (keep near the heater). Cover the baby adequately using cap, socks and mittens. Keep the room warm with the help of a heater. A baby's hands and feet should not feel cold to touch.
- During warm weather, depending on the environmental temperature, the baby should be dressed in loose cotton clothes and kept indoors as far as possible. A baby should not be sweating due to excessive covering and dressing.

- Exposure of the baby to direct sunlight is not recommended and can lead to serious hyperthermia.

1.8.2 Breastfeeding (refer Chapter 3)

- The mother should be advised to feed on demand based on hunger cues during both day and night.
- During each feed, allow the baby to feed from one side until baby lets go on his/her own. In the subsequent feed offer the breast that baby did not feed on.
- The duration of each feed may vary from 10-20 min, getting shorter as the baby grows older and more efficient at breastfeeding.
- The baby sleeps for a minimum of 1 ½ hours before waking up for the next feed. This duration gets longer with age as the baby's stomach capacity increases with gaps of 3-5 hours by 6 months of age.
- If baby is continuously suckling or demanding feeds more frequently i.e every 30 min etc it indicates a feeding problem and the mother should be supported to establish breastfeeding.
- There is no need for additional water or other fluids as breast milk contains all the water required by the baby.

1.8.3 Skin care/ bathing

- Special precautions must be taken during bathing to prevent draught and chilling. Bathing time should be 5-10 minutes in the first few weeks of life.
- Do not bathe in the first 24 hours
- Daily bathing is advisable from day 2 of life, in a normal term baby.
- Bathing should be done inside a warm room, without draughts of air (windows closed, fans switched off etc)
- Tub baths are preferred to sponge baths as tub baths cause less heat loss.
- Keep all clothes and towels ready near the bath so that baby can be wiped and dressed immediately after the bath.
- Dress the baby soon after bathing and give skin-to-skin contact and /or breastfeed to minimise hypothermia.

- All skin rashes need medical attention in order to differentiate the benign conditions mentioned above from bacterial infections like pustules, warranting treatment.

1.8.4 *Care of the umbilical stump*

- The cord must be left open and dry without any dressing. Do not apply any medication on the cord. The cord usually falls after 4 to 10 days. Nappy should be worn below the cord so that the cord is covered loosely with the baby shirt and does not get wet with urine.
- Foul smelling umbilicus and non-purulent umbilical discharge are mainly due to poor hygiene.
- Redness in the surrounding skin (periumbilical erythema) and purulent umbilical discharge are suggestive of bacterial infection, as well as bleeding from the umbilicus. These need urgent medical attention.
- Persistent clear watery umbilical discharge should be evaluated for umbilical granuloma, persistent urachus etc. and treated accordingly.

1.8.5 *Care of the eye*

- No eye drops or any special care of the eyes are necessary.
- Avoid application of any substance to the eye unless specifically prescribed by a medical practitioner-
- Unilateral eye discharge from a single eye which does not have features of acute inflammation is suggestive of blockage of the lacrimal duct.
- However, features of acute inflammation such as redness, swelling, purulent discharge, tenderness and bilateral involvement are suggestive of bacterial infection and requires urgent medical attention.

1.8.6 *Prevention of infections*

- Hand washing should be practised by all those who are touching / handling the baby.
- Breast milk feeding remains a very important method of preventing infection.

- Skin-to-skin care helps to colonise the baby with community flora and protect from harmful pathogens.
- Visitors should be minimised during the first couple of months.

1.8.7 Immunization:

All newborns should receive age appropriate vaccination according to National Immunization Schedule, Sri Lanka (Annexure 7).

1.9 Practices to be discouraged

A variety of traditional practices are common in many communities. These can range from being beneficial (eg: oil massage), inconsequential (eg: putting black mark on forehead) to a variety of harmful practices such as those listed below which should be actively discouraged:

- giving liquids other than breast milk (water, kalke) to newborn
- applying cow dung on the cord
- talisman strings with small beads on the hands

1.10 Conditions that need evaluation by a Medical Officer

- Mothers should be advised on **danger signs** in newborn babies for which urgent medical attention should be sought

The following conditions need assessment by a Medical Officer

- Bleeding from any site
- Appearance of jaundice within 24 hours of age, jaundice visible in chest / abdomen, palms or soles, jaundice persisting beyond 2 weeks in term babies
- Persistent vomiting
- Poor feeding
- Undue lethargy
- Excessive crying
- Drooling of saliva or choking during feeding
- Respiratory difficulty, apnoeic attacks or cyanosis
- Sudden rise or fall in body temperature

- Seizures
- Eye discharge
- Skin rash
- Redness at base of the umbilical stump
- Umbilical discharge
- White patches in the oral cavity

1.11 Safety of discharge

In addition to preventing any consequences of physical ill health of babies it is important to ensure that they have the optimal conditions for growth and social interactions. Therefore additional attention should be paid to understanding the maternal psychological status and fitness / suitability to look after a newborn. In the following instances the assistance of relatives / friend and a discussion with the local Public Health Midwife/ Medical Officer of Health / psychiatrist/ child protection officers will need to be sought prior to discharge to ensure a safe environment for the baby.

- Maternal psychological distress
- Unmarried or teenage mothers
- Presence of child protection issues
- Mothers with sexually transmitted disease eg: AIDS

1.12 Check list before discharge

Ideally infant should be discharged after 24 hours once all of the following criteria are fulfilled:

- Newborn examination by a MO is mandatory prior to discharge and the relevant section of the Child Health Development record (CHDR) should be filled and signed.
- Infant should be free from any clinically detectable illness including significant jaundice
- Baby has passed urine and stool
- The baby is immunised with BCG vaccination
- Breastfeeding technique is correct.
- Discharge weight is acceptable

- Weight loss is < 5% - review in 1 week
- If weight loss is >5% , weight loss/day is decreasing and total weight loss is <10% - review in 2-3 days
- If weight loss is > 10%, satisfactory weight gain on at least 2 consecutive days - review in 2-3 days
- Discharge weight is marked on CHDR
- Mother is free from any significant illness and confident to take care of her infant.
- Advice to inform area Public Health Midwife as soon as possible after going home.
- Ensure mother has access to and knows a contact in case of problems with breastfeeding (eg: phone number of Lactation Management Centre, Public Health Midwife)
- Pulse oximetry screening done and baby has passed it.
- Blood has been taken for congenital hypothyroidism screening.
- Hearing screening has been done and baby has passed it
- The latter three should be documented on the CHDR.

1.13 Follow up

If there are any concerns with feeding / weight a follow up can be arranged at the Lactation Management Centre or the baby reviewed in clinic / ward.

Mother should be advised to follow routine postnatal care provided by the Public Health Midwives and the Medical Officer of Health in the case of a normal term baby. (refer Chapter 20)

Any special issues should be followed up at the hospital clinic.

Summary

- Care of a normal newborn includes immediate care at birth with maintenance of normothermia, cord care, early initiation of breastfeeding and initial screening examination and administration of Vitamin K.
- Establishment of breastfeeding, full examination of the newborn, identifying newborns at risk are essential.

- Mother should be advised on signs that require medical evaluation, further follow up and immunisation at time of discharge.

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HYPOTHERMIA, HYPERTHERMIA AND THERMAL CONTROL

Chapter 2

HYPOTHERMIA, HYPERTHERMIA AND THERMAL CONTROL

2.1 Thermal equilibrium in newborns

Relative humidity, air currents, direct contact with cold surfaces, proximity to cooler objects and temperature in the surrounding environment affect thermal equilibrium.

Newborns are more prone to hypothermia due to:

- higher ratio of body surface area to body volume
- head accounting for a large surface area
- smaller musculature
- inability to shiver
- poor insulation
- inability to move to warmer areas
- slow neuro response to cold conditions

Fortunately, they have brown adipose tissue (BAT) which generates heat when they are cold. BAT cells take lipids and run them through the mitochondria to generate heat rather than synthesise ATP. In newborns, around 5 percent of body weight is made up of brown fat. It tends to be located on the upper half of the spine and towards the shoulders.



Figure 2.1 Distribution of brown adipose tissue (Image: <http://nursingcrib.com>)

Why are small babies more prone to hypothermia?

- Large surface area
- Decreased thermal insulation due to lack of subcutaneous fat
- Reduced amount of brown fat

2.2 Mechanisms of heat loss

There are several mechanisms for heat loss:

Evaporation	Newborns are wet with amniotic fluid.
Conduction	Newborns are placed in contact with a cool surface or object.
Convection	A flow of cooler ambient air carries heat away from the neonate.
Radiation	Bare skin is exposed to an environment containing objects of cooler temperature.

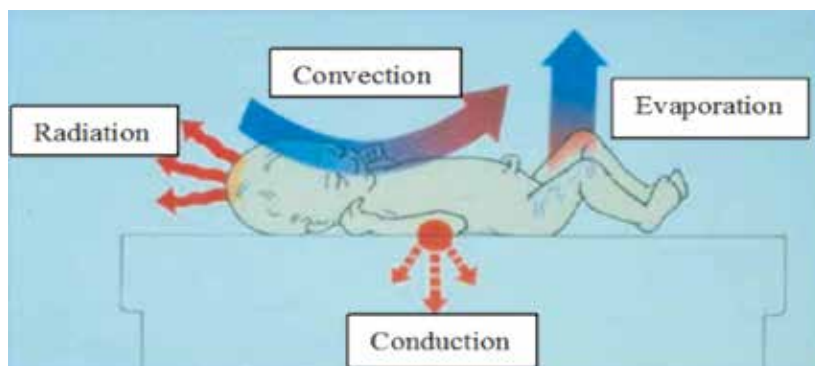


Figure 2.2. Mechanism of heat loss in a newborn

Temperature inside the mother's womb is 37°C. When the baby is delivered onto a colder surface (cold labour room bed, cold towels, cloths, tray) the baby immediately starts to lose heat via conduction. If the baby is not wiped dry, he loses heat due to evaporation of amniotic fluid from skin surface, if the baby is near open windows, fans or air conditioners, cold air replaces warm air around baby and he loses heat via convection. Colder solid objects in the vicinity absorb heat from the baby and he loses heat via radiation.

2.3 Concept of warm chain

In order to prevent the heat loss that occurs in a newborn after delivery, the baby must be kept warm at all times right from birth. Satisfactory control of temperature demands both prevention of heat loss and promotion of heat gain. The “warm chain” is a set of ten interlinked procedures carried out at birth and later, which will minimise the likelihood of hypothermia in all newborns.

1. Warm delivery room (26-28°C)
2. Warm resuscitaire / resuscitation surface
3. Immediate drying (remove the wet towel and cover the head with a cap)
4. Skin-to-skin contact between baby and the mother soon after birth
5. Breastfeeding soon after birth
6. Postponing weighing until after the completion of the first breastfeed and postpone bathing until after the first 24 hours
7. Clothing and wrapping the baby soon after birth
8. Keeping mother and baby together
9. Warm transportation
10. Training/raising awareness of healthcare providers

2.4 Temperature assessment

2.4.1 Axillary temperature:

This is the preferred site of temperature assessment using a thermometer. It is as accurate as rectal temperature but safer. Temperature is recorded by placing the bulb of the thermometer against the roof of dry axilla, free from moisture. Baby's arm is held close to the body to keep thermometer in place. Normal axillary temperature is 36.5 - 37.5°C (97.7 -99.5°F).

Electronic/digital thermometer is the preferred instrument to measure axillary temperature in newborns. An electronic thermometer needs to be switched on for recording the temperature. Clean the tip before use and read the temperature when the thermometer beeps and numbers appear on the window.



Figure 2.3. Digital thermometer

- **Do not insert the thermometer into the rectum as it can cause perforation, haemorrhage and infection**
- **The only indication for rectal temperature measurement is in babies undergoing therapeutic cooling via a specially designed neonatal rectal probe**
- **Do not add or subtract to calculate core temperature.**
- **Mercury thermometers should be avoided due to environmental hazard.**
- **Infrared thermometers are not recommended in newborns**

2.4.2 Skin temperature:

A temperature probe is used to measure the skin temperature in a baby being nursed under a radiant warmer or incubator. It is fixed to the skin of the infant over the right hypochondrial area if lying supine or over the flanks if lying prone. Areas of brown fat should be avoided and the probe should have good contact with the skin. It senses the skin temperature and displays it on the panel. Probe should be resited every 8 hours or when repositioning the infant to avoid skin burns.

2.4.3 Human touch:

Baby's temperature can be assessed with reasonable precision by human touch, the reliability of which can be enhanced by training. Abdominal temperature is representative of the core temperature and it is reliable in the diagnosis of hypothermia. The warm and pink feet of the baby indicate that the baby is in thermal comfort, but when feet are cold and abdomen is warm, it indicates that the baby is in cold stress. In hypothermia, both feet and abdomen are cold to touch. Used for screening but needs to be confirmed by measurement by above methods.

2.5 Hypothermia

2.5.1 What is hypothermia?

Temperature below 36.5 degrees centigrade is hypothermia.

2.5.2 Grading of hypothermia

It can be categorised as below:

Cold stress	36.4 to 36.1°C (97.5 – 96.8°F)
Moderate hypothermia	36.0 to 32.0°C (96.2 – 89.6°F)
Severe hypothermia	<32.0°C (<89.6°F)

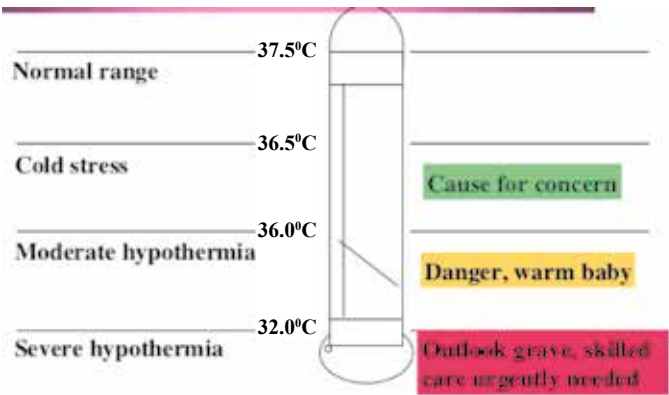


Figure 2.4 Grading of hypothermia

2.5.3 Pathogenesis, clinical signs and symptoms

Prolonged, unrecognised cold stress may divert calories to produce heat, impairing growth. Neonates demonstrate chemical (non-shivering) thermogenesis by sympathetic nerve discharge of norepinephrine in the brown fat. Lipolysis followed by oxidation produces heat locally that is transferred all over the body due to the rich blood supply to the brown fat. This reaction increases the metabolic rate and oxygen consumption 2-3 fold. This would result in breathing difficulty (tachypnoea/apnoea) and may result in tissue hypoxia and neurological damage. Activation of glycogen stores can cause transient hypoglycaemia. However persistent hypoglycaemia can result in hypoglycaemia and metabolic acidosis which increases the risk of late-onset sepsis, sclerema, disseminated intravascular coagulation, internal bleeding and mortality.

Neonates should be kept in the neutral thermal environment (thermoneutrality) which is the optimal temperature zone for neonates; it is defined as the environmental temperature at which metabolic demands (and thus calorie expenditure) to maintain body temperature in the normal range (36.5 to

37.5° C rectal) are lowest. The temperatures to be used as the neutral thermal temperature range depends on weight and age of baby.

2.5.4 *Situations where hypothermia can occur*

- i. At birth (delivery room)
- ii. During changing of nappy/clothes
- iii. Malfunctioning heat source or removing the baby from heat source
- iv. While transporting a sick baby

2.5.5 *Prevention of hypothermia*

2.5.5.1 *Steps to prevent heat loss in the delivery room*

- Warm room. (26-28°C)
- Immediately dry newborn with a dry, sterile and warm towel
- Skin-to-skin contact
 - Keep the baby's bare chest on the mother's chest and cover both of them
- Ensure baby's head is well covered
- Keep the baby with the mother (mother's temperature will keep the baby warm)

2.5.5.2 *Kangaroo mother care (KMC)*

KMC is a technique used to keep the baby warm. The neonate is held, skin-to-skin, with mother or any other adult caretaker. Kangaroo mother care should be given to all babies at risk of hypothermia whenever and wherever possible for a maximum duration of time.

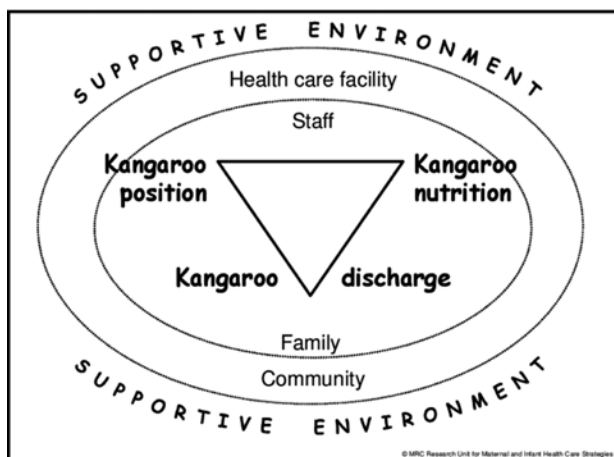


Figure 2.5 KMC triangle

2.5.5.2.1 Benefits of KMC

- (1) Better thermal protection of neonates
- (2) Increasing milk production
- (3) Increasing the exclusive breastfeeding rates
- (4) Reducing respiratory tract and nosocomial infections
- (5) Improving weight of the baby
- (6) Improving emotional bonding
- (7) Reducing hospital stay

2.5.5.2.2 Assessing the eligibility for KMC

Mother/father or any adult caretaker who is free of illness can provide KMC. Baby is sterile at birth and gets colonised with the first organisms it comes into contact. Skin-to-skin care helps the baby to be colonised with the maternal flora which is beneficial opposed to being colonised by hospital flora if delivered on the delivery room bed/resuscitaire.

Baby: KMC can be initiated immediately in all babies except those clinically unstable. The ongoing medical support, like non-invasive ventilation, oxygen therapy, IV fluids and tube feeding are not contraindications to KMC.

2.5.5.2.3 Technique & Position

1. Counsel the mother regarding KMC.
2. Advice to wear suitable clothing with a front opening.
3. Provide privacy to the mother.
4. Request the mother to sit or recline comfortably.

(Image: www.kmcindia.org/parents/takeoutour/kmc_procedure.html)



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Figure 2.6 Positioning baby in kangaroo care

Place the baby between the breasts of the mother in skin-to-skin contact in upright position. Turn the head to one side to prevent airway obstruction. Slight extended position of the head facilitates eye contact with the mother. Ensure that the abdomen of the baby is in close proximity to the epigastrium of the mother. Regular respiratory movements of mother prevent the occurrence of apnoea. The hips should be flexed and the bottom of the baby should be supported, in this way the baby clings to mother in a frog-like position.

2.5.5.2.4 Clothing for the mother and baby

The mother can wear whatever she finds comfortable as per the environmental temperature prevailing at that time, provided the dress accommodates the baby, i.e. keeps the baby comfortably in contact with her skin. Special garments are not needed unless traditional ones are too tight. The baby is placed naked in kangaroo position, except for a diaper, cap and socks.

A binder can be used by the mother/caregiver if she/he wishes to provide KMC while walking and going about day to day activities.



Figure 2.7 Binder used to keep the baby in place while providing KMC

2.5.5.2.5 Duration of KMC

KMC should be provided for as long as possible. Each session should be at least for one hour. KMC may be continued as long as the baby finds it comfortable. When the baby on KMC wriggles, pulls limbs out and cries, KMC can be discontinued. Mother also needs to be prepared and comfortable for that duration.

Skin-to-skin contact is the most practical, preferred method of warming a hypothermic infant in a health facility.

2.5.5.3 Wrapping the baby

The baby should be comfortable & clothed in multiple layers if ambient temperature is low, e.g. in an air-conditioned special care baby unit or in areas where night time temperature drops below 22°C. Head should be covered with a cap and then the baby should be wrapped in 1-2 layers of sheets/blankets.

If the environmental temperature is high multiple layers may not be required as babies can also become hyperthermic.

2.6 Management of hypothermia

Diagnosis of hypothermia should be confirmed by recording actual body temperature. A hypothermic baby has to be rewarmed as quickly as possible. The method selected will depend on the severity of hypothermia and availability of staff and equipment.

2.6.1 Management of mild hypothermia (cold stress)

- Cover adequately and ensure to replace the cold clothes of the baby with warm clothes.
- Keep the room warm (26 – 28°C) and draught free.
- Provide supervised KMC as skin-to-skin contact is the best method to re-warm a baby with mild hypothermia.
- If KMC is not practiced, use a radiant heater or other appropriate heating device.
- Continue breastfeeding.
- Monitor temperature and capillary re-filling time during re-warming.
- Watch for apnoea and hypoglycaemia.
- Monitor axillary temperature every ½ hour till it reaches 36.5°C, then hourly for next 4 hours, 2 hourly for 12 hours thereafter 4 hourly as a routine (QHT), not 3 hourly.

2.6.2 Management of moderate and severe hypothermia

- Remove cold clothes from the baby and replace with warm clothes.
- Place under radiant warmer / use incubator.
- Monitor axillary temperature every 15-30 minutes until it reaches 36.5°C, then hourly for next 4 hours, 2 hourly for 12 hours thereafter and 3 hourly. Adjust incubator / radiant warmer temperatures as required.

- An incubator (if available) may be used to warm baby. When using incubators it is essential to understand the different temperature modes available in an incubator
 - **‘Baby’ or ‘servo’ mode** where the incubator adjusts its temperature according to what we have set to be the requirement of the baby’s skin temperature; baby’s temperature is being read by the skin probe which should be attached properly.
 - **‘Air’ mode** where the temperature of the air within the incubator is set and maintained. When setting up an incubator in ‘air’ mode, temperatures within the ‘neutral thermal range’, according to the baby’s weight and age, should be used when the baby is normothermic.

While the baby is hypothermic the air mode should be used with temperatures set above the neutral thermal range (35.0°C to 38.0°C) in the incubator.

- At times, KMC may be the only option.
- Hot water bottles are not a recommended form of management; however, in the absence of any other method they can be used with utmost caution. The bottle should not touch the baby directly to ensure the baby does not get burnt.
- Monitor blood pressure, heart rate and glucose (if facilities are available).

In addition, for severe hypothermia

- Start warm intravenous fluids
- If perfusion is poor, give 10ml/kg of normal saline (0.9% NaCl).
- Give Vitamin K (Refer Chapter 1)
- Maintain oxygen saturation between 90-94%.
- Treat cause e.g.: hypoglycaemia, sepsis

Most of the babies will regain their temperature. However, if the baby remains hypothermic one hour after rewarming, or if danger signs appear at any stage of monitoring the baby, sepsis should be suspected and treated accordingly.

2.7 Discharge advice on prevention of hypothermia

- The room where a baby is nursed should be kept warm.
- In cold environments ensure that baby is adequately covered and clothed. Feet should be covered with socks, hands with mittens and head with a cap. Besides, a blanket should be used to cover the baby. In colder areas of the country, use a woollen sweater on the baby if the room is not warm enough.
- Provide with skin-to-skin contact care (KMC). If not possible, nurse baby next to the mother, as she is a good source for warmth.
- Avoid unnecessary exposure when attending to baby's needs like changing nappies.
- Use warm water when bathing; the entire baby should not be exposed at once during bathing, especially in cooler areas - small areas of the baby can be washed at a time leaving the rest of the baby covered. Keep clothes ready, dry and wrap the baby and breastfeed immediately after bathing.
- Advise mother on other danger signs like poor feeding and lethargy which might indicate sepsis and need for urgent medical review (refer Chapter 9) and that low birth weight and preterm babies are prone to hypothermia.

2.8 Hyperthermia and fever

Hyperthermia and fever occur when temperature is above 37.5°C.

2.8.1 Hyperthermia

Hyperthermia is peripherally (skin and muscle) mediated elevation of body temperature due to failed thermoregulation that occurs when the body produces or absorbs more heat than it dissipates. Heat is dissipated by dilation of the peripheral blood vessels resulting in warm and sweaty hands and feet. Hypothalamus is not involved and the temperature set point is unchanged. Physical methods are effective in reducing the temperature compared to antipyretics. When a baby falls asleep, it reduces body movements and relaxes the muscles, in order to decrease his/her thermogenesis. Respiratory inhibition may occur.

The most common cause for hyperthermia in our setting is dehydration due to delayed establishment of breastfeeding. Dehydration, especially >

5% of birth weight impedes the ability to sweat, resulting in reduced heat dissipation, which in turn causes hyperthermia. Supporting the establishment of breastfeeding will correct the dehydration as well as the hyperthermia.

Other causes of hyperthermia include (body absorbs more heat than it can dissipate)

- Environment too hot for the baby.
- Baby is overdressed: wrapping the baby in too many layers of clothes, especially in hot, humid weather.
- Leaving baby under /close to heating devices i.e. radiant warmer, incubator, hot water bottles etc. that are not functioning properly and/or are not checked regularly

Management of the baby with hyperthermia

- If the environmental temperature is hot and the baby is wrapped in several layers of clothing remove a layer or two, use light loose clothes and recheck the temperature in 30 minutes.
- Remove the baby from any direct sources of heat (heater, radiant warmer).
- Check incubator temperature settings and the temperature sensor probes.
- When the temperature is 37.5°C – 40.0°C, undressing and exposing the neonate to room temperature is usually all that is necessary.
- If the temperature is above 40.0°C, the neonate should be undressed and sponged with warm water approximately 2°C below the baby's temperature until the temperature is below 38.0°C – use of colder water is dangerous and will cause hypothermia in the baby
- Give frequent breastfeeds to replace fluids. If the baby cannot breastfeed, give expressed breast milk by cup or gastric tube. If the baby does not tolerate feeds, intravenous fluids may be given.
- Measure the temperature half hourly till it becomes normal.

2.8.2 Fever

Fever occurs due to thermogenesis by pyrogens due to infection / inflammation. The temperature set point is artificially elevated and heat dissipation is

inhibited, resulting in peripheral vasoconstriction causing cold hands and feet, with shivering causing the baby to feel cold despite high temperature. Treatment of the infection/inflammation will eliminate the fever.

Examine every baby with elevated temperature for infection. If no dehydration or environmental cause is found treat as an infection until proven otherwise.

Summary

- Problems in temperature control are common in newborns.
- Hypothermia is a common problem associated with increased mortality in newborns – especially preterm and low birth weight babies.
- Sepsis may present as hypothermia or fever.
- Hypothermia and hyperthermia can be managed easily if anticipated and monitored

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Chapter 3

BREASTFEEDING

3.1 Introduction

Breast milk is species specific and is tailor-made to suit the requirements of the human baby. Human milk has the highest content of lactose among mammalian milk in order to facilitate the rapid brain growth occurring in the first 2 years of life. Therefore, breast milk is the best milk for all babies.

*Table: 3.1 Composition of mammalian milk in different species (per 100g fresh milk)
(Handbook of Milk Composition, by R. G. Jensen, Academic Press, 1995)*

	Protein (g)	Fat (g)	Carbohydrate (g)	Energy (kcal)
Cow	3.2	3.7	4.6	66
Human	1.1	4.2	7.0	72
Water Buffalo	4.1	9.0	4.8	118
Goat	2.9	3.8	4.7	67
Donkey	1.9	0.6	6.1	38
Elephant	4.0	5.0	5.3	85
Monkey, rhesus	1.6	4.0	7.0	73
Mouse	9.0	12.1	3.0	171
Whale	10.9	42.3	1.3	443
Seal	10.2	49.4	0.1	502

Increasing breastfeeding could prevent 800,000 child deaths per year and 20,000 deaths due to breast cancer per year. Failure to breastfeed costs the world around US\$302 billion every year. Exclusive breastfeeding up to 6 months of age and breastfeeding up to 12 months was ranked the number one intervention for preventing childhood mortality in the 2003 landmark Lancet Child Survival Series.

3.2 Advantages of breastfeeding for all babies and their mothers

Better brain growth

Studies have shown that breastfed children are smarter (7 - 10 IQ points higher) with preterm infants gaining even higher benefits from breastfeeding. Early breast milk intake increases the brain volume, especially white matter volume with better microstructural organisation in preterms. A dose-response

relation between the proportion of mother's milk in the diet and subsequent IQ has also been shown. The effect of breastfeeding on IQ increases from age 7 to 16.

Protection against childhood disease: Babies who are breastfed have a larger thymus and higher immunity from a variety of anti-infective agents in colostrum and mature breast milk

- Secretory IgA – gut protection
- Lactoferrin – protects against gram positive and negative bacteria, fungi
- Alpha lactalbumin – HAMLET – protects against tumour cells
- Lysozyme – protects against E coli
- Anti – secretory factor – protects against diarrhoea
- Oligosaccharides – protects against respiratory, diarrhoea, acute otitis media, urinary tract infection
- Fatty acids – protects from *Giardia lamblia*, *Entamoeba*, *Escherichia coli*, *Shigella*
- Neutrophils and macrophages – protect against bacteria
- Lymphocytes – better acceptance in organ transplantation

Breastfeeding protects against disease in the first 2 years of life.

- Respiratory illness needing hospital admission (57% decrease)
- Diarrhoeal illness needing hospital admission (72% decrease)
- Ear infection (50% decrease)
- Necrotising enterocolitis (58% decrease)
- Sudden infant death (50% decrease)

Breastfeeding reduces asthma by 9%.

Breastfeeding reduces childhood leukaemia by 19%: acute lymphoblastic leukemia 1.3 fold and acute myeloblastic leukaemia by 1.2 fold.

Breastfeeding reduces malocclusion by 68% and enhances airway and jaw development.

Breastfeeding determines lifelong health via early programming.

It alters the microbiome as well as epigenetics reducing of the risk of obesity by 26%, type 1 diabetes by 15% and type 2 diabetes by 24%.

Breast milk is easily digested and is available at the appropriate temperature at all times.

Benefits of breastfeeding for the mother (IYCF Guideline, 2011, UNICEF)

- Reduces risk of breast cancer (not breastfeeding has a 39% higher risk)
- Reduces risk of ovarian cancer (not breastfeeding has a 26% higher risk),
- Reduces the insulin requirement in mothers and lowers the risk of type II diabetes by 14%
- Reduces the risk of postpartum depression
- Reduces anaemia by less postpartum bleeding and lactation amenorrhea
- Reduces osteoporosis
- Contraceptive benefit during exclusive breastfeeding
- More likely to return to pre-pregnancy weight
- Better emotional bonding with baby

3.3 Harms of formula feeding

- **Negates the beneficial effects of breastfeeding:** Even one drop of formula milk alters the early programming and increases the risk of disease in the baby.
- **Contains pathogenic bacteria:** such as *Enterobacter sakazakii*, which are causative organisms for neonatal meningitis.
- **Contamination by toxic chemicals:** It also has been found to contain toxic chemicals such as melamine, which caused death and renal failure in China in 2008, cupric sulphate which acts as a herbicide in 2012 and dicyandiamide, which is a precursor of melamine in 2013.

3.4 The Baby-friendly Hospital Initiative (BFHI)

The Baby-friendly Hospital Initiative (BFHI) was launched by the WHO and UNICEF to promote breastfeeding in 1991. The 10 steps of the 2018 revision of the BFHI include:

Critical management procedures:

- 1a. Comply fully with the *International Code of Marketing of Breast-milk Substitutes* and relevant World Health Assembly resolutions.
- 1b. Have a written infant feeding policy that is routinely communicated to staff and parents.
- 1c. Establish ongoing monitoring and data-management systems.
2. Ensure that staff have sufficient knowledge, competence and skills to support breastfeeding.

Key clinical practices:

3. Discuss the importance and management of breastfeeding with pregnant women and their families.
4. Facilitate immediate and uninterrupted skin-to-skin contact and support mothers to initiate breastfeeding as soon as possible after birth.
5. Support mothers to initiate and maintain breastfeeding and manage common difficulties.
6. Do not provide breastfed newborns any food or fluids other than breast milk, unless medically indicated.
7. Enable mothers and their infants to remain together and to practice rooming-in 24 hours a day.
8. Support mothers to recognize and respond to their infants' cues for feeding.
9. Counsel mothers on the use and risks of feeding bottles, teats and pacifiers.
10. Coordinate discharge so that parents and their infants have timely access to ongoing support and care.

3.5 Initiation of breastfeeding

Baby should be delivered onto the mother's abdomen / chest allowing immediate skin-to-skin contact after drying. Baby should be supported to latch on to the breast, when he/she is demonstrating hunger cues. Baby should not be separated from the mother until the first breastfeed is completed. Anthropometric measurements should be taken only after the completion of the first breastfeed. Breastfeeding should be initiated within the first hour of birth in all babies who are born in good condition (who do not require

resuscitation at birth) and have a sucking reflex along with coordinated swallowing (more than 32- 34 weeks gestation). Preterm babies more than 32 weeks should be breastfed before they are sent to the neonatal unit as soon as they are stabilised. Babies who are resuscitated can be breastfed as soon as the baby is stabilised.

3.6 Breastfeed in response to hunger cues

Caregivers should be educated on identifying and responding to the early hunger cues and not waiting for late cues like crying. If baby is crying or agitated it is important to help baby to calm down prior to breastfeeding. This can be achieved by talking, stroking, cuddling or giving skin-to-skin contact to the baby, in order to ensure successful breastfeeding.



Figure 3.1: Identifying hunger cues

3.7 Frequency and duration of breastfeeding

Breastfeeding should be done day and night “on demand” by responding to hunger cues from the baby. The number of times a baby feeds will vary. A baby who takes a large feed will sleep for longer and feed less frequently than a baby who takes smaller feeds more frequently. A baby will fall into a regular pattern of feeding about 8 to 12 times a day once the milk production increases within the first week. Frequency of breastfeeding is expected to decrease over time as the stomach capacity increases with age. The duration of feed will vary from 10-20 minutes and will reduce as the baby gets older. Allow baby to feed at one breast till the baby stops sucking and releases the breast. Mother will feel the breast emptying as the baby drains the milk. Do not put back on the same breast once baby has emptied the breast.

- o **Do not feed by the clock i.e 2 hourly, 3 hourly etc**
- o **A breastfeed does not have a fixed duration of 30 min**
- o **If baby is continuously suckling or demanding feeds more frequently i.e every 30 min etc it indicates a feeding problem and the mother should be supported to establish breastfeeding.**
- o **Do not wake the baby up for feeds. Feed when he wakes up.**
- o **Use other consoling strategies like talking, stroking, cuddling to calm the baby instead of using the breast if agitated / crying.**

3.8 Breastfeeding technique

Positioning – how the mother holds the baby

Optimal positioning is important because it will ensure correct attachment and effective suckling and prevent sore nipples and breast engorgement.

The mother can adopt different positions that are preferred by her or the baby especially when sick or with special needs (cleft palate, hypotonia etc.) provided that:

- Baby's head, neck and body are in a straight line
- Baby is facing the breast with the baby's body in close contact

- Avoid pressure on the back of the head and support the head at the nape of the neck
- Mother is supporting baby's bottom and not only the head, in the case of a newborn



Figure 3.2: Breastfeeding positions

(<https://www.google.com/getting-started-with-breastfeeding>)

Attachment – how the baby is attached to the breast

The four signs of good attachment are:

1. Baby's mouth is wide open
2. Lower lip is turned outwards
3. Baby's chin touches mother's breast
4. Majority of areola is inside the baby's mouth, with there being more areola visible above the mouth than below



Figure 3.3: Attachment good (left), poor (right)

Effective Suckling

Effective suckling is when the infant shows slow deep, rhythmic, sucks, cheeks puffing out, with pauses in between. The pauses signify that baby is swallowing milk that is in his mouth. Baby should not be disturbed during these pauses.

3.9 Is the baby getting enough breastmilk?

Mothers produce only a few drops of colostrum, immediately after giving birth. It is loaded with immune, growth and tissue repair factors which helps in the development of immunity in the newborn. It contains significant quantities of complement components that act as natural anti-microbial agents to actively stimulate the maturation of an infant's immune system.

Newborn's stomach volume increases from 10-20ml/d at birth to 80 – 150ml at 1 month of age as shown below. This is in parallel to the volume of milk produced by the mother which is a few drops of colostrum on the first day, which gradually increases to full feeds with the rise in prolactin and reduction in feedback inhibitor. The gap between breastfeeds should increase with time as the stomach capacity increases with age, where a newborn will demand feeds 1.5 – 2 hourly vs. a 2-month-old who demands 3-4 hourly feeds vs. a 6-month-old who demands 3-5 hourly feeds.



Figure 3.4 : Growth of the newborn's stomach volume with age

The adequacy of milk intake is best assessed by the trend in weight loss (<5% weight loss in the 1st 24-48 hours of life) or presence of weight gain after the first few days. It can also be assessed by counting the number of wet

nappies per day (6 or more times/day) after the milk comes in i.e. after the first week of life. Babies may take up to 2 weeks to regain the birth weight and thereafter gain 10-15 g/kg/day in the first 2 months. Preterm babies may take 3 weeks to regain birth weight.

3.10 How long should the baby be breastfed?

Ensure **exclusive breastfeeding** (feeding only breast milk and not even water; only medications are allowed) till the **completion of 6 months of age**.

- Ensure a minimum of 4 months of exclusive breastfeeding in the case of mother going back to work, growth faltering after 4 months, behaviour change in baby demanding a sudden increase of breast milk after 4 months or multiple pregnancies (twins, triplets etc.) after which complementary feeds can be started at the completion of 4 months.
- Do not introduce water, kalke, gripe water, honey, date juice, animal milk, etc. as prelacteal feeds, supplements or as a home remedy. They will introduce infection and allergies, reduce the breast milk intake by the baby (stomach volume is very small about 5ml), and thereby reduce the breast milk production.

Breastfeeding should be continued till 2 years and beyond in addition to the complementary feeding.

- The gap between breastfeeds should increase with time as the stomach capacity increases with age, where a newborn will demand 3-5 hourly feeds by 6 months of age.
- The complementary feeds should be given at these same feed times replacing the milk only feeds with solid food while facilitating conversion to an adult type food pattern with 3 main meals and 2-3 snacks.
- Breast milk should not be given in between meals as baby needs to be hungry for at least 3 hours, to accept the solid food
- Breastfeeds should be given only 1-3 times a day in a 12-month-old child in addition to his complementary feeds of 3 main meals and 2-3 snacks. Breastmilk should not be used as a replacement for a solid food meal.

3.11 Breastfeeding babies with special needs

The principles of caring for babies with special needs (such as cleft lip and palate, Down syndrome, congenital hypotonia, low APGAR score) are the same as for all babies;

- Encourage the mother to begin breastfeeding as soon as possible after birth
- Position and attach the baby well and help him to take a big mouthful of breast
- If baby cannot suckle strongly show the mother how to obtain expressed breast milk (EBM)
- Train the mother to feed the EBM with a cup until he is able to suckle well
- It is important to let a baby explore the breast and try to attach in his own way. Some babies with disabilities manage much better than we expect them to.
- When the baby has tenderness overlying the occipital area due to traumatic / difficult/ vacuum delivery - ensure that baby receives pain relief and is held avoiding the tender area.

3.12 Breastfeeding babies during illness

Why do babies stop feeding when they are ill?

- Blocked nose due to respiratory infection (common cold)
- Sore mouth (candida infection)
- Loss of appetite
- Feeding may be withheld in babies who undergo surgery.

Misconceptions held by mother or health worker which should be identified and advised against

- Breastfeeding during diarrhoea is harmful
- Breastfeeding should be stopped if stool is positive for reducing substances following an episode of diarrhoea (secondary lactose intolerance)
- Formula supplementation is indicated in babies who present with dehydration fever and early neonatal jaundice.
- Babies with cleft palate need bottle feeds

Why should babies continue to receive breastmilk during illness?

- Baby continues to get the best nourishment
- Loses less weight
- Recovers more quickly
- Baby receives more anti-infective agents to fight any infection via breast milk
- Comforted by suckling
- Breast milk production continues
- Baby is more likely to continue breastfeeding when he/she is well

Overcoming challenges

- **Upper respiratory tract infection:** Babies may tend to sleep at the breast or pull off the breast frequently when they have a blocked nose etc. Mothers should be advised to give shorter feeds more frequently to overcome these problems.
- **Secondary lactose intolerance:** Breastfeeding should be continued as most of these babies recover spontaneously and do not require any special intervention. Specific intervention should be considered only in babies where there is significant weight loss or dehydration while being breast fed.
- **Dehydration fever and breastfeeding/starvation jaundice:** Establishment of lactation (positioning, attachment, suckling pattern) is a crucial part of the management.
- **The baby may refuse to suckle at the breast or suckle less efficiently when sick:** Mothers should be trained to express breast milk and feed via cup, failing which tube feeds are used.

3.13 Skills needed to counsel mothers to breastfeed

Listening and learning skills

- Use helpful nonverbal communication – correct posture, pay attention, remove barriers, unhurried approach, touch appropriately
- Ask open questions
- Use gestures and responses which show interest

- Reflect back what mother says
- Empathize
- Avoid judging words

Building confidence skills

- Accept what the mother thinks and feels – use reflection and simple responses
- Recognise and praise what the mother and baby are doing right
- Give practical help
- Give a little, relevant information
- Use simple language
- Make one / two suggestions, not commands

3.14 Overcoming challenges with breastfeeding

3.14.1 Delay in establishing breastfeeding

- **Diagnosis**
 - Increased weight loss (> 5% in the first 24-48 hrs, >10% later)
 - Poor weight gain
 - failure to achieve birth weight by 10-14 days
 - weight gain less than 10g/kg/day in the first month
 - Dehydration fever
 - Starvation / breastfeeding jaundice
- **Management**
 - Breastfeeding with correct technique – mainstay of treatment
 - Supportive treatment - antipyretics, phototherapy as required, monitor urine output and weight gain to ensure adequacy of breast feeds
 - Train mother to express breastmilk 2-3 hourly and feed via cup in addition to breastfeeding in cases of poor weight gain / weight loss and reduced
 - **Psychological support to the mother**

3.14.2 Forceful ejection of milk

- **Diagnosis**
 - baby coughs / chokes / cries and pulls away from the breast shortly after commencing to breastfeed
 - mother has a forceful milk flow on expression
- **Management**
 - Express milk until the milk flow slows down and then start to feed the baby

3.14.3 Breast engorgement

- **Aetiology** - due to inadequate breast emptying due to poor attachment
- **Diagnosis** - whole breast is affected with features of acute inflammation
- **Management**
 - Breastfeeding with correct technique – to facilitate emptying the breast – mainstay of treatment
 - Pain relief to mother
 - Massage towards the axilla to improve lymphatic drainage
 - Use cold compression after a feed
 - Do not express milk – increased emptying leads to further increase in milk production
 - No hot compression
 - If the baby refuses to suckle on the breast due to hardened milk near the areola
 - Try to express the minimum amount of milk to soften the area around the areola to attach the baby
 - If unsuccessful try a minimum amount of hot compression to aid expression of milk

3.14.4 Mastitis

- **Aetiology** - due to inadequate breast emptying due to blockage of one or more ducts – tight underwear, supporting the breast with fingers in “scissor hold”, position of feeding

- **Diagnosis** – redness / tenderness / swelling involving only part of the breast
- **Management**
 - Breastfeeding with correct technique– mainstay of treatment
 - Pain relief to mother
 - Massage the involved area towards the nipple when baby is feeding to empty the blocked duct
 - No hot compression or milk expression
 - Antibiotics are indicated for the mother if the involvement is more than 24 hours, as non infective mastitis can convert to infective mastitis and result in a breast abscess

3.14.5 Breast abscess

- **Aetiology** – infective mastitis, cracked nipple
- **Management**
 - Antibiotics for mother
 - Pain relief to mother
 - Surgical referral for incision and drainage
 - Continue to breastfeed – on the affected breast as well
 - If baby refuses to breastfeed on the affected side – express from the affected side and feed to prevent engorgement
 - Breastfeeding with correct technique

3.14.6 Cracked / sore nipple

- **Aetiology** – poor positioning and attachment
- **Diagnosis** – ridging / flattening / skin breach over the nipple with pain during breastfeeding
- **Management**
 - Breastfeeding with correct technique even on the affected side - mainstay of treatment
 - Antibiotics for mother
 - Pain relief to mother

3.15 Situations where breastfeeding is not initiated (CDC 2020)

Maternal conditions

- Current use of chemotherapy or radiotherapy for cancer
- Human T-cell lymphotropic virus type 1 and 11
- Ebola virus
- Untreated Brucellosis
- Use of illicit street drugs

Conditions in the baby

- Metabolic diseases
 - galactosaemia,
 - phenylketonuria
 - maple syrup urine disease
- Surgical conditions - breastfeeding is initiated only after surgical correction
 - congenital diaphragmatic hernia
 - oesophageal atresia / trachea-oesophageal fistula
 - intestinal obstruction
 - imperforate anus
 - gastroschisis

3.16 Situations where expressed breast milk can be given but baby needs to be separated from the mother

Airborne and contact precautions may require temporary separation of the mother and infant, during which time expressed breast milk should be given to the infant by another care provider.

Mother is diagnosed with sputum positive (open) tuberculosis

- Expressed milk can be given
- Direct breastfeeding can be resumed after 2 weeks of treatment and documented non-contagious status

Active varicella infection in mother (5 days prior and 2 days following delivery)

- Expressed milk can be given after documented as non-contagious

3.17 Breastfeeding with HIV infection

- Mothers known to be HIV-infected and on anti-retroviral therapy, should exclusively breastfeed their infants for the first 6 months of life, introducing appropriate complementary foods thereafter, and continue breastfeeding for at least 12 months and may continue breastfeeding for up to 24 months or longer (similar to the general population) while being fully supported for anti-retroviral therapy (ART) adherence.
- Although exclusive breastfeeding is recommended, practicing mixed feeding is not a reason to stop breastfeeding in the presence of anti-retroviral drugs as this therapy reduces the risk of postnatal HIV transmission in the context of mixed feeding.

Summary

- Breast milk is the most suitable nutrition for newborn babies
- It has immunological, long term medical, psychological and financial advantages for the baby, mother and family
- Proper positioning and attachment are important in establishment of breastfeeding

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FLUID MANAGEMENT

Chapter 4

FLUID MANAGEMENT

4.1 Introduction

Breast milk is sufficient to provide nutrition and maintain fluid balance in most newborns. However, sick and small newborns require parenteral nutrition to meet their higher nutritional demands and survive with the best neurodevelopment outcomes. Different pathological states such as hypoglycaemia, hypoxia demands intravenous (IV) fluid therapy, adapted to overcome these situations. The goal of early fluid management is to allow normal weight loss while ensuring physiological stability.

4.2. Indications for intravenous fluids

- Gestation 32 weeks or less and/or 1500g or less
- Any sick baby not tolerating enteral feeds
- Surgical condition contraindicating enteral feeds
- Severe dehydration or shock (refer Chapter 14)
- Severe perinatal asphyxia (refer Chapter 11)
- Hypoglycaemia (refer Chapter 6)
- Babies requiring intubation and ventilation (refer Chapter 8)

4.3 Choice of intravenous fluids

Parenteral nutrition is indicated for babies with a gestation of 32 weeks or less, birth weight of 1500g or less and babies with surgical conditions.

It should be started soon after birth to improve cognition and achieve neonatal growth rates similar to those of the normal fetus.

The energy requirement of preterm and small babies are around 120-130 kcal/ kg/day. Preterm babies have reduced glycogen stores, less lipids and less proteins as these are mainly deposited during the last trimester.

Amino acids (AAs) should be provided soon after birth in order to improve cognition and brain growth, prevent protein breakdown and to promote growth. Protein must be administered with energy since, in the absence of non-protein energy, protein is oxidised and is not available for protein synthesis. A minimum of 1 g/kg/day of protein together with 30 kcal/kg/day of non-protein energy have been shown to prevent negative nitrogen balance.

Lipids provide the highest amount of energy as well as essential fatty acids which are required for brain development and should be given a minimum of 0.5-1 g/kg/day within the first 72 hours of life to prevent essential fatty acid deficiency.

The carbohydrate requirement is determined by the glucose utilisation rates which is higher in preterm infants at 6-8 mg/kg/minute compared to term infants with a rate of 3-5 mg/kg/minute and forms the basis for the initial empirical fluid prescription of 80 ml/kg/day for preterm babies and 60 ml/kg/day for term babies. Carbohydrate is provided with a minimum concentration of 10% dextrose as lower concentrations fail to meet the energy demands.

Total fluid prescription can be increased by 10-15 ml/kg/day until 150 ml/kg/day due to high evaporative water loss within the first week, which occurs predominantly from skin and accounts for 10-15% weight loss. However, evaporation is minimised with effective humidification (90%) of incubators. Therefore, body weight (measured at least daily – preferably by an inbuilt scale) should be used to guide fluid volume rather than blindly increasing fluids based on the day of life. Fluid will need to be restricted in neonates with certain cardiac and respiratory conditions.

Electrolyte needs are relatively low in the first few days due to free water diuresis where evaporative water loss is more than the fractional sodium excretion, increasing the risk of hypernatraemic dehydration. However, the extracellular fluid compartment contracts and the aldosterone increases, with the fractional excretion of sodium remaining at 1-3% due to renal immaturity, thereby increasing the risk of hyponatraemia, during the next few days, warranting supplementation of sodium from day 3 of life.

The following tables provide a guide to the administration of parenteral nutrition.

Table 4.1: Guide to prescribing intravenous amino acids (0.24kcal/ml, 5.8g/100ml)

Age (days)	Protein requirement	Amino acid volume*
1	1.5g/kg/day	25ml/kg/day
2	2.0g/kg/day	34ml/kg/day
3	2.5g/kg/day	43ml/kg/day
4	3.0g/kg/day	50ml/kg/day
5	3.5g/kg/day	60ml/kg/day

* The volumes are based on preparations commonly used in state hospitals

Table 4.2: Guide to prescribing intravenous lipids 10% - 1kcal/ml, 20% - 2kcal/ml

Age (days)	Lipid requirement	20%*	10%*
1-2	1g/kg/day	5ml/kg/day	10ml/kg/day
2-3	2g/kg/day	10ml/kg/day	20ml/kg/day
3-4	3g/kg/day	15ml/kg/day	30ml/kg/day

Table 4.3: Fluid requirement of neonates (ml/ kg /day)

Age(Days)	Birth weight ≥ 1500 g	Birth weight < 1500 g
1	60	80
2	75	95
3	90	110
4	105	125
5	120	140
6	135	150
7	150	150

Table 4.4: Guide for intravenous/oral electrolyte supplementation from day 3

Age (days)	Electrolyte	Requirement	Preparation
3	Sodium	3-4 mmol/kg/day	6-8ml/kg/day (3% NaCl)
3	Potassium	2 mmol/kg/day	1ml/kg/day KCl
1-3	Calcium	1mmol/kg/day	4ml/kg/day 10% Cal gluconate (4ml=0.88mmol)

- Calcium can be added on day 1 in cases of perinatal hypoxia requiring IV fluids. Calcium is best administered as an infusion when required as extravasation causes tissue damage. It should not be added in the same drip as sodium bicarbonate.
- 0.9% sodium chloride is given at 10ml/kg over 1 hour for volume expansion.
- Birth weight is used for calculating total fluid requirement calculations while baby's postnatal weight remains below the birth weight.
- Actual body weight is used for all calculations, once birth weight is regained.

4.4 Administration of intravenous fluids

- An infusion pump is the preferred method of administering large volume infusions of > 50ml as well as all blood products.
- A syringe pump is the preferred method to administer infusions < 50ml as well as drugs, inotropes, sedation etc.
- The intravenous connection line between the pump and the cannula should be filled prior to being attached to the baby.
- If an infusion or syringe pump are not available, a micro drip infusion set (Burette set) can be used. In this device, one millilitre is equal to 60 micro drops and number of drops per minute is equal to ml of fluid per hour e.g. if a baby needs 6ml/hour provide six micro drops/minute.
- Check the infusion rate of fluid hourly and document in monitoring chart to ensure delivery of correct amount of fluid.
- Use aseptic precautions including washing hands, alcohol rub, sterile gloves while filling syringe pump/infusion pump or micro drip set with fluid, or giving IV medications.
- Calculate and prepare fluids for a maximum of 24 hours.
- Fluids may need to be adjusted according to the metabolic state of the baby.
- Maintain strict input/output chart and review it every 6 hours.
- Urine output can be calculated by measuring the weight of diapers/nappies using a kitchen grade electronic scale. Include the volume of medications and IV flushes in the total fluid calculations.
- Avoid bladder catheterisation in babies passing urine spontaneously.
- Secure the IV cannula properly and attach to connector and bacterial filter.
- Before infusing IV fluid, check:-
 - expiry date of the fluid
 - seal of the infusion bottle for its intactness
 - the fluid is clear and free from any visible particles

- that syringe, infusion line, micro drip infusion set and fluid bag are changed every 24 hours to avoid contamination and nosocomial infection.

4.5 Monitoring of babies receiving IV fluids

- Inspect the infusion site every hour.
- Look for redness and swelling around the insertion site /tip of the cannula, which indicates that the administered fluid is leaking into the subcutaneous tissues and is not being infused into the vein.
- If redness or swelling is seen at any time, stop the infusion, remove the cannula, and establish a new IV line in a different vein.
- Check the volume of fluid infused and compare to the prescribed volume, record all findings every hour in the fluid monitoring chart.
- Measure blood glucose regularly as advised by the ward doctor; initially once every shift.
- **Daily monitoring to decide the total daily requirement for fluids**

1. Weight

- Weigh the baby daily, preferably using an in built electronic weighing scale where available.
- A baby in an incubator should be weighed using the inbuilt scale, if available.
- If the daily weight loss is more than 5%, increase the total volume of fluid by 10 ml/kg body weight for one day and then reassess.
- If there is no weight loss or there is weight gain in the initial 3 days of life, do not give the daily increment, keep the fluid rate same as the previous day.
- However, if there is excessive weight gain (3-5%) and or signs of over hydration such as puffiness over the eyelids and or oedema, decrease the fluid intake by 15 – 20 ml/kg/day

2. Urine output

- Urine output is measured by weighing wet nappies and subtracting its dry weight, on an electronic kitchen grade weighing scale.
- **Oliguria**
 - Defined as urine output <1 ml/kg/hr over a 6-hour period beyond 48 hours of age.
 - If there is oliguria and weight loss, increase daily fluid intake by 10-20 ml/kg.
 - However, if there is oliguria with weight gain, decrease daily fluid volume by 10 ml/kg and evaluate for renal failure.
- **Acute kidney injury**
 - Replace insensible losses and urine output.
 - Choice of IV fluids should be a combination of 10% dextrose with added sodium (without potassium) to maintain normoglycaemia and normal blood chemistry. During fluid restriction, glucose infusion rate should not be below 4 mg/kg/min to avoid hypoglycaemia. This may necessitate giving higher dextrose concentrations.

4.6 Adjusting IV fluid with enteral feeding

4.6.1 *Term, appropriate for gestational age babies*

- As soon as a baby has been stabilised after birth, breast milk can be commenced even in the smallest babies. If the baby cannot be directly breastfed, give expressed breast milk by cup or nasogastric tube. If baby is able to tolerate enteral feeds and is suckling well, omit intravenous fluids.
- If baby has been hypoglycaemic tail off intravenous fluids gradually.

4.6.2 *Preterm / small for gestational age babies*

- If the baby is tolerating cup or tube feeds, increase the volume of breast milk as available, while decreasing the volume of IV fluid

to maintain the total daily fluid volume according to the baby's daily requirement.

- Calculate the total fluid requirement per day. Subtract the daily volume of feeds and give the remaining as IV fluid.
- Parenteral nutrition and electrolytes infusion are stopped when the enteral feeds reach 50% of the daily requirement with the remainder being given as 10% dextrose.
- IV fluids are stopped when the enteral feeds reach 75% of the total daily fluid requirement or 100 ml/kg/day.

4.7 Worked examples on fluid management

The volumes are based on preparations commonly used in state hospitals.

Example 1

Calculation of fluids for a 1-day-old 31 weeker with a birth weight of 1.0kg.

Expressed breast milk was not sent regularly, but received 0.2-0.3ml 4 times. Expressed breast milk volume can be included in the fluid calculation when receiving regularly.

Total fluid requirement	= 80ml/kg/d = 80ml/d
Aminoacids	= 25ml/kg/d = 25ml/d
10% dextrose	= (80 – 25ml/d) = 55ml/d

Example 2

Calculation of IV fluids for a 2-day-old 30 weeker with a birth weight of 1.0kg. Current weight 990g.

Total fluid requirement	= 80ml/kg/day = 80ml/d
Expressed breast milk	= 1ml 2hrly = 1ml x 12 = 12ml/d
Amino acid = 34ml/kg/day	= 34 ml/d = 34/24 ml/h
Lipids 20% = 5ml/kg/d	= 5ml/d = 5/24 ml/h
10% dextrose = 80 – (12+34+5)	= 29ml/d = 29/24ml/h

Example 3

Calculation of IV fluids for a 3-day-old 30 weeker with a birth weight of 1.0kg. Current weight 980g.

Keep total fluids the same as minimal weight loss

Total fluid requirement = 80ml/kg/day = 80ml/d

Expressed breastmilk should increase steadily.

Expressed breast milk = 2ml 2hrly = 2ml x 12 = 24ml/d

Since this is less than 50% of the total fluids parenteral nutrition has to be continued.

Aminoacid = 43ml/kg/d = 43ml/d

20% lipids = 10ml/kg/d = 10ml/d

Since it is day 3 – electrolytes should also be added.

3% NaCl = 8ml/kg/d = 8ml/d

KCl = 1ml/kg/d = 1ml/d

Ca = 4ml/kg/d = 4ml/d

10% dextrose = 80 – (24+43+10+8+1+4)

Since this is not plausible reduce the amino-acid solution by 1-step to 35ml/kg/day

10% dextrose = 80 – (24+35+10+8+1+4)

Since it is still not plausible, reduce amino acid solution by another step

10% dextrose = 80 – (24 + 25+10+8+1+4)
= 8ml/d

Example 4

Calculation of IV fluids on day 4. Current weight 980g. EBM has increased to 4 cc 2 hourly.

Total fluids can be kept the same as there is no change in the weight from day 3.

Total fluid requirement = 80ml/kg/day = 80ml/d

Enteral feeds via EBM = 4ml 2 hourly = 4 x 12 = 48ml/d

Since this comes to 50% of the total requirement parenteral nutrition can be omitted.

Total fluid requirement = 80ml/kg/day = 80ml/d
 Enteral feeds via EBM = 4ml 2 hourly = 4 x 12 = 48ml/d
 10% dextrose = 32ml/d = 1.3ml/hr
 with a syringe pump OR 1.3 micro drops/min with a micro drip set

Example 5

Calculation of IV fluids on day 5. Current weight 990g. EBM has increased to 6 cc 2 hourly.

EBM 6ml 2 hrly = 6 x 12 = 72ml/day, is more than 75% of the fluid requirement i.e 80ml/kg/day.

Therefore, IV fluids can be stopped.

4.8 Special situations

4.8.1 *Intestinal obstruction*

Aspirate should be replaced with normal saline with added potassium on volume basis every 8 hours. (replace nasogastric losses with 0.9% NaCl + 10 mmol KCl/ per 500ml bag)

4.8.2 *Dehydration*

- Serial recording of weight is the most reliable way to assess the severity of dehydration. However upto 10% weight loss maybe normal during the first week in a newborn.
- Physical signs of dehydration are less reliable in newborns.
- Dehydration is corrected slowly in newborns unless there are features of shock when fluid boluses would be indicated. The deficit, maintenance fluids and ongoing losses.
- Addition of potassium can be done after reviewing electrolyte reports and once urine output is established.
- Babies with sepsis, necrotising enterocolitis and dehydration due to excessive transepidermal losses or inadequate intake often require a maximum of 2 fluid boluses of 10ml/kg of 0.9% NaCl.

4.8.3 *Hypernatraemic dehydration*

- This occurs most often due to delayed establishment of breastfeeding. This leads to reduced removal of breast milk from the breast, build-up of factors inhibiting lactation which thereby reduce the breast milk flow.
- The high sodium levels are due to the stasis and reduced removal of milk from the breasts and / or due to high sodium levels in the breast milk itself irrespective of the volume being produced or removed from the breast.
- Delayed establishment of breastfeeding leads to gap-junctions in the breast alveolar epithelium remaining open resulting in higher transfer of sodium to the breast milk. Establishment of breast milk feeding will lead to closure of these gap junctions and normalisation of sodium content in the breast milk.
- Therefore breastfeeding should be promoted and supported throughout the management of hypernatraemic dehydration.
- Hypernatraemia can cause brain haemorrhages that result in permanent neurological damage.
- Babies present with lethargy, poor feeding, convulsions or they would be alert, hungry and crying irritably.
- **The target maximum drop in sodium concentration should be 0.5mmol/l/hr or 15mmol/day.**
- A slower sodium drop is acceptable if the baby is haemodynamically stable.
- **Rapid correction of hypernatraemia causes cerebral oedema.**
- Management:
 - Baby should be admitted if the weight loss is more than 10% of birth weight.
 - Unrestricted breastfeeding / expressed breast milk should be provided in addition to below.
 - Shock should be treated with normal saline, 0.9% NaCl, bolus of 10ml/kg.
 - Initial intravenous fluid volume used should be 100ml/kg/day or less depending on availability of breast milk (rather than 150ml/kg/day).

- Commence IV fluid therapy with normal saline (0.9% NaCl) if serum sodium is >160mmol/l or if the sodium level is not known yet as the IV fluid should have a sodium concentration 10-15mmol/l lower than the serum level.
- Monitor serum sodium 4-6 hourly
- Transfer to a level 3 neonatal unit (Annexure 9).

Summary

- Start parenteral nutrition on day 1 with 10% Dextrose and amino acids along with expressed breast milk.
- Add lipids to 10% dextrose and increase the amino acids on day 2.
- Add electrolytes and increase amino acids and lipids on day 3.
- Include expressed breastmilk in the total fluid requirement when obtaining regular volumes.
- Parenteral nutrition can be stopped when enteral feeds are 50% of the total daily requirement.
- IV fluids can be stopped when EBM is 75% of the total daily fluid requirement.
- Use of syringe/infusion pump or microdrip infusion set facilitates the administration of small volume of IV fluids.
- Serial weight recording and urine output are useful in assessing fluid balance in newborns.

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MANAGEMENT OF LOW BIRTHWEIGHT AND PRETERM BABIES

Chapter 5

MANAGEMENT OF LOW BIRTHWEIGHT AND PRETERM BABIES

5.1 Introduction

Low birth weight or LBW denotes birth weight of less than 2500g. Preterm babies are babies less than 37 weeks gestation. In Sri Lanka 15.7% (DHS 2016/17) of babies are LBW and 7% are preterm (EMONC survey 2012). These babies have a higher mortality and are more prone to malnutrition, recurrent infections and neurodevelopment handicaps. Appropriate care of these infants, with adequate attention to feeding and nutrition improves their survival and optimises the long term neurodevelopmental outcome.

5.2 Definitions

(1) Classification of low birth weight babies

<1000 g – extreme low birth weight

1000-1499g – very low birth weight

(2) The gestation or maturity of the baby

Pre-term : < 37 completed weeks

Term : 37 to 41wks + 6days

Post-term : $\geq$ 42 completed weeks

(3) Classification of preterm babies

- a. <28 weeks – extreme preterm
- b. 28 - 31+6 weeks – very preterm
- c. 32 - 33+6 weeks – moderate preterm
- d. 34 - 36+6 weeks – late preterm

5.3 Prevention of complications of prematurity

- The incidence of prematurity is around 10 to 12 percent in all parts of world. The complications related to preterm birth and the mortality can be significantly (30-50%) decreased by giving

antenatal steroids (ANS) to mother. The ANS recommended are injection Betamethasone 12 mg IM every 24 hours (2 doses) OR Dexamethasone 6 mg IM every 12 hours (4 doses). The ANS have optimal benefit when given to mothers with preterm labour or APH, before 35 weeks and when delivery occurs 24 hours after completing therapy.

There is no role for giving steroids to the baby after birth to prevent the complications of prematurity

- Recent evidence has shown that antenatal magnesium sulphate therapy given to women at risk of preterm birth substantially reduced the risk of cerebral palsy in their children.

5.4 Identification of a preterm baby

The gestational age of a baby can be most accurately estimated to ± 5 days with measurement of the crown rump length (CRL) on antenatal sonography done at 8-13 weeks.

An estimation of gestational age ± 2 weeks is also possible by the mother's measurement of the biparietal diameter in the 2nd trimester, last menstrual period or by doing a detailed physical and a neuromuscular examination using the New Ballard Score. Assessment of gestational age should be done as soon as possible (ideally within 24 hours or latest 4 days) in order to arrive at an accurate estimate and for decisions regarding management and prognostication.

New Ballard Score for gestational age assessment (www.ballardscore.com)

Neuromuscular Maturity

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

Physical Maturity

Skin	Sticky, friable, transparent	Gelatinous, red, translucent	Smooth, pink; visible veins	Superficial peeling and/or rash; few veins	Cracking, pale areas; rare veins	Parchment, deep cracking; no vessels	Leathery, cracked, wrinkled	
Lanugo	None	Sparse	Abundant	Thinning	Bald areas	Mostly bald	Maturity Rating	
Plantar surface	Heel-toe 40-50 mm; -1 <40mm:-2	>50mm, no crease	Faint red marks	Anterior transverse crease only	Creases entire 2/3	Creases over entire sole	Score	Weeks
							- 10	20
Breast	Imperceptible	Barely perceptible	Flat areola, no bud	Stippled areola 1-2 mm bud	Raised areola 3-4 mm bud	Full areola 5-10 mm bud	- 5	22
							0	24
							5	26
Eye/Ear	Lids fused loosely: -1 tightly:-2	Lids open; pinna flat stays folded	Slightly curved pinna; soft; slow recoil	Well curved pinna; soft but ready recoil	Formed and firm, instant recoil	Thick cartilage ear stiff	10	28
							15	30
							20	32
Genitals (male)	Scrotum flat, smooth	Scrotum empty, faint rugae	Testes in upper canal, rare rugae	Test descending few rugae	Test down, good rugae	Test pendulous, deep rugae	25	34
							30	36
							35	38
Genitals (female)	Clitoris prominent labia flat	Clitoris prominent, small labia minora	Clitoris prominent, enlarging minora	Majora and minora equally prominent	Majora large minora small	Majora cover clitoris and minora	40	40
							45	42
							50	44

5.4.1 Neuromuscular maturity

Posture: Total body muscle tone is reflected in the infant's preferred posture at rest and resistance to stretch of individual muscle groups. As maturation progresses, the fetus gradually assumes increasing passive flexor tone that proceeds in a centripetal direction, with lower extremities slightly ahead of upper extremities. The preterm infant primarily exhibits unopposed passive extensor tone, while the infant approaching term shows progressively less opposed passive flexor tone.

Square window: The examiner straightens the infant's fingers and applies gentle pressure on the dorsum of the hand, close to the fingers and the angle between the palm of the infant's hand and forearm is estimated as shown in Figure 5.1.



Figure 5.1: Square window



Figure 5.2: Arm recoil

Arm recoil: With the infant lying supine, the examiner places one hand beneath the infant's elbow for support. Taking the infant's hand, the examiner

briefly sets the elbow in flexion, then momentarily extends the arm before releasing the hand. The angle of recoil to which the forearm springs back into flexion is noted as in Figure 5.2.

Popliteal angle: With the infant lying supine, and with nappy removed, the thigh is placed gently on the infant's abdomen with the knee fully flexed. After the infant has relaxed into this position, the examiner gently grasps the foot at the sides with one hand while supporting the side of the thigh with the other. Care is taken not to exert pressure on the hamstrings, as this may interfere with their function. The leg is extended until a definite resistance to extension is appreciated. At this point the angle formed at the knee by the upper and lower leg is measured as shown in Figure 5.3.



Figure 5.3: Popliteal angle



Figure 5.4: Scarf sign

Scarf sign: This manoeuvre tests the passive tone of the flexors about the shoulder girdle. With the infant lying supine, the examiner adjusts the infant's head to the midline and supports the infant's hand across the upper chest with one hand. The thumb of the examiner's other hand is placed on the infant's elbow. The examiner nudges the elbow across the chest, feeling for passive flexion or resistance to extension of posterior shoulder girdle flexor muscles as shown in Figure 5.4.

Heel to ear test: This manoeuvre measures passive flexor tone about the pelvic girdle by testing for passive flexion or resistance to extension of posterior hip flexor muscles. The infant is placed supine and the flexed lower extremity is brought to rest on the mattress alongside the infant's trunk. The examiner supports the infant's thigh laterally alongside the body with the palm of one hand. The other hand is used to grasp the infant's foot at the sides and to pull it toward the ipsilateral ear as shown in Figure 5.5.



Figure 5.5: Heel to ear test

5.4.2 Physical maturity

The following are some of the parameters used in gestational assessment.

Skin: The skin of preterm neonate is thin, transparent and gelatinous whereas that of a term neonate is thick, non- gelatinous and keratinised.

Hair: The back of a preterm baby has abundant growth of fine hair called lanugo. The hairy area turns bald as the gestation matures.

Ear cartilage: The external ear or the pinna is soft and devoid of cartilage in preterm neonates and hence, it does not recoil back promptly on being folded. In a term baby there is instant recoil.

Breast nodule: Breast nodule measures less than 5mm in preterm neonates and 5mm or more in term babies (Figure 5.6)



Figure 5.6: Breast nodule of a preterm (left) and term (right) infant

Sole creases: In preterm infants the soles are initially smooth with minimal creases and as the gestation advances a single deep transverse crease is seen in the anterior one third. In term neonates multiple creases are present over the anterior two-thirds of the sole (Figure 5.7).



Figure 5.7: Sole creases of a preterm (left) and term (right) infant

External genitalia of preterm infants: In males (Figure 5.8), the scrotum does not have rugae and testes are not descended into the scrotum. In female infants (Figure 5.9), the labia are widely separated, not covering the labia minora, resulting in the prominent appearance of the clitoris (Figure 5.9).



Figure 5.8 Male external genitalia of a preterm(left) and term (right) infant



Figure 5.9 Female external genitalia of a preterm(left) and term (right) infant

5.5 Problems of preterm neonates

The basic underlying feature of the preterm LBW infant is immaturity of its organ systems. They are prone to the following complications.

- **Hypothermia**
- **Feeding problems** - Preterm neonates less than 34 weeks of gestation may not be able to co-ordinate sucking and swallowing. Therefore, they are unable to feed from the breast.
- **Respiratory distress syndrome (RDS):** Preterm babies especially those less than 34 weeks have immature lungs, hence they develop RDS characterised by rapid and laboured respiration, in-drawing of the chest, grunting and cyanosis.
- **Apnoeic spells:** Because of the immature respiratory control mechanisms these babies also have a tendency for apnoeic spells. In an apnoeic spell the baby stops breathing, develops a slow heart rate and turns blue.
- **Intra-ventricular haemorrhage (IVH):** Preterm infants also have an immature vascular bed around the brain ventricles. These delicate vessels may rupture and cause intra-ventricular haemorrhage.
- **Hypoglycaemia** - Immature metabolic pathways of preterm infants predispose them to develop hypoglycaemia.
- **Hyperbilirubinaemia**

- **Hypoxia** necessitating resuscitation
- **Infection** is another major problem among preterm babies and indeed an important killer because they are immuno-compromised hosts.
- **Retinopathy of prematurity (ROP)** is the commonest cause of preventable blindness by abnormal blood vessel formation due to the damage to the immature retina via excess oxygen therapy as well as prematurity in children and can be avoided by minimising the use of oxygen and ensuring adequate postnatal growth in preterm babies. Babies who are very low birth weight (<1500 g) or <32 weeks gestation at birth should be screened for ROP, in 2nd-3rd week of life. (Annexure 8)
- **Osteopenia of prematurity:** Hypophosphatasia due to phosphate wasting reduces bone mineralisation causing abnormal bone remodelling with increased risk of fractures and reduced linear growth. A serum alkaline phosphatase (ALP) >900IU and phosphate <1.8 mmol/l has 100% sensitivity but only 70% specificity. A baby with osteopenia, rickets or fractures has to be treated until normalisation of the ALP or for 6 months postnatally.
- **Anaemia of prematurity:** The baby being delivered prior to placental iron transport and fetal erythropoiesis being completed and blood sampling for laboratory tests, are the main contributors.

5.6 Small for gestational age babies (SGA)

Most (50-70%) of SGA babies are healthy and constitutionally small.

But (30-50%) are growth restricted babies.

- 80% - Placenta mediated growth restriction
- 20% - Non placenta mediated growth restriction - intrinsically small due to chromosomal anomalies / congenital infections

Placenta mediated growth restriction is also known as asymmetrical growth restriction

- Late insult
- Disturbance in cell hypertrophy
- Decreased cell size

- Reversible
- Brain is spared, head: abdomen ratio is increased
- Due to placental insufficiency, maternal hypertension etc.
- Better prognosis

Non placenta mediated growth restriction is also known as symmetrical growth restriction (20%)

- Early insult
- Due to disturbance of cell hyperplasia causing reduced cell number
- Irreversible
- Head: abdomen ratio is normal
- Due to chromosomal anomalies, congenital infections etc.
- Poor prognosis

5.7 Problems of small for gestational age neonates

The basic underlying problem amongst them is in-utero under nutrition and hypoxia. They are more prone to:

- Fetal distress, meconium passage in utero and birth asphyxia.
- Polycythaemia
- Hypothermia
- Hypoglycaemia
- Congenital malformations

5.8 Management of low birth weight babies

5.8.1 Delivery of LBW babies

Ideally, the delivery of an anticipated LBW baby should be conducted in a hospital with newborn care facilities i.e level-1 hospitals and above. The in-utero transfer of a LBW fetus is far more desirable and safe than transport after birth.

5.8.2 Deciding the place where a LBW baby should be managed

LBW babies weighing >1500 grams (and >34 weeks gestation):

These babies are kept with the mother in the post-natal ward. However, they are provided with extra assistance and monitoring.

Monitor baby for

1. Respiratory distress
2. Hypoglycaemia
3. Hypothermia
4. Adequacy (weight gain) and safety (aspiration) of feeding

The mothers of these babies are educated and supported on a regular basis by the health care providers in the postnatal ward. Training of the mother during her stay should include,

- (1) Kangaroo mother care (KMC) and assessment of temperature by touch and on how to use a digital thermometer
- (2) Breastfeeding
- (3) Expression of breast milk and cup feeding if indicated
- (4) Recognition/reporting of danger signs and
- (5) Basic life support

Baby is discharged when breastfeeding is established in a minimum of 48 hours.

Once the mother and the family are confident that they can care for the LBW baby and the baby is clinically well, the LBW baby can be discharged and managed at home.

A baby who is unable to feed from the breast and cup or is sick should be immediately admitted to the SCBU/NICU.

LBW babies less than 1500 grams (and / or <34 weeks gestation)

These babies should be monitored and cared for in the SCBU or NICU as the case may be. The period of care in the SCBU may be for a very short period or for several days depending on the sickness level of the baby.

**Many of these babies do not need IV fluids, antibiotics
or oxygen**

5.8.3 *Keeping LBW babies warm*

5.8.3.1 *At home*

Baby should be nursed next to the mother and the room should be kept warm. The baby should be clothed well (2-3 layers of clothes). If the room is not warm enough, a woolen sweater should also be put on. Feet should be covered with socks, hands with mittens and head with a cap. Besides, a blanket should be used to cover the baby. Mother should be trained to monitor the baby for cold stress by hand touch. A baby in cold stress should be given additional warmth immediately.

On the other hand a baby should not be made too hot and sweaty either. If the weather is very warm the number of layers of clothes should be reduced and woolen clothings removed. Baby should be kept comfortably in loose clothing.

Mother needs to know how to strike a balance between the baby getting cold, initially indicated by hands and feet getting cold, and being too hot with the baby being warmer than usual when touched and sweaty.

5.8.3.2 *In the hospital*

Small babies should be kept away from direct air currents from windows, fans, air conditioners etc. Regular monitoring of axillary temperature at least once every 6-8 hours should be carried out in all hospitalised babies. If the baby is hypothermic despite kangaroo mother care (refer Chapter 2) and warm clothes as mentioned above, the baby should be admitted to the neonatal unit for incubator care, observation and screening for ongoing sepsis.

5.8.4 *Nutrition and fluids*

Enteral feeding with breast milk should be initiated soon after birth.

5.8.4.1 *Quantity of feeding*

- Baby should be offered direct breastfeeding if tolerated. Mother should be encouraged to visit the baby as soon as possible and initiate direct breastfeeding if possible or skin-to-skin care as soon as possible. She should also be empowered with the skills to express breastmilk 2-3 hourly.
- All available breast milk should be given to the baby 2-3 hourly via cup. Tube feeds are used if baby is unable to tolerate cup feeds.

- It is normal to obtain only a few drops of breast milk on the first day which will steadily increase by supporting the mother to give skin-to-skin care, express breast milk or directly breastfeed.
- Few drops of breast milk are adequate to provide nutrition and maintain a fluid balance in most babies more than 1500g and 34 weeks gestation.
- Parenteral nutrition may be required in babies <1500g and <34 weeks gestation in addition to enteral nutrition. (refer Chapter 4)
- Enteral feeds should not be calculated based on the IV fluid requirement.
- Daily measurement of milk volume per feed, weight, measuring urine output by weight of wet nappies and monitoring blood sugar 6 hourly will ensure that baby is receiving adequate fluid.
- Milk volume obtained for each feed is expected to steadily increase to 150ml/kg/day by the end of the first week. It can be further increased to 200ml/kg/day as tolerated by the baby.
- IV fluids will need to be initiated due to massive weight loss, reduced urine output <1ml/kg/hr after 48 hours or hypoglycaemia (refer Chapters 4 and 6)

5.8.4.2 Frequency of feeding

LBW babies should be fed every 2-3 hours starting as soon as possible after birth. Start 2 hourly to increase production of breastmilk and change to 3 hourly when obtaining adequate breastmilk if giving expressed breastmilk. When baby is stable, change to demand feeding based on hunger cues.

5.8.4.3 Mode of feeding

The mode of feeding will depend on the maturity and the well-being of the baby.

Term SGA baby:

- These babies have all the reflexes and therefore the skills necessary to obtain an adequate amount of milk but get tired easily.
- Therefore, the breastfeed should be limited to 10-15 min and the baby given a rest by giving the remainder of the feed by cup (breastfeeding expends more energy than a cup feed).

- However, when the baby grows and is bigger and stronger he will be able to extract more from the breast and cup feeds can be weaned.
- Timed 2-3 hourly feeds should be stopped and baby should be fed according to hunger cues when the baby is stabilised.

Preterm baby

- The mode of feeding will be decided depending on the maturity.
- The neonate at 30 weeks attains the ability to coordinate swallowing with respiration, but still has no suck-swallow coordination. Hence, most neonates less than 30 weeks (or 1200g), need to be tube fed.
- However, since each baby is different, the baby can be assessed with regard to the readiness to cup feed when stable, by an experienced health personnel. If baby is deemed to be ready, a small amount of feed can be offered via cup and amount increased gradually as the baby matures.
- At 34 -35 weeks, the suck-swallow coordination is gained. Hence, babies >34 weeks can be breastfed and those between 30-34 weeks need cup feeds in addition to breastfeeds.
- A baby should be put to suckle the empty breast when baby is showing sucking movements and hunger cues during KMC.
- When the baby is assessed to have suck swallow coordination baby can be given to feed on a partially filled breast and gradually progress onto a full breast.

Table 5.1: Guidelines for the modes of providing fluids and feeding

Categories of neonates			
Birth weight (g) Gestation (weeks)	<1500g <32 weeks	1500-1800 33-34	>1800 >34
Initial	Intravenous (IV) fluids + tube feeds	Breastfeeding + cup feeding	Breastfeeding. If unsatisfactory, give cup feeds
After 1-3 days	Increase tube feeds; wean off IV fluids	Breastfeeding + cup feeding	Breastfeeding
Later (1-3 weeks)	Tube / cup feeds	Breastfeeding	Breastfeeding
After more time (4-6 weeks)	Breastfeeding + cup feeding	Breastfeeding	Breastfeeding

5.8.4.4 Techniques and methods of feeding

Start Non-Nutritive Sucking (NNS) as soon as the baby is stable on KMC

An infant born prematurely develops the sucking behaviour (coordinated sucking, swallowing and breathing) over time to be able to feed on breast. This transition may be facilitated by encouraging NNS in these small babies. The NNS sucking is initiated by allowing the baby to suck on an empty breast (after expression). The NNS may be started right from the time the baby is on tube feeds. The NNS may encourage the development of sucking behaviour, improve digestion of the feed and has been shown to reduce hospital stay.

Trophic feeds (minimal enteral nutrition)

Minimal enteral nutrition (MEN) or trophic feeds are small volumes of expressed breast milk (whatever the mother is able to express) delivered intra-gastric, starting soon after birth in preterm/growth restricted babies. These feeds enhance gut growth, hormone secretion and gut motility. The clinical benefits of MEN are: reduction in the days required for attaining full feeds, decreased hospital stay and reduced risk of necrotising enterocolitis. Feeds should be increased as provided by the mother. Aim to achieve full feeds by 4-5 days after birth.

Nasogastric feeds/ orogastric feeds

Nasogastric feeding is the preferable method of feeding. Orogastric is recommended for babies on nasal CPAP or on nasal prong oxygen.

Using a naso / orogastric tube for gavage feeding

- For gavage feeding, a 5-6 French size polyethylene feeding catheter is required for naso/orogastric placement.
- At the time of feeding, the outer end of the tube is attached to a 10 ml syringe (without plunger) and milk is allowed to trickle by gravity over 10-15 minutes.
- The nurse providing the feed should continuously observe the baby during the feed as regurgitation / aspiration can happen even with tube feeds.
- Baby should be observed closely even after the feed.
- The baby should be placed in the left lateral position for 15 to 20 minutes to avoid regurgitation. There is no need to burp a tube-fed baby.
- The tube may be left in situ for 2 or 3 days.
- While pulling out a feeding tube, it must be kept pinched and pulled out gently to avoid trickling of gastric mucus into the trachea.
- The position of the tube should be always checked if in doubt. This can be done by aspiration of a small amount of gastric content.
- If the abdomen is distended but soft and aspiration reveals only milk or altered milk and baby is otherwise clinically well, feeds should be continued.
- **Stop feeds** and get the baby evaluated urgently if the distended abdomen is tense or tender or the baby has vomiting or the aspirate is bile stained (ensure that the tube has not passed the pylorus) or blood stained.

Routine pre-feed gastric aspiration is not recommended

Method of feeding by a cup

- Wrap and swaddle baby with a cloth to avoid the baby trying to push away the cup.
- Hold baby in a sitting, upright or semi-upright position on your lap while supporting the head and shoulders with your hand or elbow.

- Hold the small cup of milk to the baby's lips. The cup should rest lightly on the baby's lower lip.
- Tip the cup so that the milk just reaches the baby's lips and touches the baby's upper lip.
- The baby becomes alert and opens his mouth and eyes – A LBW baby starts to take the milk into his mouth with his tongue. A full-term baby sucks the milk.
- DO NOT POUR the milk into the baby's mouth. Just hold the cup to his lip and let him take it himself.
- When the baby has had enough, he closes his mouth and will not take any more. If he has not taken the calculated amount he may take more next time, or you may need to feed him more often.
- Measure his intake over 24 hours – not just at each feed.

Breastfeeding

The method of breastfeeding is essentially the same as for the normal weight babies. LBW babies may be slow in sucking and take longer to feed. Mother may need extra support in positioning and attachment (refer Chapter 3)

5.9 Intravenous fluids

The fluid requirements of neonates are detailed in Chapter 4.

5.10 Judging adequacy of nutrition

- The key measure of optimal feeding is the weight pattern of the baby. A preterm LBW baby loses up to 1 to 2 percent weight every day amounting to 10 percent cumulative weight loss during the first week of life. Birth weight is regained by the 14th -21st day of life.
- It is desirable to weigh all LBW babies at 1-2 weeks, depending on establishment of breastfeeding.
- Hospitalised LBW babies should be weighed 2-3 times a week using the same weighing scale.
- The expected weight gain of preterm babies who are exclusively breast milk fed is 10-30g/kg/day.

- Excessive weight loss, or inadequate weight gain indicates inadequate feeding, cold stress, excessive insensible water loss, sodium depletion or systemic illness (like anaemia, sepsis, urine infection and late metabolic acidosis etc).

5.11 Vitamin and mineral supplements needed by preterm and LBW babies

Vitamin K

Babies <1500 g at birth should receive 0.5 mg IM/IV at birth while those ≥1500 g should receive 1mg IM. IM route is preferred. **It should be continued weekly for 4-6 weeks.**

Vitamin D

All LBW infants who exclusively breastfed should receive 400IU daily of vitamin D from first few days of life once they accept full feeds (multivitamin and calcium supplements contain vitamin D). Vitamin D supplementation at 200-400IU/day should continue until 2 years of age as part of the multivitamin supplement. Most available drops contain 400IU/ml.

Multivitamin drops

0.3 ml/kg/ day from the time baby is commenced on feeds to a maximum of 0.6 ml/day. Folic acid is given as a once weekly dose of 500 micrograms (1/2 of a 1mg tablet) till 1 year and 1mg till 2 years of age (Annexure 2).

Table 5.2: Vitamin requirement in preterm babies compared to what is supplied in breast milk

	Recommended dietary intake	Breast milk
Vitamin A ⁴⁴		
<1 kg	1500 IU/kg/day	450 IU/kg/day
1-1.75kg	700-1500 IU/kg/day	(150 ml/kg/day)
1.75-2.5kg	700 IU/kg/day	
>2.5kg	333IU/kg/day	
Vitamin E ⁴⁵	5 IU/day + breast milk	Good source
Vitamin D ⁴⁶	200-400 IU	
Vitamin C ⁴⁷	20mg/100kcal	8mg/100kcal
Vitamin B1 ⁴⁷	300µg/100kcal	29µg/100kcal
Vitamin B2 ⁴⁷	300µg/100kcal	60µg/100kcal
Vitamin B6 ⁴⁷	150µg/100kcal	28µg/100kcal
Niacin ⁴⁷	4mg/100kcal	210µg/100kcal
Biotin ⁴⁷	5µg/100kcal	0.56µg/100kcal
Pantothenic acid ⁴⁷	1.4µg/100kcal	250µg/100kcal
Zinc ⁴³	500-1000µg/kg/day	
Folic acid ⁴⁸	50µg/100kcal	50µg/L
Vitamin B12 ⁴⁸		Adequate Supply

Calcium and phosphate supplementation

All very low birth weight (VLBW) babies (1500g) should receive calcium 120-200mg/kg/day and phosphorus at 60-140mg/kg/day. These may be continued till 40 weeks post conceptual age or 3.5 – 4kg weight, whichever comes later. If combined preparations are used, the optimal ratio of Ca and phosphorus should be 2:1.

Iron supplementation

3mg/kg/day from 2 weeks of age is effective in preventing anaemia of prematurity and needs to be continued at least till 2 years of age. If the baby is already anaemic use 6mg/kg/day of elemental iron.

5.12 Screening very preterm/high risk babies

In addition to universal screening, following screening procedures are recommended

- Ultrasound scan brain - to check for intraventricular haemorrhages within the first week and periventricular leukomalacia later on
- Screening for ROP - (Annexure 8)
- Hearing screening – (Annexure 6)
- Screening for osteopenia of prematurity – Alkaline phosphatase should be < 800IU/l and serum phosphate should be >1.8mmol/l
- Neurological deficit – Hammersmith Neurological Examination (Annexure 10)

5.13 Discharge planning of LBW babies

The discharge of LBW and preterm babies should be planned and the following points should be considered prior to discharge;

- The weight gain should be consistently demonstrated for 3 consecutive measurements if the baby is more than 1 week old (or weight loss should be less than 10%). The weight, head circumference and the length should always be recorded at the time of discharge.
- Mother should be confident in breastfeeding the baby directly and via cup.
- Methods of temperature regulation like the KMC and any other skills should be well known to mother and adequately practiced in the hospital under supervision.
- A neurological examination should be done before discharge to identify any neurological deficits and early intervention commenced. Hammersmith Neurological Examination can be used to perform the neurological examination.
- Nutritional supplements should have been started prior to discharge.
- Baby should have received BCG prior to discharge.
- A family meeting with both parents and all potential caregivers should be held to educate the caregivers and assess the safety of discharge.

- Hand washing and minimal handling
- Co-sleeping and risk of suffocation
- Safety of feeding and risk of aspiration
- Early stimulation and avoiding screen time
- Identifying danger signs
 - Feeding difficulty
 - Fast or difficult breathing
 - Fever or cold to touch
 - Mother feels that the baby is /unwell sick
- Make a contingency plan on how to reach the hospital in case of emergency.
- Educate on contact details of the hospital and where to go in case of emergency.
- Hands-on training on basic resuscitation and first-aid for choking.
- Importance of regular follow up including screening for retinopathy of prematurity and hearing evaluation at 40 weeks of corrected gestational age (Annexure 8)

5.14 Vaccinations in LBW babies

Vaccination schedule is same for LBW babies. However, BCG may be delayed if they are sick.

If the baby is completing 2 months at the time of discharge, give BCG and Pentavalent, fIPV (at three different sites) and OPV on the same day.

First pentavalent and OPV to be given after completing one month following BCG if the BCG was delayed more than one month.

5.15 Growth monitoring in LBW infants

The weight of all LBW babies should be checked two to three times a week and OFC weekly during NICU stay. Serial growth monitoring allows early identification of growth faltering. Preterm growth chart should be used for growth monitoring (Annexure 11).

5.16 Follow up of LBW infants

All <1500g and <34 weeks babies should be followed up in a tertiary care centre where ever possible or a centre with a paediatrician.

The following should be monitored at each clinic visit.

- Growth - weight and length curve should follow the birth trajectory and should be plotted in the preterm growth chart.
- Head circumference – should be measured at each clinic visit and plotted in the CHDR.
- Feeding and nutrition – Feeds need to be given according to the hunger cues and not according to the clock – cup feeds should be weaned off and direct breastfeeds should be established.
- Complementary feeds can be started at 4 months of completed gestational age (CGA) if baby has head control and is reaching out.
- Continue vitamin and iron supplementation till 2 years of age.
- Screen for neurological deficit including hypertonia, hemiplegia, eye contact etc and refer for early intervention.
- Development assessment – assessed for corrected gestational age
- Promote early stimulation.
- Ensure completion of screening for congenital deafness, retinopathy of prematurity, osteopenia of prematurity, anaemia of prematurity and periventricular leukomalacia.

5.16 Prognosis

Mortality of LBW babies is inversely related to gestation and birth weight and directly to the severity of complications. In general, over 90% low birth weight babies who survive the newborn period have no neurodevelopment handicaps. Therefore, essential care of the LBW neonates is a highly rewarding experience.

Summary

- Low birth infants may be premature, growth restricted or both.
- These infants are more prone to complications such as hypothermia and feeding problems.

- Gestational age assessment should be done in all low birth weight babies.
- Mothers of LBW babies need additional support in establishing breastfeeding, expressing breastmilk and feeding via cup and advice on avoiding hypothermia.
- LBW babies need nutritional supplements.
- These babies should be monitored in a centre with specialised care

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MANAGEMENT OF HYPOLGYCAEMIA

Chapter 6

MANAGEMENT OF HYPOLGYCAEMIA

6.1 Introduction

Hypoglycaemia is the most common metabolic disorder in newborn babies. Anticipation, prevention, and early treatment are essential to reduce morbidity and mortality, and long-term neurodevelopmental sequelae from this disorder.

6.2 Definition of hypoglycaemia vs operational threshold

6.2.1 *Definition of hypoglycaemia*

World Health Organization described hypoglycaemia as blood sugar level $<45\text{mg/dl}$ (2.6mmol/L) in 1997. However there is no research basis or consensus regarding the definition of neonatal hypoglycaemia at present as there is no single concentration of plasma glucose associated with the appearance of clinical signs or causation of cerebral injury. Therefore the definition of clinically significant hypoglycaemia remains one of the most confused and contentious issues in contemporary neonatology.

Hypoglycaemia may be symptomatic or asymptomatic. It is important to realize that even asymptomatic hypoglycaemia can cause brain damage and should be treated without delay.

Cornblath et al. developed the concept of an “Operational Threshold,” defined as “that concentration of plasma or whole blood glucose at which clinicians should consider intervention.”

6.2.2 *Operational threshold*

Operational thresholds used to guide intervention are

- CBS $<18\text{mg/dl}$ (1.0mmol/l) at any time
- CBS $<45\text{mg/dl}$ (2.6mmol/l) in a neonate with abnormal clinical signs
- 2 consecutive CBS $<36\text{mg/dl}$ (2.0mmol/l) in an asymptomatic baby with a risk factor for hypoglycaemia

6.3 Screening of neonates at risk of hypoglycaemia

6.3.1 *Who should be screened?*

- Babies less than 37 weeks gestation
- Low birth weight babies < 2.5kg
- Infants of diabetic mothers
- Infants of mothers taking beta blockers
- All sick neonates
 - Perinatal acidosis (pH <7.1, base deficit ≥ -12mmol/l)
 - Hypothermia (<36.5°C) not attributed to environmental factors
 - Suspected / confirmed early onset sepsis
 - Cyanosis
 - Apnoea
 - Altered level of consciousness
 - Seizures
 - Hypotonia
 - Lethargy
 - High pitched cry
 - Respiratory distress
 - Poor feeding
 - Polycythaemia
 - Jitteriness

6.3.2 *When do we screen ?*

- Blood sugar drops to a physiological nadir soon after birth and takes about 4 hours to adapt to the new blood sugar levels after the placental supply ceases at birth. A delay is expected in adaption in the babies at risk of hypoglycaemia.
- Therefore these newborns at risk of hypoglycaemia should be screened before the second feed within around 4 hours after birth

- The purpose of screening is to anticipate and prevent symptomatic hypoglycaemia in at-risk newborns.
- If the first blood sugar is normal, check blood sugar approximately 2-3 hourly (pre-feed) for 12 hours, 4-6 hourly from 12-24 hours and every 12 hours for another 24 hrs.
- Blood sugar should be checked at any time if symptoms suggestive of hypoglycaemia are present in any baby.
- Check temperature of the baby along with these sugar checks.

6.3.3 *How do we screen ?*

Technique of estimation of blood sugar

- Things needed for performing capillary blood sugar estimation:
 - a) soap and water to wash hands, b) alcohol for skin preparation, c) test strips d) glucometer and e) lancet or 26 gauge needle.
- Heel is the commonly used site. One can also directly prick over the vein to obtain blood sample. This is less painful compared to the heel prick.
- Make sure heel is not cold. Heel can be warmed by holding it in your hand for a few minutes.
- Prepare the site with 70% isopropyl alcohol / spirit, using a scrubbing / circular motion.
- **Allow spirit to dry.** Contamination by alcohol may lead to erroneously high values.
- Do not use povidone / betadine, as specimen contamination may alter results.

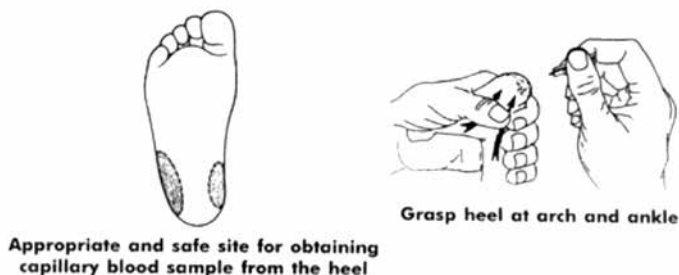


Figure 6.1: Heel prick - site and method of sampling

- Make a skin puncture on the postero-lateral aspect of heel, ideally using the lancet, or a needle. Avoid pricking the middle portion of heel and avoid making deep punctures.
- Follow the instructions on the glucometer.
- If blood glucose is low by glucometer, send blood sample to laboratory for confirmation. However, treatment should be started immediately based on glucometer estimation. Plasma glucose is 10% higher than blood glucose.

Delay in lab analysis of blood sample may result in fall of plasma glucose level by 14-18 mg/dl/hour.

6.4 Prevention of hypoglycaemia

- Breastfeed the baby within the first hour after birth.
- Ensure plenty of skin-to-skin contact and actively support breast feeding to facilitate establishment of breastfeeding
- If the baby is unable to suck, expressed breast milk may be given via a cup.
- Ensure normothermia (36.5 – 37.5°C)

6.5 Clinical features of hypoglycaemia

There are no specific or characteristic features of hypoglycaemia in the newborn. The common symptoms are:

- Jitteriness, irritability
- Lethargy, limpness
- Weak or high-pitched cry
- Poor feeding, vomiting
- Tachycardia (>180/min)
- Sweating
- Hypothermia
- Poor respiratory effort or apnea, tachypnea
- Dusky colour or cyanosis
- Seizures, coma

6.6 Differential diagnosis

The clinical features of hypoglycaemia are non-specific and can mimic any other illness in the newborn. Moreover, hypoglycaemia can occur as a complication during the course of illness. Therefore, it is a good clinical practice to check blood glucose in any sick newborn. Important differential diagnoses include sepsis, hypothermia, and perinatal asphyxia.

If the signs are not alleviated by correction of hypoglycaemia, consider other diagnostic possibilities for the symptoms.

6.7 Management

- **If the blood sugar is > 36mg/dl without clinical features**
 - Support breastfeeding
 - Repeat 2nd blood sugar in 4 hrs - > 36mg/dl – repeat 3rd blood sugar in another 4 hours and then 6 hourly for 24 hours.
- **If the blood sugar is 18 - 36mg/dl without clinical features**
 - Repeat in 4 hours after supporting breastfeeding - if still 18 - 36mg/dl - support breastfeeding and repeat in 4 hours
 - If 3rd reading is also 18-36mg/dl - start IV 10% dextrose as per flowchart C
- **If the blood sugar is <18mg/dl / or symptomatic (Flowchart C)**
 - Give a bolus of 2.5 ml/kg body weight of 10% Dextrose IV slowly over 1 minute and commence intravenous infusion of 10% dextrose 60ml/kg/day (4mg/kg/min)
 - If an IV line cannot be established give IM glucagon 200 micrograms/kg or 40% dextrose gel (if available)
 - Continue to establish breastfeeding and support expression of breast milk.
 - Recheck blood sugar in 30 minutes.
 - If blood sugar is still < 18mg/dl
 - Give IV 10% dextrose 2.5ml/kg and increase infusion by 2mg/kg/minute.
 - Check blood sugar in 30 minutes and repeat cycle if blood sugar <18mg/dl or symptoms persist.

- If the blood glucose is 19-45 mg/dl
 - Glucose infusion rate (GIR) is increased in steps of 2 mg/kg/min.
 - Check blood glucose 30 minutes after starting the infusion of glucose or any change in (GIR)
 - If GIR is >8mg/kg/min test for hyperinsulinism.
- If blood glucose is > 45 mg/dl
 - Slowly wean off IV infusion
 - Continue enteral feeds
 - Monitor if blood sugar is > 45mg/dl closely for a minimum of 24 hours

6.7.1 Intravenous dextrose

- **Indications for intravenous dextrose**

- Symptomatic hypoglycaemia
- Asymptomatic hypoglycaemia with 1 reading of <18mg/dl or >2 readings of 18-36mg/dl
- Take a sample for lab glucose and another serum bottle for later use.
- A bolus of 10% dextrose should always be followed by an infusion to prevent rebound hypoglycaemia.
- The highest concentration of dextrose solution which can be infused safely through a peripheral vein is 12.5%. Concentrations higher than this necessitate central line placement and referral.

- **Tapering of glucose infusion**

Once the blood glucose levels remain above 45 mg/dl for more than 24 hours and the baby's ability to feed improves, begin tapering GIR in steps of 2mg/kg/min every 6 hours as the oral feeds increase. If blood glucose drops below 45 mg/dl any time, go back to the previous GIR. IV fluids can be stopped when the baby is able to maintain normal blood glucose levels at GIR of 4mg/kg/min and is accepting breastfeeds well.

- **Do not discontinue the dextrose infusion abruptly; if discontinued abruptly can result in rebound hypoglycaemia.**

6.7.2 Breast milk for prevention and treating hypoglycaemia

Breast milk is the most effective enteral feed to prevent and treat hypoglycaemia

- Only breast milk promotes ketogenesis, which is an important alternate source of energy to the brain.
- Breast milk improves the glucose utilisation rate whereas intravenous glucose infusions reduce the hepatic glucose output as well as reduce the glucose utilisation by the tissues.
- Therefore enteral feeds are more beneficial than intravenous glucose to facilitate adaption of the neonate treat hypoglycaemia and the former should be used in preference to intravenous fluids in all cases of hypoglycaemia unless the baby is symptomatic.
- Enteral feeds should not be stopped during the administration of intravenous fluids.

6.8 Refractory hypoglycaemia

- When glucose infusion rate is $>10\text{mg/kg/min}$
- Obtain samples during an episode of hypoglycaemia for
 - Serum insulin
 - Urine ketone bodies
 - Growth hormone levels
 - Cortisol levels and follow up with an endocrine referral.
- Get an endocrinology opinion

6.9 Glucose Infusion Rate

The Glucose infusion rate (GIR) is calculated using the following equation. The same can also be used to crosscheck the GIR used using Table 6.1 and 6.2.

$$\text{___ ml/kg/day} \times \text{___ \% dextrose} \times 0.007 = \text{___ mg/kg/min (GIR)}$$

6.10 Frequency of blood glucose measurements after blood glucose returns to normal

- If the baby is receiving IV fluid for any reason, continue blood glucose measurements every 6 hours for as long as the baby requires IV fluid. If the blood glucose is less than 36 mg/dl, treat as described above.
- If the baby no longer requires or is not receiving IV fluid, measure blood glucose every 12 hours for 24 hours (two more measurements):
 - If the blood glucose is less than 36mg/dl, treat as described above.
 - If the blood glucose remains normal, discontinue measurements.

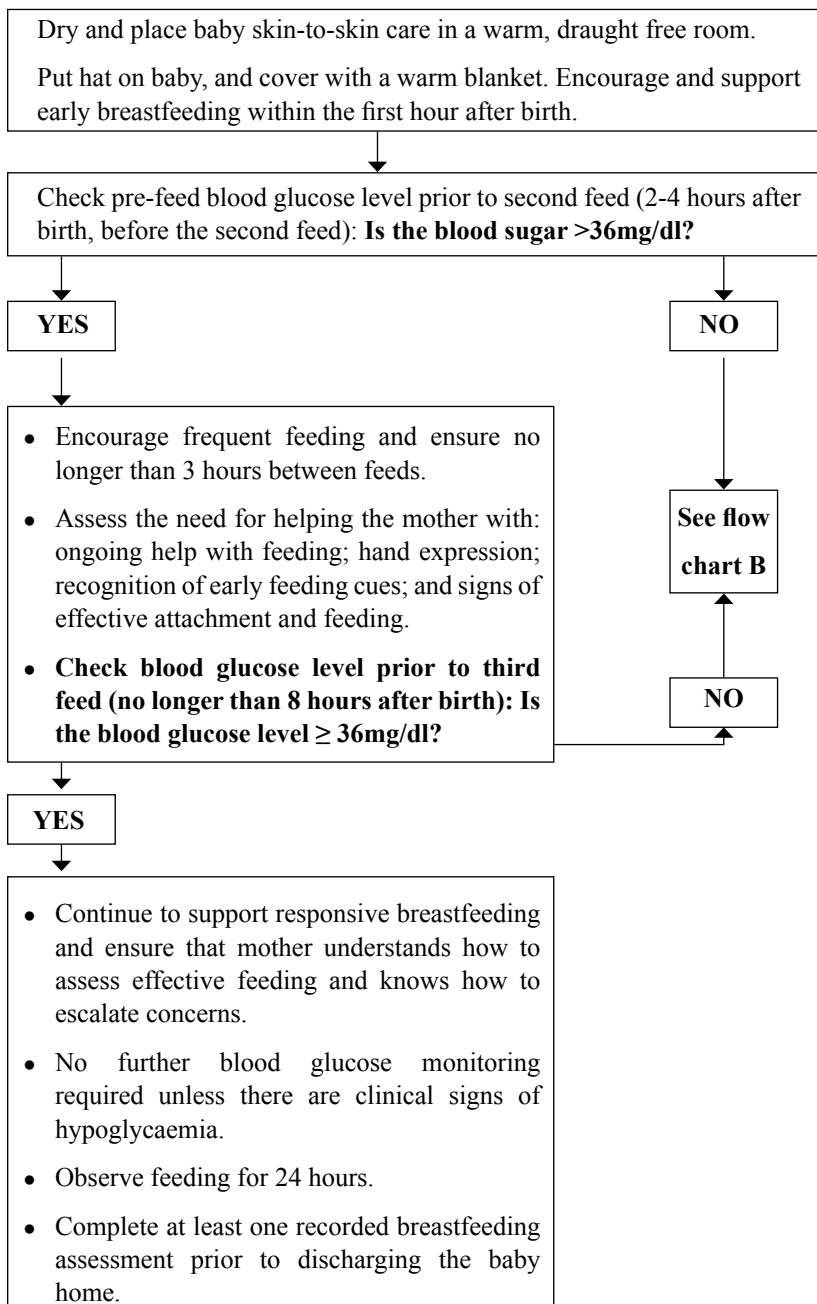
6.11 Post discharge advice and follow up

Babies who have had hypoglycaemia, whether symptomatic or asymptomatic, are at risk of neurodevelopmental sequelae such as seizures, developmental delay and cognitive deficits. Therefore these babies should have close follow-up of their neurodevelopmental status in a specialised centre.

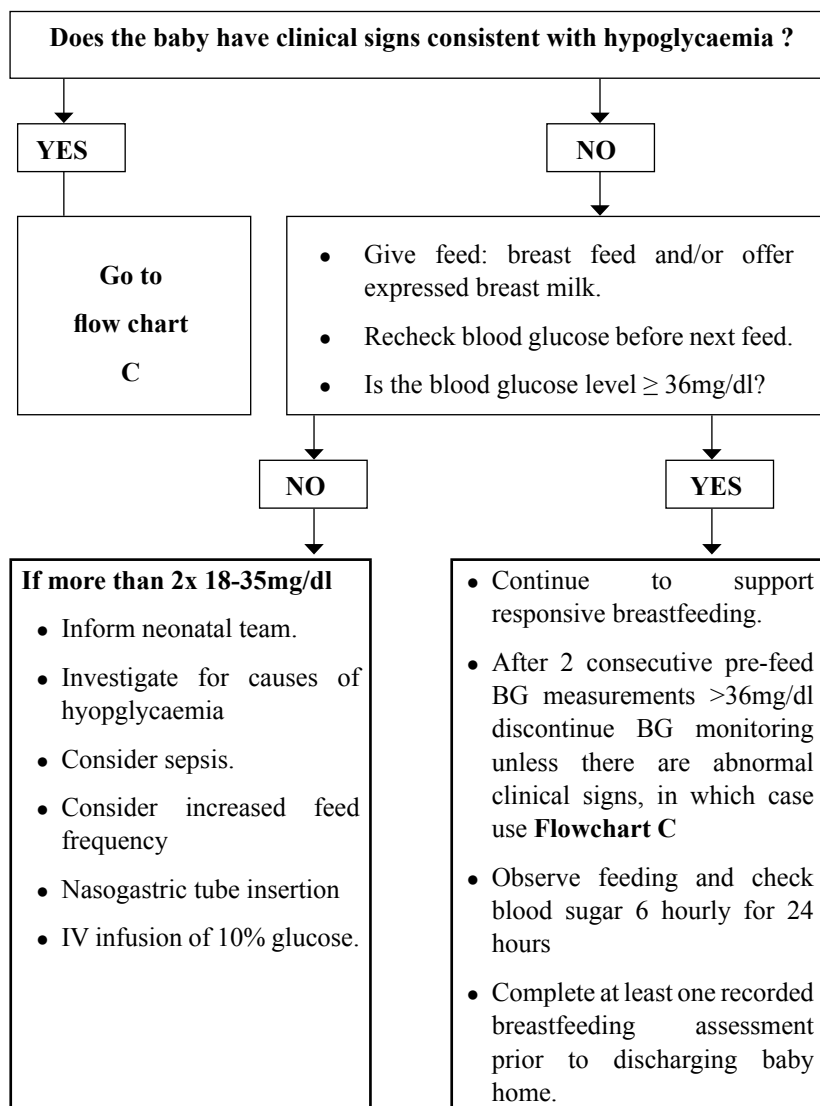
Summary

- Hypoglycaemia is a common problem in preterm/LBW infants, sick newborns, and infants of diabetic mothers.
- Hypoglycaemia can produce brain injury with long-term neurodevelopmental consequences.
- Newborns at risk of hypoglycaemia should be screened using the glucometer.
- The symptoms of hypoglycaemia are nonspecific and can be confused with other common neonatal problems.
- Initiation of breastfeeding within one hour of birth and frequent breastfeeding help prevent hypoglycaemia.
- Newborns with hypoglycaemia should be followed up for neurodevelopmental status.

Flowchart A. Screening infants at risk of hypoglycaemia



Flowchart B. Prefeed blood glucose 18 – 35mg/dl without symptoms



Flowchart C. Pre-feed blood sugar <18mg/dl and or clinical symptoms

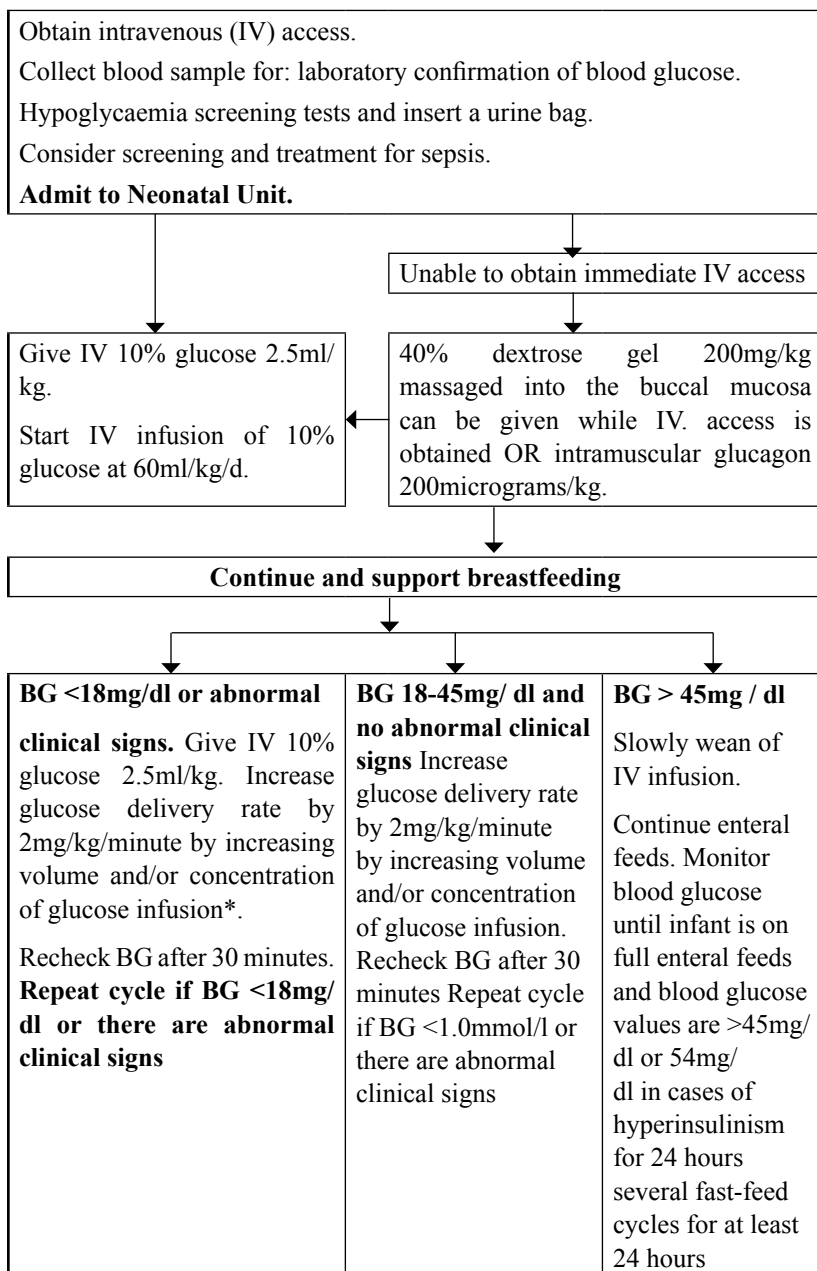


Table 6.1: Achieving appropriate glucose infusion rates for neonates with birth weight >1500 gms using a mixture of D10 & D25

Volume (ml/ kg/d)	Glucose infusion rate				Glucose infusion rate				Glucose infusion rate		
	6 mg/kg/min				8 mg/kg/min				10 mg/kg/min		
	D10 (ml/ kg/d)	D25 (ml/ kg/d)	Normal saline (ml/ kg/d)	Distill Water (ml/ kg/d)	D10 (ml/ kg/d)	D25 (ml/ kg/d)	Normal saline (ml/ kg/d)	Distill Water (ml/ kg/d)	D10 (ml/ kg/d)	D25 (ml/ kg/d)	Normal saline (ml/ kg/d)
60	42	18	-	-	24	36	-	-	5	55	-
75	68	7	-	-	49	26	-	-	30	45	-
90	60	10	20	-	40	30	20	-	20	50	20
105	85	-	20	-	65	20	20	-	45	40	20
120	86	-	20	14	88	12	20	-	70	30	20
135	86	-	20	29	115	-	20	-	95	20	20
150	86	-	20	44	115	-	20	15	120	10	20

Table 6.2 : Achieving appropriate glucose infusion rates for neonates with birth weight <1500 gms using a mixture of D10 & D25

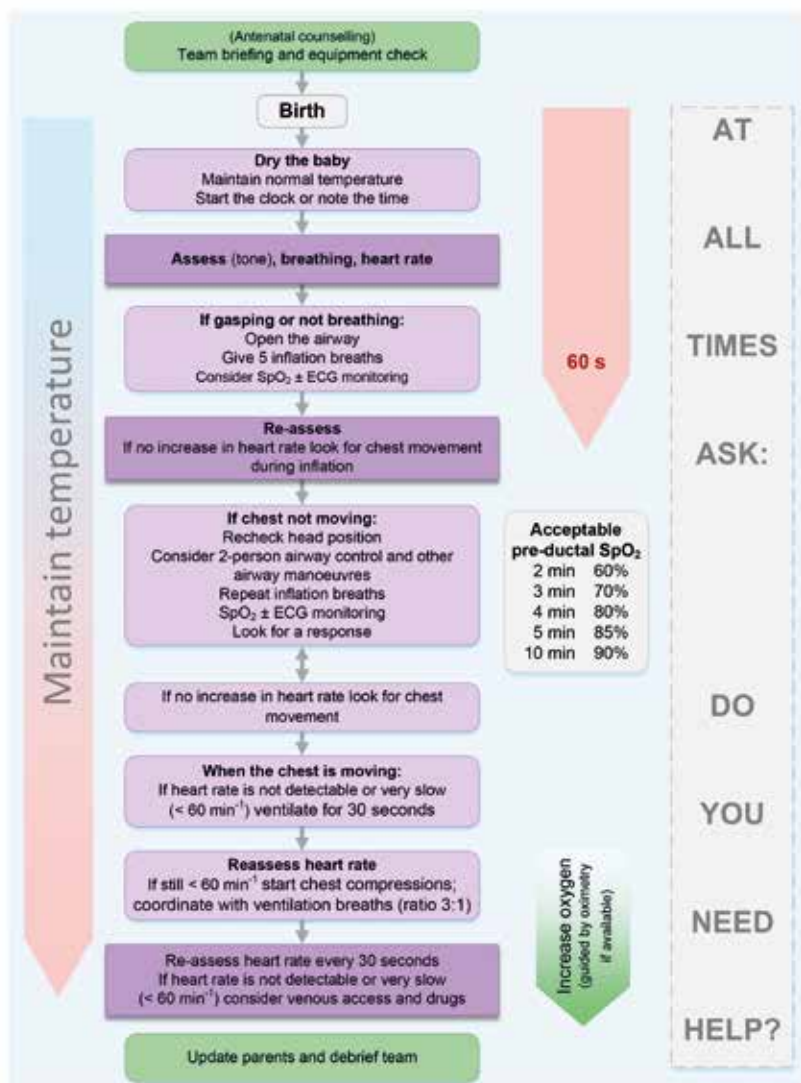
Volume (ml/ kg/d)	Glucose infusion rate				Glucose infusion rate				Glucose infusion rate		
	6 mg/kg/min				8 mg/kg/min				10 mg/kg/min		
	D10 (ml/ kg/d)	D25 (ml/ kg/d)	Normal saline (ml/ kg/d)	Distill Water (ml/ kg/d)	D10 (ml/ kg/d)	D25 (ml/ kg/d)	Normal saline (ml/ kg/d)	Distill Water (ml/ kg/d)	D10 (ml/ kg/d)	D25 (ml/ kg/d)	Normal saline (ml/ kg/d)
80	76	4	-	-	55	25	-	-	35	45	-
95	87	-	-	8	80	15	-	-	60	35	-
110	87	-	20	-	70	20	20	-	50	40	20
125	87	-	20	18	70	20	20	15	75	30	20
140	86	-	20	34	70	20	20	30	100	20	20
150	86	-	20	44	115	-	20	15	120	10	20
150	86	-	20	44	115	-	20	15	120	10	20

References

1. Alecia Thompson-Branch, Thomas Havranek. Neonatal Hypoglycaemia. *Pediatrics in Review* 2017; 38(4)
2. Ilana Levene et al, Identification and management of neonatal hypoglycaemia in the full-term infant (British Association of Perinatal Medicine—Framework for Practice). *Arch Dis Child Educ Pract Education and Practice* 2018. Online First: 16 May 2018. <http://dx.doi.org/10.1136/archdischild-2017-314050>
3. Paul J. Rozance, and William W. Hay, Jr. Describing hypoglycaemia - definition or operational threshold? *Early Hum Dev.* 2010 May; 86(5): 275–280. Published online 2010 May 31. doi: [10.1016/j.earlhumdev.2010.05.002]
4. World Health Organisation 1997. Hypoglycaemia of the newborn.

Annexures

Annexure 1



Annexure 2

General Circular No. 01-b8 | 2016

My No. FHB/ CNU/01/Gen/2016
Office of the Director General of Health Services,
Ministry of Health, Nutrition & Indigenous Medicine
Suwasiripaya,
Rev. Baddegama Wimalawansa Thero Mawatha,
Colombo 10.
21.11.2016

All Provincial Directors of Health Services
All Regional Directors of Health Services
All Heads of Institutions
All Medical Officers of Health

Iron Supplementation for Infants and Young Children

Prevalence of anaemia among Sri Lankan children of 6 to 12 month and 1-2 year age groups, in whom there is rapid physical and mental development, is found to be high; 34% and 24% respectively (MRI 2012). Iron deficiency has been a major cause for the high prevalence of anaemia. Iron is a micronutrient required for growth and development of infants and young children, and scientific evidence shows that iron deficiency and iron deficiency anemia can lead to reduction in IQ, retardation in growth and increased risk of infections. Therefore iron supplementation has been strongly recommended by the WHO as an evidence based intervention aimed at improving iron status and reducing anemia among these groups of children (WHO 2013. Essential Nutrition Actions). The Technical Advisory Committee on New Born and Child Health and the Subcommittee on Maternal and Child Nutrition of the Ministry of Health chaired by the DDG PHS II have recommended the adoption of this evidence based intervention in Sri Lanka as a short term measure to prevent anemia among this important target group.

For the past few years multiple micronutrient (MMN) supplementation for infants and young children has been implemented in all the districts of Northern Province, Eastern Province, Uva Province, Hambantota and Nuwaraeliya districts. From year 2017 onwards this programme will be expanded to all 26 health districts.

Hence the following iron supplementation regime for all infants and young children will be implemented in Sri Lanka from 01st of January 2017 onwards;

Birth outcome	Age of commencement	Dose	Frequency	Duration
Term	Infants on completion of 6 months of age	One MMN sachet per day	Once daily	2 months (60 days)
	Children on completion of 12 months of age	One MMN sachet per day	Once daily	2 months (60 days)
	Children on completion of 18 months of age	One MMN sachet per day	Once daily	2 months (60 days)
	≥ 2.5 kg (See annex 1 for feeding instructions)			
If MMN is not available				
	Infants on completion of 6 months of age	Elemental Iron – 10-12.5mg/day	Once daily (1 hour before or 2 hours after a meal)	3 months

Pre terms and low birth weight children are excluded from the above regime. They should be managed during the first 2 years of life according to the following schedule.

Birth outcome	Age of commencement	Dose	Frequency	Duration
Pre-term* (< 37 weeks POA) Or Low birth weight* (< 2.5kg)	Infants from the age of 2 weeks	Elemental Iron 3mg/kg/day	Once daily	Till completion of 2 years of age
	Soon after birth	Multivitamin drops ** 0.3ml/kg/day	Once daily	Till completion of 2 years of age
	Soon after birth	Folic acid** 500 micrograms	Once weekly	Till completion of 1 year of age
	From completion of 1 year	Folic acid** 1 mg	Once weekly	till completion of 2 years of age

**If the baby is discharged prior to 2 weeks, supplementation can be started at the follow up clinic at 2 weeks. If the infant is not followed up at the hospital clinic, the area MOH should continue the same schedule till 2 years of age.*

*** For the prevention of anemia of prematurity*

Preparations of supplements and mode of administration:

Iron supplements are available either as a component of a multiple micronutrient powder or a liquid (drops/syrup). Please note that the concentration of elemental iron differs between dosage forms i.e. between drops and syrups as well as among different brands.

Multiple micronutrients (MMN); 1g sachet of lipid encapsulated powder contains 15 micronutrients including iron (ferrous fumarate) 10mg, Vitamin C (ascorbic acid) 30mg, folic acid 150ug, Zinc (zinc gluconate) 4.1mg. For detailed guidelines on MMN supplementation including composition please refer to the guideline (annex I).

Iron drops:

Strength of the commonly used iron drops have a concentration of 50 mg **elemental iron** in 1 ml (which should be dosed at 0.06ml/kg/day) or 25mg **elemental iron** in 1 ml (which should be dosed at 0.12ml/kg/day).

Iron syrup:

Commonly used iron syrup has a concentration of 50mg **elemental iron** in 5ml (0.3ml/kg/day) and 25mg elemental iron in 5ml (0.6ml/kg/day).

Multivitamin drops;

Multivitamin drops available in the country have 40mg of vitamin C in 0.6ml Therefore 0.3ml/kg/day will provide 20mg of Vitamin C /kg/day.

Folic Acid tablets;

The available tablet strength is 1mg. Therefore, half a tablet dissolved in expressed breast milk should be given once a week till the baby is one year of age and from one year onwards 1mg once a week till completion of 2 years of age.

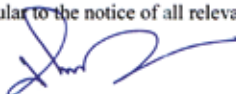
Logistics

MMN will be issued by the Family Health Bureau and iron drops/syrup and multi vitamin drops by the Medical Supplies Division of the Ministry of Health for the government sector health institutions.

The MOOH should arrange to obtain their MMN stocks through Regional Medical Supplies Division (RMSD). OIC RMSD is required to prepare in triplicate and send the Monthly Stock Return/Request form (Nutrition Supplies) (see annex II) on a quarterly basis to MOMCH and the FHB. *(Please note that this return should be replaced when the new Monthly Stock Return H 1158 Form becomes available).*

Iron drops/syrup and multi vitamin drops are to be requested by MOH annually and obtained through the respective RMSDs. These should be issued to preterm/ low birth weight babies on prescription by Medical Officer in charge of the clinic centre (MOH/AMOH/MO/RMO).

You are requested to adhere to the above iron supplementation regime for all infants and young children in Sri Lanka from 01st of January 2017 onwards. Please bring the contents of this circular to the notice of all relevant health staff to ensure the success of this programme.



Dr. P. G. Mahipala
Director General of Health Services

Dr. P. G. Mahipala
Director General of Health Services
Ministry of Health, Nutrition & Indigenous Medicine
"Suwasiripaya",
365, Rev. Baddegama Wimalawansa Thero Mawatha,
Colombo 10.

Cc;

Secretary - Health, Nutrition & Indigenous Medicine
Additional Secretary Medical Services
Additional Secretary Public Health Services
Deputy Director General Medical Services I & II
Deputy Director General Public Health Services I & II
Director Maternal and Child Health
Director Private Health Sector Development
Director Medical Services
Director Nutrition
Director Nutrition Coordination Division
Director Health Education Bureau
Director MRI
Director MSD
All Deans of Faculties of Medicine
President - SLMA
President - Sri Lanka College of Pediatricians
President - College of Community Physicians of Sri Lanka
President - Perinatal Society of Sri Lanka
President - Sri Lanka Medical Nutrition Association
President - Nutrition Society
President - College of Medical Administrators of Sri Lanka
President - College of General Practitioners of Sri Lanka
President - Independent Medical Practitioners' Association of Sri Lanka

Annexure 3

General Circular No : 02-72/2011

7th April 2011.
Ministry of Health,
"Suwasiripaya", 385,
Rev. Baddegama Wimalawansa Thero Mawatha,
Colombo 10.

Circular Letter No;

All DDGs Ministry of Health,
All Directors of Ministry of Health,
All Provincial Directors of Health Services,
All Directors of Teaching Hospitals,
All Regional Directors of Health Services,
All Heads of Institutions,
All Medical Officers of Health,

Formats on Newborn Care

This circular replaces the previous General Circular No;01-10/2007 of the Ministry of Health. Ministry of Health has decided to introduce a standard set of formats on newborn care to all the maternity and newborn care institutions in the country in order to facilitate improvement of services. Standard formats would strengthen the maintenance and flow of information on newborn care at different levels.

The set of formats to be introduced include Neonatal Examination Format, NICU/SCBU Admission Register, NICU/SCBU History Record Sheet, Neonatal Diagnosis Card, Neonatal Transfer Form, Neonatal Admission Sheet and Neonatal Monthly Return. These formats were developed by the Family Health Bureau of the Ministry of Health with representatives from Perinatal Society of Sri Lanka, Sri Lanka College of Obstetricians and Gynecologists and Sri Lanka College of Paediatricians.

Heads of Institutions should make arrangements to create awareness amongst staff attached to Maternity/Neonatal care units and OPD regarding these formats and ensure its usage appropriately. Sisters in charge of following units should keep adequate stocks of formats indicated for each unit and ensure that they are appropriately utilized.

Labour Room	-Neonatal Examination Format –H :1162 -NICU/SCBU History Record Sheet –H :1164 -Neonatal Transfer Form – H :1166
Neonatal Intensive Care Unit/Special Care Baby Unit (NICU/SCBU)	- NICU/SCBU Admission Register - Neonatal Diagnosis Card –H:1165 - Neonatal Transfer Form – H :1166 -Neonatal Monthly Return - H : 1168
Post natal ward	- NICU/SCBU History Records Sheet – H : 1164 - Neonatal Diagnosis Card –H:1165 - Neonatal Transfer Form – H :1166
OPD	-Neonatal Admission Sheet – H :1167

All officers concerned should comply with the above instructions and make every effort to successfully use these formats in all the maternal and neonatal care units in the country.



.....
Dr. Ajith Mendis,
Director General of Health services/ Ministry of Health

Cc; Secretary – Ministry of Health,
Add. Secretary / Medical Services,
All Provincial Secretaries of Health Services,
President/ Sri Lanka College of Medical Administrators,
President/ Sri Lanka College of Paediatricians,
President/ College of Community Physicians of Sri Lanka,
President/ Sri Lanka College of Obstetricians and Gynecologists,
President/ Perinatal Society of Sri Lanka,
President/ Government Medical Officers Association.

Annexure 3.1

NEONATAL EXAMINATION FORMAT

H: 1162
(Revised 2020)

(To be attached to the mother's BHT)

(To be kept in Labour Room, PHM should take from Labour Room to Operating Theatre for LSCS)

Part 1A

Maternal BHT No:						
Disc No:						
Ward No:					VOG	

To be filled by Nursing Officer (Labour room/OT)

Mother's Name :

Mother's Age :

Mother's Blood Group :

Parity : G P C

Pregnancy: ☐ Single ☐ Multiple (No.)

Baby's date of birth

DD	MM	YY

POG (Weeks)		
Time of birth	am/pm	

Mode of delivery	Unassisted vaginal delivery			Indication for intervention
	AVD	Breech	Vaccum	
		Forceps	Others	
	LSCS	Elective	Emergency	

APGAR Score	1min	5min	10min
Colour			
Muscle tone			
Respiratory effort			
Heart rate			
Response to stimuli			
Total			

Sex	M	F	Undetermined
Weight (g)			
Length (cm)			
OFC (cm)			
Baby kept warm			
Time of first feed	am/pm		

Temperature of baby at 1hr		°C / °F
----------------------------	--	---------

Vit K given 1mg /0.5mg	Yes	No
------------------------	-----	----

Any other problems/observations identified by Nursing Officers (Labour room)

.....
.....

Name of Nursing Officer : 1.....

Midwife :

2.....

PHO was informed : Yes ☐

No ☐

If yes time am/pm

Baby sent to : Postnatal ward ☐

SCBU ☐

NICU ☐ Transferred out to.....

Time am / pm

Date :

Part 1B

Maternal History

(Should be completed by MO LR/ Obstetric MO before sending baby out of LR/OT)

Relevant past obstetric history

Past medical complications and drug history:

Complications of pregnancy:

Complications of labour:

Relevant social history:

ROM in hours		
Chorioamnionitis	Yes	No
Maternal pyrexia	Yes	No
Positive HVS	Yes	No
Previous child with GBS	Yes	No
Prolonged 2nd stage	Yes	No
Maternal WBC		
Maternal CRP		

Number of VE's:

Other risk factors	
Oligohydramnios	
Polyhydramnios	
Meconium	
Doppler abnormalities	

Maternal Medications	Name/dose/route	Last dose given at (time/date)
Antibiotics		
Pethidine (last dose)		
Insulin (last dose)		
Mg SO ₄		
Steroid	1st dose	2nd dose Not given

Part 1C

(To be filled by Paediatric Medical Officer/Obstetric Medical Officer when applicable)

Resuscitation notes - (Fill/check the APGAR score in part 1A)

Airway opening manoeuvres	
Head in neutral position	
Jaw thrust	
Oral airway	
Suction under direct vision	
Intubation	

Inflation breaths	
Ventilation breaths	
Chest compressions	

Drugs	given	not
	Dose/route	given
Adrenaline		
0.9% N. Saline		
10% dextrose		
Naloxone		
NaHCO ₃		
Other		

Time of establishment of spontaneous respiration.....am/pm

Resuscitation:	Airway	NNE 01
	Ventilation	NNE 02
	Chest compression	NNE 03
	Drugs	NNE 04

Polythene bag used	YES	NO
--------------------	-----	----

Plan of Management

To be sent to PN ward	
To sent to NICU/SCBU	NNE 05
Keep baby warm	
To be observed in LR/SCBU/PNW	
Fit for breastfeeding	

Other comments:

.....

Time.....am/pm

Maturity assessment postnatally (in weeks).....

Name and Designation of the Medical officer.....

Date...../...../..... Time am/pm

Maturity of baby			weeks
------------------	--	--	-------

Baby's	Growth	SGA		NNE 06	AGA		NNE 07	LGA		NNE 08	Baby's blood group	
--------	--------	-----	--	--------	-----	--	--------	-----	--	--------	--------------------	--

Pulse oxy metery : Pre ductal SPO₂ %
 Post ductal SPO₂ %
 Pass Fail Referred

Component	Status	
	Normal	Abnormal
Eye / red reflex		NNE 09
Mouth / lips		NNE 10
Palate		NNE 11
Dysmorphic features		NNE 12
Encephalocele		NNE 13
Heart murmurs		NNE 14
SPO2		NNE15
Respiration		NNE 16
Genitalia		NNE 17
Anus		NNE 18
Hips		NNE 19
Spine		NNE 20
Birth injuries		NNE 21
Femoral pulse		NNE 22
Moro Reflex		NNE 23
Congenital Talipes equinovarus		NNE 24
Limb defects		NNE 25

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 104

Name of Medical Officer :

(to be filled by post natal ward nursing officer)

Breast Feeding	with in 1st 24hr		with in 2nd 24hr	
Positioning	Good	Need Support	Good	Need Support
Attachment	Good	Need Support	Good	Need Support
Feeding Problem Identified	YES / NNE 26		NO	
urine within 1 st 24hr	YES		NO / NNE 27	
urine frequency	1 st 24hr		2 nd 24hr	
Meconium within 1 st 24hr		YES	NO / NNE 28	
IF "NO" within 2 nd 24hr		YES	NO	
IF "NO" Paediatric surgery referral		YES	NO	

Date:/...../.....

Time: am / pm

01 :

02 :

03 :

Plan of Management at LMC

[illegible]

Part IV**To be completed by Medical Officer on discharge or transfer****Diagnoses / Other Problems**

- 1.....
- 2.....
- 3.....
- 4.....

Action taken / plan suggested

-
-
-
-

Plan of management by the Consultant/SR/ Registrar/SHO/MO on discharge:

-
-
-

If baby was transferred : (NICU/ SCBU/ Hospital)

Date:/...../..... Time: am/pm

BCG given	Yes	No
Discharge examination conducted	Yes	No

Discharge weight:

% Weight loss:

Breast Feeding established
on day 1/2/.....

Follow up plan	Institution / Ward	Date/Time
1.By MOH		
2.Specialist clinic		
3.Review in clinic/ward		

Name of the Medical Officer : Date:/...../..... Time: am/pm

Part V**Discharge checklist (to be filled by Nursing Officer on discharge)**

01. BCG given		11. Birth chit given	
02. Vit K given		12. CHDR given with all the details entered	
03. Neonatal examination done	NNE 29	13. Diagnosis Card given with weight on discharge written	
04. Newborn Screening for Congenital Hypothyroidism done	NNE 30	14. Danger signs of the baby explained to the parents	
05. Pulse Oximetry Screening done	NNE 31	15. Parents counselled on discharge	
06. Hearing Screening done	NNE 32	16. Follow up clinic arranged	
07. KMC given	NNE 33	17. In an event of neonatal death-Parents counselled	
08. Breastfeeding established		-Diagnosis card given	
09. Urine output satisfactory			
10. Meconium passed			

Name of Nursing Officer:

Date:/...../..... Time: am/pm

Annexure 4

දුරකථන : 011 2669192, 011 2675011
 தொலைபேசி : 011 2669507, 011 2694033
 Telephone : 011 2675449, 011 2675280

ෆැක්ස් : 011 2693866
 தொலை : 011 2693869
 Fax : 011 2692913

විද්‍යුත් තැපෑල : jgustmaster@health.gov.lk
 மின்னஞ்சல் முகவரி :
 e-mail :

වෙබ් අඩවිය : www.health.gov.lk
 இணையத்தளம் :
 website :



සුවසිරිපාය
 சுவசிரிபாய

SUWASIRIPAYA

මගේ අංකය :
 எனது இல : FHB/INR/UCH/2015
 My No. :

ඔබේ අංකය :
 உமது இல :
 Your No. :

දිනය : 24.11.2015
 திகதி : 46/11/2015
 Date :

සෞඛ්‍ය, පෝෂණ සහ දේශීය වෛද්‍ය අමාත්‍යාංශය சுகாதார, போசணை மற்றும் கதேச வைத்திய அமைச்சு Ministry of Health, Nutrition & Indigenous Medicine

All Deputy Director Generals, Ministry of Health Nutrition & Indigenous Medicine,
 All Directors Ministry of Health Nutrition & Indigenous Medicine,
 All Directors of Teaching Hospitals,
 All Heads of Decentralized units and Specialized Campaings,
 Provincial Directors of Health Services,
 Regional Directors of Health Services,
 All Heads of Institutions,
 All Deans of the Medical Faculty,
 All Medical Officers of Health.

New born Screening for congenital Hypothyroidism

Congenital hypothyroidism (CH) is a condition that could be treated effectively if detected early. If not detected and treated early it causes severe mental retardation. Treatment is simple, inexpensive and effective. With early detection and treatment, infants usually develop normally without mental handicaps and become productive members of society. It is identified as a very effective screening programme and the cost benefit of such a programme has shown to be very high.

The Medical Research Institute (MRI) and the University of Ruhuna, Nuclear Medicine Unit (NMUK) are providing laboratory support for the newborn screening for congenital hypothyroidism.

The Family Health Bureau is collaborating with the Hospitals, the Provincial Health Authorities, the MRI and the NMUK in implementing the newborn screening programme for congenital hypothyroidism.

Herewith I'm attaching the list of institutions along with the designated laboratory for the same and the guidelines for newborn screening for congenital hypothyroidism. Please bring the contents of this circular and guidelines to the notice of all health workers in your Province/ District/ Institution and take necessary steps to implement this programme with immediate effect.

Dr. P.G. Maheepala
 Director General of Health Service

Dr. P. G. Mahipala
 Director General of Health Services
 Ministry of Health, Nutrition & Indigenous Medicine
 "Suwasiripaya"
 385, Ven. Baddagama Wimalawansa Thero Mv.
 Colombo 10.

List of institutions and the designated laboratory to send samples for newborn screening for congenital hypothyroidism

	District	Name of the Hospital	Laboratory for NB screening for Congenital Hypothyroidism
1.	Colombo	Castle Street Hospital for Women	MRI
		Colombo North Teaching Hospital , Ragama	MRI
		Colombo South Teaching Hospital , Kalubowila	MRI
		De Soysa Maternity Hospital	MRI
		Mulleriyawa Base Hospital Type B	MRI
		Homagama Base Hospital Type A	MRI
		BH Awissawella	MRI
2	Gampaha	DGH Gampaha	MRI
		TH Ragama	MRI
		DGH Negombo	MRI
		BH Wathupitiwala	MRI
		BH Minuwangoda	MRI
		BH Meerigama	MRI
3	Kalutara	DGH Kaluthara	MRI
		Kethumathi Hospital Panadura	MRI
		BH Horana	MRI
		BH Pimbura	MRI
4	Anuradhapura	TH Anuradhapura	MRI
		BH Thambuththegama	MRI
		BH Kebettigollawa	MRI
		BH Padaviya	MRI
5	Polonnaruwa	DGH Polonnaruwa	MRI
		BH Medirigiriya	MRI
		BH Welikanda	MRI
6	Kandy	TH Kandy	MF Karapitiya
		TH Peradeniya	MF Karapitiya
		DGH Nawalapitiya	MF Karapitiya
		BH Gampola	MF Karapitiya
		BH Theldeniya	MF Karapitiya
7	Matale	DGH Matale	MF Karapitiya
		BH Dambulla	MF Karapitiya *
8	Nuwaraeliya	DGH Nuwaraeliya	MF Karapitiya
		BH Dickoya	MF Karapitiya
		BH Rikillagaskada	MF Karapitiya
9	Kurunagala	PGH Kurunagala	MRI
		BH Kuliapitiya	MRI
		BH Nikaweratiya	MRI
		BH Polpitiyagama	MRI
		BH Galgamuwa	MRI
		BH Dambadeniya	MRI

10	Puttalam	BH Puttalam	MRI
		DGH Chilaw	MRI
		BH Marawila	MRI
11	Monaragala	DGH Monaragala	MF Karapitiya
		BH Wellawaya	MF Karapitiya
		BH Siyabalanduwa	MF Karapitiya
		BH Bibile	MF Karapitiya
12	Badulla	PGH Badulla	MF Karapitiya
		BH Diyathalawa	MF Karapitiya
		BH Mahiyanganaya	MF Karapitiya
		BH Wellimada	MF Karapitiya
13	Ampara	DGH Ampara	MF Karapitiya
		BH Potuvil	MF Karapitiya
		BH Mahaoya	MF Karapitiya
		BH Dehiattakandiya	MF Karapitiya
14	Kalmunei	BH Kalmunei South	MF Karapitiya
		BH Kalmunei North	MF Karapitiya
		BH Samanthurei	MF Karapitiya
15	Trincomalee	DGH Trincomalee	MF Karapitiya
		BH Kantalai	MF Karapitiya
16	Bataloa	TH Batticaloa	MF Karapitiya
		BH Kaluwanchikudi	MF Karapitiya
		BH Kinniya	MF Karapitiya
		BH Muttur	MF Karapitiya
		BH Kattankudy	MF Karapitiya
		BH Eravur	MF Karapitiya
		BH Valachcheniya	MF Karapitiya
17	Mullaithivu	DGH Mullaithivu	MRI
		BH Mankulam	MRI
		BH Mallavi	MRI
18	Mannar	DGH Mannar	MRI
19	Killinochchi	DGH Kilinochchi	MRI
		BH Mulankavil	MRI
20	Vavuniya	GH Vavuniya	MRI
		DH Chddikullam	MRI
21	Kegalle	TH Kegalle	MF Karapitiya
		BH Mawanella	MF Karapitiya
		BH Karawanella	MF Karapitiya
		BH Warakapola	MF Karapitiya
22	Ratnapura	PGH Rathnapura	MF Karapitiya
		BH Kahawatta	MF Karapitiya
		BH Embilipitiya	MF Karapitiya
		BH Balangoda	MF Karapitiya
		BH Kalawana	MF Karapitiya
23	Matara	DGH Matara	MF Karapitiya
		BH Kaburupitiya	MF Karapitiya
		BH Deniyaya	MF Karapitiya
24	Hambantota	DGH Hambantota	MF Karapitiya
		BH Tangalla	MF Karapitiya
		BH Tissamaharama	MF Karapitiya
		BH Walasmulla	MF Karapitiya

25	Galle	TH Mahamodara	MF Karapitiya
		BH Balapitiya	MF Karapitiya
		BH Elpitiya	MF Karapitiya
		BH Udugama	MF Karapitiya
26	Jaffna	TH Jaffna	MRI
		BH Pointpedro	MRI
		BH Thellippalai	MRI
		BH Chavakachcheri	MRI
		BH Kayts	MRI

Guidelines for newborn screening for congenital hypothyroidism

Congenital hypothyroidism (CH) is a treatable deficiency of the thyroid hormone that causes severe mental retardation and growth deficiency if it is not detected and treated early. Undetected at or near birth, CH clinically manifests itself too late for treatment to completely eliminate the mental and growth retardation that result. In many newborns CH may be diagnosed late or go completely undiagnosed resulting in unnecessary health, economic and social burdens for the family. Treatment is simple, inexpensive and effective. With early detection and treatment, infants usually develop normally without mental handicaps and become productive members of society. For optimum results treatment has to be initiated within two weeks.

Goal of the newborn screening programme; is to detect CH and begin treatment before the infant reaches the age of two weeks.

Newborn Screening system comprised of six essential components;

1. Education – Health professionals, parents and the general public
2. Screening – Proper timing, specimen collection, transport, laboratory testing and reporting
3. Early follow up – abnormal test notification, tracking and confirmatory testing
4. Diagnosis – Clinical and biochemical evaluation
5. Management – Counseling, treatment monitoring and long term follow-up
6. Evaluation – outcome monitoring and quality assurance throughout the system

Guidelines are given for each component, to be followed by the staff responsible for implementing the programme.

1. Education –

Professional education

From the outset, for the newborn screening for CH to be successful, health practitioners should be involved in its development. Health professionals should be educated on the benefits and operation of newborn screening as a preventive public health programme. They must also understand their role in this process.

Role of the Medical Officer of Health and the staff –

- Antenatal parent education on newborn screening for CH
- Postnatally deliver reports to parents, trace and refer newborns with abnormal reports to the Paediatricians for confirmatory diagnosis and treatment, follow up newborns with abnormal reports at home visits
- Educate mothers to inquire about report at second postnatal visit

Role of the hospital staff

- Counsel and educate parents
- Sample collection before the newborn is discharged
- Fill in the investigation request form correctly

- Store samples appropriately until dispatch to the laboratory
- Dispatch samples to the laboratory safely, on time
- Medical management of the detected case

Role of the laboratory staff

- Testing specimens
- Inform positive cases urgently to parents, Medical Officer of Health (MOH) office and hospital by telephone/fax/telegram and in addition to the letter
- Dispatch negative results to the relevant MOH office regularly
- Maintain laboratory standards and quality assurance systems

Parent education

In order to assist parents in understanding the importance and need for newborn screening, ongoing education is necessary. This has to be done at antenatal clinics in the MOH and at home visits by the Public Health Midwives (PHM). In the antenatal clinics this topic has to be addressed in the health education talk. The MOH has to update the staff on the newborn screening programme at the monthly conference.

*A parent education leaflet has to be prepared and given to the mother at the time of drawing blood.

2. Screening

Sample collection

Specimen has to be collected in the postnatal ward before the newborn is discharged from the hospital. It is strongly recommended that all newborns undergo screening by five days of age. The procedure should be carried out adhering to universal precautions.

All doctors and nurses in the postnatal ward and NICU/SCBU should be trained to do the heel prick by the Consultant Paediatrician in charge of the unit. The duty of performing the heel prick should be assigned to a nursing officer trained in heel prick in each unit in the morning shift at the same time when the BCG is given.

The heel prick – filter paper method is used for sample collection. Filter papers will be provided by the Laboratory.

Heel prick procedure –

Wash hands with soap and water before each collection.

Materials required – a pair of clean gloves, a sterile lancet with tip of a length less than 2.4 mm (approximately 2.0mm), sterile cotton balls, 70% isopropyl alcohol/surgical spirit and the filter paper card. Lancets should not be re used.

Preliminary preparation –

Complete the patient information form (supplied by the laboratory) using a ball-point pen. Avoid touching the filter paper collection area before, during and after the collection of blood spots. Adhere to universal precautions as in other procedures.

Location of the heel stick –

Use the lateral or medial plantar surface of the heel for the puncture site.

The heel puncture should only be taken from the shaded areas indicated by the arrows.



The heel puncture should only be taken from the shaded areas indicated by the arrows.

Heel preparation –

In order to increase blood flow, position the infant with feet at or below the level of the heart. Once ready clean the puncture site with a sterile cotton ball soaked in 70% isopropyl alcohol/surgical spirit and allow to air dry.

Puncture –Puncture the heel with a sterile lancet. Puncture device should not exceed 2.0 mm in length. For safety scalpel blades or needles should not be used as puncture device since depth of puncture or incision cannot be easily controlled and may lead to unwanted contact with the heel bone.

Steps should be taken to prevent pain during sample collection. Mother can start breastfeeding the baby which provide analgesia for the baby. Gentle stroking of the newborn and reassurance of the mother may be helpful.

Sample Collection –

After the heel has been punctured, wipe away the first drop of blood with a sterile gauze pad or cotton ball and allow a large drop of blood to form. Intermittently apply gentle pressure to the heel with the thumb and ease this pressure as drops of blood form. Avoid excessive milking or squeezing since this may cause specimen hemolysis or result in an admixture of tissue fluids with the specimen and might adversely affect test results. Allow a sufficient quantity of blood to soak through and completely fill one of the pre-printed circles on the filter paper. Apply blood to only one side of the filter paper. Examine both sides of the filter paper to ensure that the blood has uniformly penetrated and saturated the filter paper.

Post-collection

After collection elevate the baby's heel above the level of the heart while applying pressure to the wound with a sterile gauze pad or cotton swab until the bleeding stops. It is not advisable to apply adhesive bandages over the skin puncture sites of newborns.

Sample collection in special situations –

Samples of the babies who are admitted to the special care baby unit or the neonatal intensive care unit can be collected in the usual manner. If a newborn receives blood/blood products, the specimen should be collected before the transfusion. Screening can be performed on premature infants although caution must be taken when interpreting the results. It is recommended that preliminary screen be done by five days of age on all newborns even if the baby is in intensive care.

Specimen drying and transport -

Once the specimen is collected it should be air dried horizontally on a non absorbent open surface. It is important to keep the specimen horizontal to avoid migration of excess blood to a side of the circle. If the specimen is not transported to the laboratory on the same day keep it in the refrigerator in dry plastic/glass container with a lid in the lower compartment (8°C) until it is transported. Moisture is detrimental to stability of dried blood spot specimen. Specimen packed in a dry envelop has to be transported to reach the laboratory within three days of collection. Nursing Sister/Nurse in-charge of the postnatal ward/NICU/SCBU is responsible for transporting the specimens to the laboratory on the stipulated date.

Record keeping

Request form

The request form supplied for this purpose has to be completed and dispatched to the laboratory. Following is a specimen of the request form;

Newborn Screening for Congenital Hypothyroidism

(To avoid delays in processing complete this form accurately)

Hospital: _____ Ward: _____ BHT no: *
Date of Collection: _____ Time of Collection: _____
Mother's name: _____
Mothers Address: _____
Mothers contact telephone/mobile No: _____
Mothers resident MOH area : _____ Mothers resident PHM area: _____

Babys Date of Birth: _____ Time of birth: _____
Sex of baby: _____ Birth weight: _____ Kg POG: _____ weeks
Signature of Medical officer _____

*In case of multiple pregnancies identify babies as T1, T2 etc.

Specimen Register

A specimen register has to be maintained in the postnatal ward NICU/SCBU in the following format. Information of all the specimens collected and dispatched has to be recorded in this register by the nursing officer at the time of collection.

Date of collection	Mother's BHT	Mother's Name	Mothers Home address	Mother's Telephone No	Mother's MOH area	Specimen sent by

Child Health Development Record

Make a note on the first page of the Child Health Development Record when the specimen is collected for newborn screening. Make sure that the Name of the hospital and BHT number is inserted here. In case of multiple pregnancies identify babies as T1, T2 etc.

TSH as the primary screen - The established Units (i.e., NMU Peradeniya & NMU Galle) had already developed their laboratory specific cut-off (whole blood TSH of 20.0mIU/mL) values for TSH assay with due consideration to the time after delivery and on the characteristics of the reagents in use and statistical testing of pilot projects. This will minimize false positive results which need unnecessary confirmatory testing. (box)

Abnormal results should be marked in red in the laboratory records.

Abnormal results should be informed by the analytical laboratory to the parents, MOH, hospital directly by telephone/fax to avoid any unforeseen delay. In positive cases the MOH should inform the PHM and trace the baby within 24 hours. Transmission of results of all specimens should be done directly to the MOH. All screening results should reach the postnatal clinics of the relevant MOH. PHMs should collect the reports of the newborns of their area and hand over to the parents during home visiting, after making a note in the CHDR (1st page or notes page) and the Birth and Immunization register.

3. Diagnosis

Once the screening tests have been completed and the results are known, it is important for babies who are presumptively at risk for a disorder to have confirmatory testing performed. This has to be done at a Paediatric clinic under the guidance of the Consultant Paediatrician according to the standard guidelines.

4. Management

Medical management should be closely monitored to ensure proper patient compliance and desired health outcome. Treatment of CH is lifelong and treatment compliance should be periodically monitored. Long term follow-up (reporting) helps ensure optimal health outcome and can be used to evaluate the screening programme.

1. Screening positive infants should have confirmatory measurements of FT4 and TSH in a serum sample as soon as possible.
2. All infants with low FT4 and elevated TSH have CH until proven otherwise.
3. Counseling of parents regarding the condition must be done by the Paediatrician.
4. Optimal cognitive outcome depends on both adequacy and timing of postnatal Thyroxine therapy.
5. Initial dose is 10-15mcg /kg /day Thyroxin should be given as a single daily dose in the early morning on an empty stomach for better absorption. Goal of therapy is to normalize T4 within 2 weeks and TSH within one month. The serum FT4 or total T4 should be in the upper half of the normal range during the first 3 years of life with a low normal serum TSH.
6. T4 value is used to adjust the dose, please note that the infants with low T4 (<10 mcg/dl) and high TSH (>15mcg/dl) during the first year have low IQ values.
7. All infants with confirmed CH should have an US Scan of the neck to visualize the thyroid gland.
8. Follow up is done with FT4 and TSH measurements. This should be done 4 weeks after the initiation of treatment and every 2 months for 6 months followed by every 4 months up to 3 years. Thereafter every 6 months until the growth is completed.
9. FT4 and TSH should be repeated after 4 weeks of adjusting the dose.
10. CH is permanent if the gland is absent or ectopic or if the serum TSH is above 10mIU/L after the first year of life.
11. If the clinician feels the diagnosis should be reviewed it should be done at 3 years of age. Discontinue therapy for 30 days and retest with FT4/THS. Regarding individual cases with doubts the Paediatrician should seek expert opinion from an Endocrinologist.

Annexure 5

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 ෆැක්ස් : 0112693866
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 විද්‍යුත් තැපෑල : postmaster@health.gov.lk
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 e-mail :
 වෙබ් අඩවිය : www.health.gov.lk
 இணையத்தளம் :
 website :



සුවසිරිපාය
 சுவசிரிபாய
SUWASIRIPAYA

මගේ අංකය : FNB/INBU/Circular
 எனது இல : Guideline/2017/03
 My No :
 ඔබේ අංකය :
 உமது இல :
 Your No :
 දිනය :
 நாதி :
 Date : 05/07/2017
 19-04-17

සෞඛ්‍ය, පෝෂණ සහ දේශීය වෛද්‍ය අමාත්‍යාංශය சுகாதார, போசணை மற்றும் சுதேச வைத்திய அமைச்சு **Ministry of Health, Nutrition & Indigenous Medicine**

All Provincial Directors of Health Services
 All Regional Directors of Health Services
 All Heads of Institutions

Newborn screening to detect Critical Congenital Heart Diseases (CCHD)

Studies have shown that up to one third of babies with CCHDs are not detected prior to discharge, even after anomaly scanning and clinical examination of the newborn. Pulse oximetry can assist in detecting some CCHD that are not detected clinically or by antenatal anomaly scans. Early detection of CCHDs provide an opportunity for timely interventions. In addition to detecting CCHDs pulse oximetry screening has incidentally detected respiratory compromise and poor perfusion due to sepsis.

Herewith I am attaching the guidelines for newborn screening for CCHDs. Please bring the contents of this circular and guidelines to the notice of all health workers in your Province/ District/ Institution and take necessary steps to implement the newborn screening to detect Critical Congenital Heart Diseases (CCHD) with immediate effect.


 Dr J.M.W. Jayasundara Bandara
 Director General of Health Service

Dr. J. M. W. Jayasundara Bandara
 Director General of Health Services (Acting)
 Ministry of Health, Nutrition & Indigenous Medicine,
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Cc;
 DDG (MS I & II, PHS II, BME, MSD, Logistics)
 DMCH
 D/Health Education & Publicity
 President, Sri Lanka College of Paediatricians
 President, Sri Lanka College of Obstetricians & Gynaecologists
 President, Perinatal Society of Sri Lanka

PULSE OXIMETRY SCREENING FOR DETECTION OF CRITICAL CONGENITAL HEART DISEASES IN NEWBORNS

Introduction

The incidence of moderate to severe congenital heart disease is estimated to be 6/1000 live births with duct dependent critical congenital heart diseases (CCHDs) being present in 2-3/1000 live births¹. The CCHDs that are of concern include, hypoplastic left heart syndrome, pulmonary atresia (with intact septum), tetralogy of Fallot, total anomalous pulmonary venous return, transposition of the great arteries, tricuspid atresia and truncus arteriosus². Cardiovascular malformations account for 6-10% of all infant deaths and 20-40% of deaths caused by congenital malformation³. Pulse oximetry non-invasively checks the oxygen saturation of the baby. Low values could indicate the presence of a serious congenital heart diseases.

What is the advantage of the test?

Pulse oximetry can assist in detecting some critical congenital heart diseases (CCHD) that are not detected clinically or by antenatal anomaly scans. Even if anomaly scanning was available up to 50% of CCHDs are missed⁴. In the first 24-48 hours babies with CCHDs could still appear to be pink, with no murmurs and have palpable femoral pulses in the presence of coarctation. Studies have shown that even after anomaly scanning and clinical examination of the baby, upto one third of babies with CCHDs are not detected prior to discharge⁴. These CCHDs could result in cardiovascular collapse, severe metabolic acidosis and death in rapid sequence after discharge. Early detection can reduce the risk of these and provide an opportunity for timely interventions⁵.

In addition to detecting CCHDs pulse oximetry screening has incidentally detected respiratory compromise and poor perfusion due to sepsis^{6,7}

What are the limitations of the test?

However it is important to note that although pulse oximetry can detect an additional number of babies with CCHD who would be missed with only antenatal ultrasound and clinical examination, upto 8-10% of CCHDs are still not detected prior to discharge^{3,6,7}. Parents have to be made aware of this. The usefulness of pulse oximetry screening will be potentially greater in our country than in those countries where antenatal anomaly scanning is available.

DOING THE PULSE OXIMETRY SCREENING TEST^{2,11,12}

How is the test performed?

Equipment

A pulse oximeter consists of a sensor and a monitor. The sensor consists of a photodetector and a source of light (red and infra-red). The test involves putting a sensor on the baby's hand and foot in order to obtain an indirect measurement of the oxygenation of baby's blood. The differential absorption of red and infrared light by oxyhaemoglobin and deoxyhaemoglobin is the basis on which a value is obtained for oxygen saturation.

A motion tolerant pulse oximeter, that reports functional oxygen saturation, which has been validated for use in low perfusion conditions and has 2 percent root-mean-square accuracy should be used.

It is absolutely imperative that a sensor/probe suitable for newborns is used as adult probes will not have good contact and therefore will not give accurate values.

The probes used should be those recommended for that particular machine by the manufacturer and a sensor not recommended for that particular instrument should not be used to ensure accurate results.

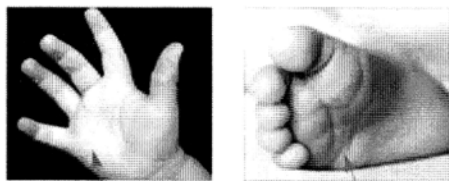
There are variations in calibration curves between manufacturers/and even different brands from the same manufacturer the same instrument should be used to take the two measurements in the same baby.

The results from a pulse oximeter can be affected by the patient/sensor interface – therefore correct alignment of the sensor and light source is important as well as the site used being well perfused and free of artefacts such as extraneous lights (phototherapy), motion and venous congestion. In cases of poor perfusion due to low environmental temperature rewarming of the baby including local rewarming will help in obtaining an accurate reading.

When using reusable probes they should be cleaned in between babies with a suitable substance recommended by the manufacturer. It should not be immersed in any liquid.

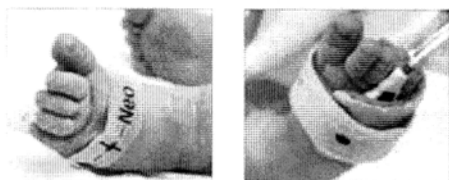
Probe placement

In this screening test oxygen saturation would be recorded from two sites – right hand and a foot. The outside fleshy areas of the hand and foot should be chosen.



Right hand application site . Foot application site

The photodetector portion of the probe should be placed on the fleshy portion and the light emitter on the top of the hand or foot directly opposite the photodetector. Secure the probe using the recommended adhesive or foam tape; it is not advisable to use standard tape of securing the probe.



Other practical points include:

- Not holding the probe in place as it can interfere with the reading
- Take the reading on the foot first as babies can get very fussy when trying to open up the fingers and place a probe on the palm
- The test can be done while the baby is nursing – this will help in calming a crying baby whose movements are interfering with the reading.

Who will do the test and when?

Pulse oximetry test can be performed by a nursing officer or a medical officer. The findings should be recorded on the neonatal examination record.

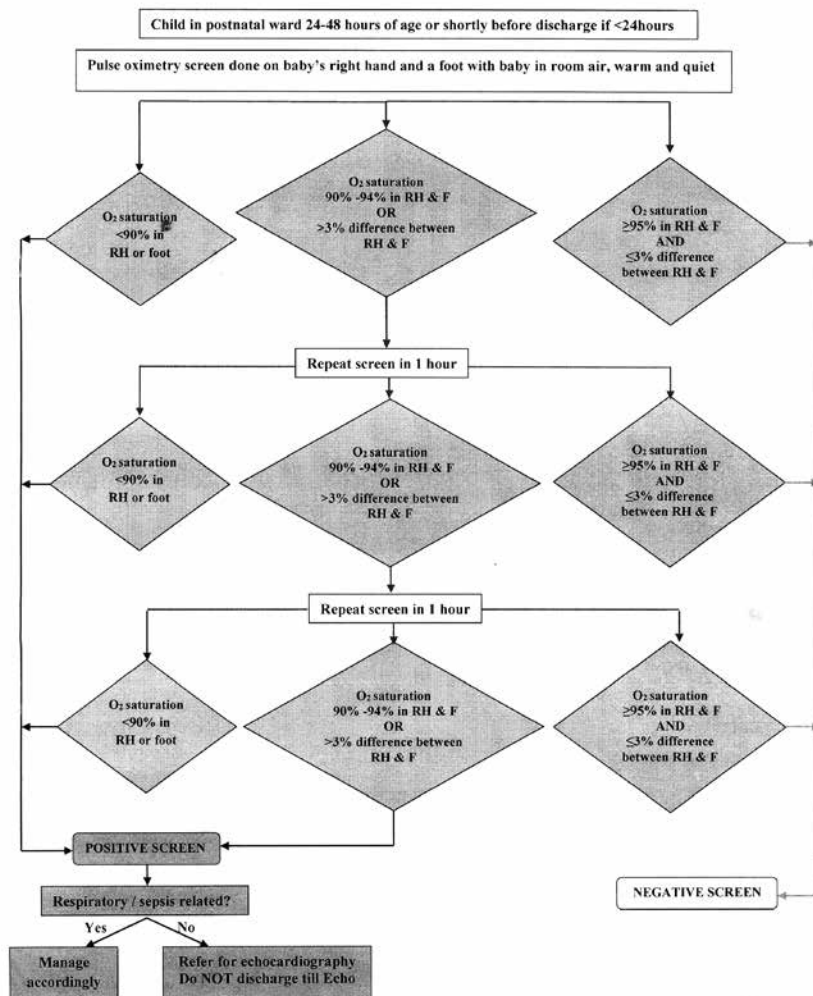
The test should be done after 24 hours (on 2nd day of life), to reduce false positive rate. If however the mother is being discharged before that and the baby is otherwise fit to be discharged, the test can be done on discharge.

Informing parents

Parents should be informed that:

1. This test is being done to screen for critical congenital heart diseases (non-critical congenital heart diseases can still be present and manifest later, eg' ASD /VSD)
2. Even if the baby has a negative result on the test the baby might still have a critical congenital heart disease
3. If the baby has a positive result on the test, the baby cannot be discharged until a cause for low SPO2 has been identified. An echocardiogram is required to rule out CCHD unless any other cause has been identified. Baby may require admission to the neonatal unit for observation and management

Algorithm



References

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Annexure 6

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சுவசிரிபாய

SUWASIRIPAYA

මගේ අංකය : FHR/INBU/NB Screening
2010/01

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My No. :)

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Your No. :)

දිනය : 22.12.2019
திகதி :
Date :)

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To all Deputy Director Generals
All Provincial Directors of Health Services
All Regional Directors of Health Services
All Directors of the Ministry of Health
Heads of all Special Campaigns
All Directors of Teaching, Provincial General and District General Hospitals
All Medical Superintendents of Base Hospitals
All Heads of Health care Institutions
All Medical Officers of Health

Newborn Screening for Congenital Deafness

Newborn Screening for Congenital Deafness is included in the 'Essential Service Package' in Sri Lanka and implemented nationally for all the newborns before discharge from the hospital after birth. About 1-2/1000 babies are born with permanent hearing loss in one or two ears. Permanent hearing loss can significantly affect the development of a child. Early detection of congenital deafness in the newborn enables a better chance of developing language, speech and communication skills.

Herewith, the guideline for Newborn Screening for Congenital Deafness is attached. Please bring the contents of this guideline to the notice of all health workers in your Province/ District/ Hospital/ Institution and take necessary steps to implement newborn screening to detect congenital deafness. Ministry of Health is in the process of procuring Oto Acoustic Emission (OAE) equipment for the hospitals without portable OAE machines. The specifications can be obtained from the Biomedical Engineering Services, Ministry of Health and Family Health Bureau to purchase OAE machines if local funds are available.

Dr. Anil Jasinghe
Director General Health Services

cc:

President, Sri Lanka College of Otolaryngologists
President, Sri Lanka College of Paediatricians
President, Sri Lanka College of Obstetricians
President, Perinatal Society of Sri Lanka

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385, Rev. Baddegama Wimalawansa Thero Mawatha, Colombo 10, Sri Lanka.

Guideline for Newborn Screening for Congenital Deafness

1. Introduction

A national programme has been initiated by the Ministry of Health to screen newborns for congenital deafness. One to two babies of every 1000 births are born with permanent hearing loss in one or two ears. A permanent hearing loss can significantly affect the baby's development. If deafness is corrected during early life, the child could acquire language, speech and communication skills and will lead a normal life. It will also help them to make the most of the relationships with their family or caregivers from an early age. However, if this **correction is delayed** even though the child could hear with intervention, the language ability will be significantly affected and thereby the child will be disabled.

This National programme for prevention of deafness is currently in progress and neonatal hearing screening shall be included in routine screening of the newborn. All newborns should be screened for hearing before being discharged from the hospital. The guideline issued, should be followed by the staff responsible for implementing this programme.

Test to be used in normal newborn: OAE (Oto Acoustic Emission) test

2. OAE (Oto Acoustic Emission) test

2.1 Advantages of the test

1. OAE is a noninvasive procedure, which can be performed in both ears within 5 minutes. But test time per baby may vary from 3-6 minutes dependent upon type of equipment and cooperation of the newborn.
2. This test will detect the cochlear causes of hearing loss.
3. The OAE test has a high negative predictive value, thus a good screening test.

2.2 Limitations of the test

1. Screening OAE may miss a disorder called auditory neuropathy/auditory dysynchrony.
2. Ambient noise and inexperience of the operator (technique) may affect the results.
3. External and middle ear pathologies may affect the test.

3. When to Screen the newborn for hearing

1. Testing should not be attempted prior to 12 hours of life; it is preferable to screen between 24-72 hours of life.
2. Testing should be completed as close to discharge as possible (close to 24hrs of birth). Babies born through caesarian section need to wait at least 24 hours for first attempt to allow ear canal debris to clear.
3. Screening should be conducted after a breastfeed whenever possible, to increase the chance of infant sleeping during the procedure.

4. False positive rate decreases after 12-24 hours after birth. False positive rate decreases overtime during the first 4 days of life when using OAE.
5. In newborns with risk factors for deafness (Annex 1) and newborns admitted to neonatal ICU, AABR (Automated Acoustic Brain stem Response) test should be performed.
6. In pre-term newborns, consider performing the test after 34 weeks of gestational age.
7. If the newborn is receiving antibiotic therapy, postpone hearing screening whenever possible until the antibiotic course is completed. For such newborns, hearing screening should still be performed prior to discharge. Antibiotic therapy should not be a reason for a "missed" screening.
8. Readmissions during first month of life:
A repeat hearing screening should be completed on all infants readmitted during the first month of life when there are conditions associated with potential hearing loss. eg. Hyperbilirubinemia requiring exchange transfusion or culture positive sepsis etc. Referral for an ABR should be done before discharge.

4. Who will do the test?

OAE has to be performed by a trained assigned Nursing Officer (Neonatal Hearing Screening Nursing Officer).

1. Screener/ testers should be trained by individuals with experience in newborn hearing screening techniques and practice. e.g. - Audiology Technician. Training should be competency based and involve hands-on components.
2. Screeners should also have adequate skills in soothing and calming newborns.
3. Screeners should be trained and prepared to discuss the test procedures with parents and caretakers.

5. Hearing Screening Environment:

Ideally, a space should be set aside to use for screening considering the following;

1. Close to/ in the postnatal ward
2. Has curtains
3. Has minimal noise
4. Free of electrical interference

Screening will be faster and more effective if conducted in a quiet and controlled environment.

During the time of screening

1. Turn off television/ radio
2. Ask the staff and others in the ward to be quiet
3. Minimize acoustics and electrical interference

6. How is the newborn hearing screening test (OAE) performed?

6.1 Equipment

Hearing screening of well babies will be done by a hand-held screening machine called the “Oto Acoustic Emission” or an OAE machine. This machine is an objective hearing measurement tool, utilizing ear probes that measure/ record low intensity sounds generated by the outer hair cells.

It is recommended that this machine is included in the inventory of the Nursing Officer (NO) assigned to perform the test. A trained NO from the ENT ward or any other unit (eg: Postnatal ward in a Maternity hospital) to be appointed to carry out newborn hearing screening in the hospital. Maintenance and all other procedures will be in accordance with the Department rules governing medical equipment.

6.2 Performing the OAE test

1. Inform the mother about the procedure before starting it
2. Visually inspect both ear canals for debris (wax, blood, and vernix) and clean it with rolled gauze wick if wet.
3. Change the position of the newborn, especially if the newborn has been lying on the ear you plan to test.
4. ***If both ear canals are patent and dry, OAE test will be performed in both ears.***
5. Set the ear phone probe by gently pulling the ear up and out: this will open up the canal.
6. If the probe does not pass on the first try:
Remove the probe and check for debris. Replace the tip if needed. Clean the probe if needed. Reposition the probe and repeat the screening.
7. If any abnormalities found in the ear canal, the newborn should be referred to ENT surgeon.

6.3 Informing test results to the parents

- ***If the test indicates ‘pass’ on both sides:*** Inform the mother “Your baby does not need any further testing at this stage”.
- ***If the test fails on either side:*** “Your baby need to undergo the same test again (repeat test)”
- ***If the 2nd OAE test fails:*** “Your baby’s test results warrants further testing”

6.4 Documentation and reporting of hearing

The test results should be documented in the BHT and CHDR via a ‘Frank’ placed in CHDR & BHT.

- Following the 1st OAE test, a form should be filled by the tester as shown in Figure 1.
1. ***If the test passes on both sides:*** mark in front of ‘Pass’ box.

2. *If the test fails on either side:* mark the relevant cage and repeat the OAE test within 2-3 weeks at the same institution. If the patient cannot attend to same unit refer to local ENT surgeon.

OAE Test			
Date:			
1 →	Pass		
2 →	Fail	B/L	R/S
		L/S	
		Date for 2 nd Test	
			
			
		(Tester's signature)	
			
		(Guardian's signature)	

Figure 1

- *If the 2nd OAE test fails:*

Refer the baby to specialized unit with AABR facility (pre identified district referral center) by completing the following form.

Newborn Hearing Screening	
Refer to:	
Name :	
Age:	Sex:
Address:	
.....	
Tel. No:	
This patient failed OAE test (B/L, R/S, L/S) twice. Please do the needful.	
.....	
Date	Consultant/ MO

Figure 2

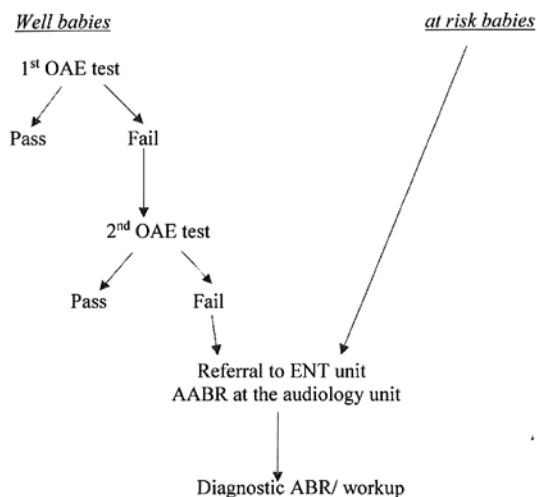
- The Medical Officer responsible for the neonatal examination in the post-natal ward should ensure the completion of the newborn hearing screening prior to discharge.
- All babies with failed screening test at discharge should be referred to ENT unit for appropriate further testing.
- The babies with failed hearing tests should be traced by the PHM / MOH of the area and refer to the relevant institution.

7. Protocol for NICU and at “risk baby” (Annex 1)

Referral note:

“Please do the hearing assessment for this patient”. Filled by MO-NICU/ Consultant Paediatrician or Neonatologist / Medical Officer (Paediatrics).

8. Protocol for Neonatal hearing screening



Annex 1 -Factors to identify ‘at risk’ newborns for ENT referral

Maternal factors

1. **Family history** of permanent hearing loss in childhood
2. **consanguinity**
3. **Maternal infections** during pregnancy or delivery
(Toxoplasmosis, Syphilis, HIV, Hepatitis B, Rubella, CMV, Herpes simplex, measles, mumps and others)
4. **Chemotherapy.**
Eg: Aminoglycoside gentamicin
Loop diuretics (furosemide)
Platinum based chemotherapy agents - Cisplatin.

Factors related to Newborns

1. All newborns required **neonatal intensive care for more than 7 days**
2. **Syndromes** associated with hearing loss,
Eg:
 - Waardenburg, Alport, Pendred, Jervell, Lange-Nielson
 - Neurofibromatosis, Osteopetrosis, and Usher syndrome (associated with progressive or late-onset hearing loss)
 - syndromes associated with hearing loss that include observable physical anomalies of the head, neck, and ears which frequently result in hearing loss (e.g., Down syndrome)
 - Neurofibromatosis Type II (NF2)
 - Neurodegenerative disorders Eg: Hunter syndrome
 - Sensory motor neuropathies Eg: Friedreich ataxia and Charcot-Marie-Tooth syndrome.
3. **Craniofacial & neck anomalies** including the pinna, ear canal, ear tags, ear pits, and temporal bone anomalies.
4. **Culture-positive postnatal infections** associated with sensorineural hearing loss
Eg: bacterial and viral (especially herpes viruses and varicella) meningitis, Hemophilus Influenza Type B
5. **Head trauma/birth trauma**
Eg:
Basal skull (potential damage to either the cochlea or middle ear)
Temporal bone (the inner ear) fractures
Perforation of the tympanic membrane, bleeding, or disruption of the ossicular chain
6. **Ototoxic medications** given in the neonatal period
Eg: aminoglycosides (gentamycin), loop diuretics

NATIONAL IMMUNIZATION SCHEDULE - SRI LANKA

NATIONAL IMMUNIZATION PROGRAMME

FIRST YEAR OF LIFE



0-4 Weeks **BCG** Preferably within 24 hours of birth (Before leaving hospital)
If a scar is not present 2nd dose could be offered after 6 months, upto 5 years

On completion of :

2 Months OPV & Pentavalent (DTP-HepB-Hib) (1st dose)
IPV (Fractional IPV) (1st dose)

4 Months OPV & Pentavalent (DTP-HepB-Hib) (2nd dose)
IPV (Fractional IPV) (2nd dose)

6 Months OPV & Pentavalent (DTP-HepB-Hib) (3rd dose)

9 Months MMR (1st Dose)

For a default or for an un-vaccinated child minimum of 6-8 weeks gap between doses is adequate

SECOND YEAR OF LIFE



On completion of :

12 months Live JE

18 months OPV & DTP (4th dose)

PRE-SCHOOL AGE



On completion of :

3 years MMR (2nd Dose)

SCHOOL- GOING AGE



On completion of :

5 years OPV & DT (5th dose)

10 years HPV (1st Dose)
(Grade 6)

HPV (2nd Dose) 8 months after 1st dose

11 years aTd (adult Tetanus diphtheria)
(Grade 7) (6th dose)

FEMALES IN THE CHILD-BEARING AGE

15-44 years Rubella containing vaccine (MMR)

One dose of MMR vaccine should be given to all females between 15 and 44 years of age, who have not been vaccinated with rubella containing vaccines earlier

PREGNANT WOMEN

Tetanus Toxoid

No documented evidence of previously being vaccinated with Tetanus Toxoid containing vaccine

1st Dose 1st Pregnancy, after 12 weeks of POA

2nd Dose 1st Pregnancy, 6-8 weeks after the 1st Dose

3rd Dose 2nd Pregnancy, after 12 weeks of POA

4th Dose 3rd Pregnancy, after 12 weeks of POA

5th Dose 4th Pregnancy, after 12 weeks of POA

Tetanus Toxoid is not indicated :

1. Mothers already received 5 doses of Tetanus Toxoid during previous pregnancies are protected and do not need further Tetanus Toxoid vaccination for the present pregnancy
2. Mothers already received 6 doses of Tetanus Toxoid containing vaccination according to the National Immunization Schedule and if the gap between the last Tetanus Toxoid containing immunization and the present pregnancy is less than 10 years, are protected and do not need further Tetanus Toxoid vaccination for the present pregnancy
3. Mothers already received 6 doses of Tetanus Toxoid containing vaccination according to the National Immunization Schedule during childhood and adolescence and have received at least 1 booster dose of Tetanus Toxoid during pregnancy or due to trauma within last 10 years, are protected and do not need further Tetanus Toxoid vaccination for the present pregnancy

With documented evidence of previously being vaccinated with Tetanus Toxoid containing vaccine

One booster dose of Tetanus Toxoid (TT) is indicated during 1st pregnancy, with a written evidence of previously being vaccinated with 6 doses of Tetanus Toxoid containing vaccination as per National Immunization schedule during childhood and adolescence (3 doses of DTP in infancy + DTP at 18 months + DT at 5 years + aTd at 11 years) and a gap of 10 years or more after the last Tetanus Toxoid containing vaccination



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Annexure 8

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Ministry of Health

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Date:

General Circular No: 02-27/2014

All DDGs of Ministry of Health

All Directors of Ministry of Health

All Provincial/Regional Directors of Health Services

Directors of Teaching Hospitals/Provincial General Hospitals

Medical Superintendents of District General Hospitals/Base Hospitals

Guidelines for screening of Retinopathy of Prematurity

The Ministry of Health with the technical collaboration of the Family Health Bureau, Sri Lanka College of Paediatricians, Sri Lanka College of Ophthalmologists, The Associations of Vitreo Retin Specialists of Sri Lanka and the Perinatal Society of Sri Lanka has revised the guidelines for screening of Retinopathy of Prematurity.

Make arrangements to inform the contents of this guideline to all the relevant staff in your institution and ensure adherence to the guidelines for screening of Retinopathy of Prematurity.

Dr P.G. Maheepala

Director General Health Services

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Colombo 10.

1. Indications;

Babies with – POG less than 34 weeks

Birth weight less than 1500 g

Any sick or preterm neonate based on clinical judgement

Any baby with cyanotic congenital heart disease

One criterion is adequate for referral

2. Timing of screening;

All the pre term babies and high risk neonates to be screen at postnatal age of between 3-4 weeks

3. Place of screening;

Screening would be conducted inside the NICU/SCBU until the baby is discharged.

Facilities for screening, staff to assist should be made available in the neonatal unit Out patients to be followed up at eye units by prior appointment

4. Procedures prior to screening

Maintain sterility - use gloves

Use individual bottles of topical medication

Topical medication to be instilled by the mother for out patients under the supervision of the nursing officer

5. Dilatation of the pupil

Start eye drops ½ hr before the scheduled examination

One drop of Tropicamide 0.4%

Phenylephrine 2.5% combination

Wipe the excess with a cotton swab

Drops could be repeated twice, 10 minutes apart

6. Method of examination

With topical anaesthetic drops

Use paediatric eye speculum

Use a cotton tip applicator or irrigating vectis as an indenter

Binocular indirect ophthalmoscope and 20 D lens and 28 D lens

7. Recording the findings

Record in the standardized format (to be retained in the eye unit) and in the summary form (to be attached to the inner page of the CHDR)

Record in; Zone 1,2,3

Grade 1,2,3,4,5

Presence of plus disease

Zone 1 ROP or any evidence of plus disease refer to the treatment centre

8. Counseling

Parents to be counseled regarding

- the disease
- Importance of follow up
- Possibility of requiring treatment

For inpatients - Group counseling is possible

Responsibility of counseling – In patients; Neonatal unit staff under the neonatologist
- Out patients; Eye unit by trained staff.

9. Review

Depend on the presence or absence of ROP

No ROP – Follow up every 2 weeks

In the presence of ROP follow instructions on referrals

10. Referrals

Preliminary referral; Neonatologist/Paediatrician to request the ophthalmologist in the closest eye unit for screening.

For treatment; the Eye Surgeon should refer to the designated center for the respective hospital.

Following are the available centers as at April 2014;

National Eye Hospital Colombo

Lady Ridgeway Hospital for Children Colombo

Teaching Hospital Kandy

Teaching Hospital Karapitiya

Teaching Hospital Jaffna

District General Hospital Ampara.

Sri Jayewardenepura Hospital-

11. Discharge from examination

No ROP at 42 weeks

Regressed ROP (treated or spontaneous)

12. Special remarks

Prevention of spread of conjunctivitis

Preferably the mother of each child should instil the drops, with own vial of drugs, with gloved hands. Examiner should be gloved and change with each examination.

To prevent drop outs from follow up mother should be given written instructions with a date, time, place specified

Annexure 9

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Ministry of Health

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දිනය 26.09.2014
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Date;

General Circular No; 01-36/2015

All Director Generals Ministry of Health
All Directors, Ministry of Health
All Provincial/Regional Directors of Health Services
Directors of Teaching/Provincial General Hospitals
Medical Superintendents of District General/Base Hospitals

Levels of Neonatal Care for the Specialist Hospitals in Sri Lanka

Services for neonatal care have improved over the past decades in Sri Lanka. Many hospitals have established facilities to provide special care and neonatal intensive care to the newborn babies. Provision of surgical facilities when needed for the newborns also has improved over the years.

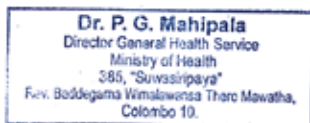
The availability of neonatal care has improved outcomes for high risk infants including those born preterm or with serious medical or surgical conditions. The concept of regionalized perinatal care was articulated in 1976 March of Dimes report *Toward Improving the Outcome of Pregnancy: The 90s and Beyond*. The report included criteria that stratified maternal and neonatal care into 3 levels of complexity and recommended referral of high risk patients to centers with the personnel and resources needed for their degree of risk and severity of illness. At present there are Consultant Neonatologists or Consultant Paediatricians working in Neonatology posts in many specialist hospitals have established Special Care and Intensive Care facilities for new born babies. The evidence suggest it is best to provide neonatal care for the critically ill neonates in a more centralized manner as it would lead to better outcomes in the newborn. As the number of critically ill newborns that are treated by the unit increases, the outcomes have shown to improve. In addition for the provision of care for the critically ill newborns more sophisticated facilities are required and centralization of such services have shown to be most cost effective.

Henceforth, for further improvement of neonatal care services, levels of neonatal care for the specialized hospitals are defined and it is envisaged to improve the capacity of larger units which provide care for the most ill babies and dealing with transfers from the periphery.

Four levels of neonatal care for specialist hospitals in Sri Lanka are identified and the four levels of care with the minimum facilities that should be available in such units are attached to this circular.



Dr P G Maheepala,
Director General Health Services



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Secretary, Ministry of Health

Additional Secretary, Medical Services

Chief Accountant Ministry of Health

President, Sri Lanka College of Paediatricians

President, Sri Lanka College of Obstetricians and Gynaecologists

President, Perinatal Society of Sri Lanka

Four levels of neonatal care for specialist hospitals and the minimum criteria for each of the levels are as follows;

Level III+ Criteria

- Cardiac surgery
- Neonatal neuro surgery
- ECMO
- Head Cooling
- Extremely low BW < 1000g
- And Level III Facilities
- And a MBC and LMC

Level III Criteria

- Neonatal surgery (in selected units)
- Ventilation up to CPAP, IPPV, high frequency + NO
- Exchange transfusion
- Cooling (selected centers only)
- BW <1250g + > 1250g with complications
- TPN
- And Level II Facilities
- And Level I Facilities
- And a MBC and LMC

Level II Criteria

- Short term ventilation + CPAP
- Other SCBU facilities
- Continuation of care of transferred back babies from level 3 & 4
- Intensive photo therapy
- BW> 1250g without complications

Level I Criteria

- Feeding problems-tube
- Nasal prong O2
- Photo therapy-single
- Incubator care/ thermal
- IV fluids
- IV antibiotics
- Management of hypoglycemia
- Thermal Care
- Stabilization and transport

**** Intrauterine transfers have to be sent to a Level III centre. If after delivery if there is no problem send back to Level II or I**

Following is the list of hospitals with the level of care;

Name of the Hospital	Identified Level of Care
Western Province	
LRH -	III+
CNTH	III
CSTH	III
SJGH	III
DMH	III
CSHW	III
DGH Kalutara	III
DGH Gampaha	II
DGH Negombo	II
BHA Panadura	II
BHA Avissawella	II
BHA Homagama	II
BHA Wathupitiwela	II
BHA Horana	II
BHB Mulleriyawa	I
Southern Province	
TH Karapitiya	III+
TH Mahamodara	III
DGH Matara	II
DGH Hambantota	III
BHA Balapitiya	II
BHA Tangalle	II
BHA Elpitiya	II
BHB Kamburupitiya	I
BHB Tissamaharama	I
BHB Deniyaya	I
BHB Walasmulla	I
BHB Udugama	I
Sabaragamuwa Province	
PGH Ratnapura	III
DGH Kegalle	II
BHA Embilipitiya	II

Name of the Hospital	Identified Level of Care
BHB Mawanella	I
BHB Balangoda	I
BHB Kahawatta	I
BHB Karawanella	I
BHB Warakapola	I
BHB Kalawana	I
Northwestern Province	
PGH Kurunegala	III
DGH Chilaw	II
BHA Kuliyaipitiya	II
BHA Puttalam	II
BHB Marawila	I
BHB Nikaweratiya	II
BHB Dmabadeniya	I
BHB Galgamuwa	I
Northcentral Province	
TH Anuadhapura	III
DGH Polonnaruwa	III
BHB Thambuttegama	I
BHB Padaviya	II
BHB Medirigiriya	I
Central Province	
TH Kandy	III
TH Peradeniyay	III
SBCH	III+
DGH Nuwaraeliya	III
DGH Matale	II
DGH Nawalapitiya	II
BHA Gampola	
BHA Dambulla	II
BHA Dickoya	II
BHB Rikillagaskada	II
BHB Theldeiniya	I

Name of the Hospital	Identified Level of Care
Uva Province	
PGH Badulla	III
DGH Monaragala	II
BHA Diyathalawa	II
BHA Mahiyanganawa	II
BHB Welimada	I
BHB Siyambalanduwa	I
BHB Bibile	I
Eastern Province	
TH Batticaloa	III
DGH Trincomalee	II
DGH Ampara	II
BHA Kalmunai North	II
BHA AMH Kalmunai	II
BHA Kanthalai	II
BH Kinniya	I
BH Samanthurai	I
BHB Akkaraipattu	I
BHB Dehiattakandiya	I
BHB Muttur	I
BHB Valachchenai	I
BHB Mahaoaya	I
Northern Province	
TH Jaffna	III+
DGH Vavuniya	II
DGH Killinochchi	II
DGH Mannar	II
DGH Mullativu	II
BHA Pointpedro	I
BHA Thellipalai	I
BHB Kyts	I
BHB Chettikulam	I
BHB Chawakachcheri	I

Annexure 10

Hammersmith Neonatal Neurological Examination Term and preterms at term age
Ricci D et al Early Hum Devel 2008

Page 1

Patient Name
DOB

GA

ID

Date

	arms & legs extended or very slightly flexed	legs slightly flexed	leg well flexed but not adducted	leg well flexed & adducted near to abdomen	abnormal posture: opisthotonus a) arms flexed, b) legs extended
POSTURE					
ARM RECOIL	arms do not flex	arms flex slowly not always, not completely	arms flex slowly, more complete	arms flex quickly and completely	arms difficult to extend, snap back forcefully
ARM TRACTION	arms remain straight, no resistance	arms flex slightly or some resistance felt	arms flex well till shoulder lifts, then straighten	arms flex to approx. 100° maintained as shoulder lifts up	flexion of arms <100° maintained when body lifts up
LEG RECOIL	No flexion	incomplete or variable flexion	complete but slow flexion	complete fast flexion	flexion stays when back & bottom up
LEG TRACTION	legs straight - no resistance	legs flex slightly or some resistance felt	legs flex well till bottom lifts up	leg flexes & flexed when bottom up	flexion stays when back & bottom up
POPITAL ANGLE	180°	150°	110°	90°	90°
HEAD CONTROL (FL)	no attempt to raise head	infant tries: effort better felt than seen	raises head but drops forward or back	raises head: remains vertical	head upright or extended, cannot be passively flexed
HEAD CONTROL (BL)	no attempt to raise head	infant tries: effort better felt than seen	raises head but drops forward or back	raises head: remains vertical, it may wobble	head upright or extended, cannot be passively flexed
HEAD LAG	head drops & stays back	tries to lift head but it drops back	able to lift head slightly	lifts head in line with body	head in front of body
VENTRAL SUSPENSION	back curved, head & limbs hang straight	back curved, head & limbs slightly flexed	back slightly curved, limbs flexed	back straight, head in line, limbs flexed	back straight, limbs above body

1	.5	2	.5	3	.5	4	.5	5	
3	0	9	6	50	9	12	0	1	25-27w
1	0	6	2	51	16	12	1	1	28-29w
2	0	4	2	55	17	8	0	2	30-31w
0	0	0	2	51	4	9	0	4	32-34w
0	0	0	0	6	3	90	1	0	Full term

3	1	9	9	44	9	23	2	0	25-27w
1	1	3	4	42	15	33	0	1	28-29w
1	0	8	3	42	10	36	0	0	30-31w
0	0	2	2	54	15	25	0	2	32-34w
0	0	5	2	22	3	67	1	0	Full term

3	0	17	5	51	10	14	0	0	25-27w
7	1	14	7	45	8	18	0	0	28-29w
7	2	15	4	51	7	14	0	0	30-31w
6	2	25	0	59	4	4	0	0	32-34w
0	0	1	0	22	8	69	0	0	Full term

3	0	14	4	18	5	52	0	4	25-27w
0	0	5	2	24	5	62	0	2	28-29w
0	0	10	2	34	2	50	0	2	30-31w
0	0	9	0	38	2	49	0	2	32-34w
0	0	3	1	4	1	91	0	0	Full term

3	1	17	6	35	6	27	1	4	25-27w
1	1	17	2	36	6	35	1	1	28-29w
2	0	21	8	38	5	25	0	1	30-31w
0	4	29	10	43	2	10	0	2	32-34w
0	0	0	1	12	12	72	0	3	Full term

3	0	22	8	46	6	14	0	0	25-27w
5	1	16	5	48	7	17	1	0	28-29w
2	0	15	10	53	5	15	0	0	30-31w
2	0	26	4	49	4	13	0	2	32-34w
0	0	5	5	19	20	51	0	0	Full term

3	0	17	4	46	9	21	0	0	25-27w
0	0	13	5	46	12	24	0	0	28-29w
3	0	14	2	48	13	20	0	0	30-31w
4	0	15	4	55	4	18	0	0	32-34w
0	0	0	6	26	12	56	0	0	Full term

3	0	3	5	57	11	21	0	0	25-27w
1	2	6	4	50	13	24	0	0	28-29w
1	0	2	2	63	11	21	0	0	30-31w
0	0	4	2	77	2	15	0	0	32-34w
0	0	0	4	29	15	52	0	0	Full term

3	3	27	13	36	3	15	0	0	25-27w
3	3	18	7	40	14	15	0	0	28-29w
7	3	16	5	46	7	16	0	0	30-31w
4	0	21	4	56	0	15	0	0	32-34w
0	0	9	4	44	12	31	0	0	Full term

0	0	21	11	38	11	15	4	0	25-27w
3	0	25	8	44	8	10	0	2	28-29w
3	0	22	8	47	5	14	1	0	30-31w
2	0	17	2	56	2	19	0	2	32-34w
0	0	4	5	47	16	28	0	0	Full term

Tone pattern items

Page 2

FLEXOR TONE (arm and leg traction)	arm flexion < leg flexion	arm flexion = leg flexion	arm flexion > leg flexion; difference ≤ 1 column	arm flexion > leg flexion; difference > 1 column
FLEXOR TONE (resting posture)		arms and legs generally flexed	strong arm flexion with strong leg extension <i>intermittent</i>	strong arm flexion with strong leg extension <i>continuous</i>
LEG TONE (resting posture and popliteal angle)	leg traction > popliteal angle	leg traction = popliteal angle	leg traction < popliteal angle; difference ≤ 1 column	leg traction < popliteal angle; difference > 1 column
HEAD CONTROL (sitting)	neck extension < neck flexion	neck extension = neck flexion	neck extension > neck flexion; difference ≤ 1 column	neck extension > neck flexion; difference > 1 column
NECK AND HEAD TONE (horizontal)	ventral suspension < head lag	ventral suspension = head lag	ventral suspension > head lag; difference ≤ 1 column	ventral suspension > head lag; difference > 1 column

1	.5	2	.5	3	.5	4	.5	5	
0	0	45	0	27	<1	27	0	1	25-27w
0	0	40	<1	40	0	20	<1	0	28-29w
0	0	34	<1	47	<1	18	0	1	30-31w
0	0	38	<1	36	<1	24	<1	2	32-34w
0	0	25	3	53	0	18	0	<1	Full term

0	0	0	0	99	<1	0	0	1	25-27w
0	0	0	0	96	<1	3	0	1	28-29w
0	0	0	0	96	<1	2	0	2	30-31w
0	0	0	0	94	<1	2	0	4	32-34w
0	0	0	0	99	0	<1	0	<1	Full term

0	0	43	<1	34	0	21	<1	1	25-27w
0	0	41	0	39	<1	19	0	1	28-29w
0	0	38	0	36	<1	22	<1	4	30-31w
0	0	19	<1	50	<1	29	<1	2	32-34w
0	0	4	0	57	0	35	0	1	Full term

0	0	25	0	64	0	9	0	2	25-27w
0	0	17	0	70	0	13	0	0	28-29w
0	0	18	0	76	0	6	0	0	30-31w
0	0	23	0	64	0	13	0	0	32-34w
0	0	3	0	94	0	3	0	<1	Full term

0	0	20	0	39	0	35	0	6	25-27w
0	0	31	0	42	0	26	0	1	28-29w
0	0	24	0	49	0	26	0	1	30-31w
0	0	17	0	51	0	28	0	4	32-34w
0	0	24	0	58	0	18	0	<1	Full term

Reflex items

Page 3

TENDON REFLEX	absent	felt, not seen	seen	'exaggerated'	clonus
SUCK/GAG	no gag / no suck	weak irregular suck only;	weak regular suck	strong suck; (a) irregular (b) regular	no suck but strong clenching
PALMAR GRASP	no response	short, weak flexion of fingers	strong flexion of fingers	strong finger flexion, shoulder ↑	very strong grasp; infant can be lifted off couch
PLANTAR GRASP	no response	partial plantar flexion of toes	toes curve around the examiner's finger		
PLACING	no response	dorsi-flexion of ankle only	full placing response with flexion of hip, knee & placing sole on surface		
MORO REFLEX	no response or opening of hands only	full abduction at shoulder and extension of the arms; no adduction	full abduction but only delayed or partial adduction	partial abduction at shoulder and extension of arms followed by smooth adduction	• no abduction or adduction; • only forward extension of arms from the shoulders • marked adduction only

1	.5	2	.5	3	.5	4	.5	5	
0	0	9	0	55	7	13	3	13	25-27w
0	0	12	0	50	7	22	4	5	28-29w
0	0	24	1	52	1	13	0	9	30-31w
0	0	18	0	57	0	17	4	4	32-34w
<1	0	21	0	78	0	<1	0	<1	Full term

0	0	1	0	3	3	93	0	0	25-27w
0	0	3	0	7	0	90	0	0	28-29w
0	0	0	0	6	2	92	0	0	30-31w
0	0	4	0	10	0	86	0	0	32-34w
0	0	1	0	5	0	92	0	2	Full term

0	0	5	0	47	7	30	1	10	25-27w
0	0	3	1	40	8	43	1	4	28-29w
0	0	1	0	51	3	35	0	10	30-31w
0	0	7	0	53	3	30	0	7	32-34w
<1	0	6	0	84	0	9	0	<1	Full term

0	0	4	1	95	0	0	0	0	25-27w
0	1	5	2	92	0	0	0	0	28-29w
0	0	2	1	97	0	0	0	0	30-31w
0	0	2	2	96	0	0	0	0	32-34w
<1	0	2	0	98	0	0	0	0	Full term

5	2	12	3	78	0	0	0	0	25-27w
0	2	12	6	80	0	0	0	0	28-29w
1	0	8	8	83	0	0	0	0	30-31w
0	0	4	0	96	0	0	0	0	32-34w
1	0	18	0	81	0	0	0	0	Full term

0	0	13	1	61	4	20	0	1	25-27w
0	0	12	1	64	6	15	1	1	28-29w
0	0	12	1	51	3	28	0	5	30-31w
0	0	23	0	46	2	27	0	2	32-34w
0	0	1	0	20	0	79	0	0	Full term

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SPONTANEOUS MOVEMENT (quantity)	no movement	sporadic and short isolated movements	frequent isolated movements	frequent generalized movements	continuous exaggerated movements
SPONTANEOUS MOVEMENT (quality)	only stretches	stretches and random abrupt movements Some smooth movements	fluent movements but monotonous	fluent alternating movements of arms + legs; good variability	cramped synchronous mouthing jerky or other abnormal movement
HEAD RAISING	no movement	infant rolls head over, chin not raised	infant raises chin, rolls head over	infant brings head and chin up	infant brings head up and keeps it up

1	.5	2	.5	3	.5	4	.5	5	
0	0	15	3	28	3	51	0	0	25-27w
0	0	17	3	26	11	43	0	0	28-29w
0	0	13	0	31	8	48	0	0	30-31w
0	0	20	0	27	0	51	0	2	32-34w
<1	0	3	0	5	0	92	0	<1	Full term

0	0	16	4	42	11	23	1	3	25-27w
0	0	22	5	35	1	23	2	2	28-29w
0	0	20	6	34	2	36	0	2	30-31w
0	0	21	0	15	0	60	0	4	32-34w
2	0	5	0	<1	0	93	0	<1	Full term

0	0	36	6	34	6	14	1	3	25-27w
1	1	35	4	34	9	14	1	1	28-29w
1	1	40	5	28	1	21	1	2	30-31w
0	0	40	0	30	4	22	2	2	32-34w
<1	0	10	0	50	0	40	0	<1	Full term

Abnormal signs

ABN. HAND OR TOE POSTURES		hands open, toes straight most of the time	intermittent fisting or thumb adduction	continuous fisting or thumb adduction; index finger flexion, thumb opposition	continuous big toe extension or flexion of all toes
TREMOR		no trem or or trem or only when crying	tremor only after Moro or occasionally when awake	frequent tremors when awake	continuous tremors
STARTLE		no startle even to sudden noise	no spontaneous startle but reacts to sudden noise	2-3 spontaneous startles	more than 3 spontaneous startles
					continuous startles

1	.5	2	.5	3	.5	4	.5	5	
0	0	57	4	37	0	2	0	0	25-27w
0	0	64	6	28	0	2	0	0	28-29w
0	0	67	1	30	1	1	0	0	30-31w
0	0	75	2	21	0	2	0	0	32-34w
0	0	85	0	12	0	3	0	<1	Full term

0	0	43	1	29	8	16	0	3	25-27w
0	0	43	0	27	9	19	2	0	28-29w
0	0	54	0	24	3	19	0	0	30-31w
0	0	62	0	30	0	4	0	4	32-34w
0	0	88	0	12	0	<1	0	<1	Full term

22	0	40	7	20	1	10	0	0	25-27w
23	1	35	7	30	2	2	0	0	28-29w
37	1	32	1	25	1	3	0	0	30-31w
50	0	35	0	9	0	6	0	0	32-34w
<1	0	94	0	6	0	<1	0	<1	Full term

EYE APPEARANCE	does not open eyes		full conjugated eye mov	transient nystagmus strabismus roving eye movements sunset sign	persistent nystagmus strabismus roving eye movements downward deviation
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1	.5	2	.5	3	.5	4	.5	5	
6	0	0	0	74	4	16	0	0	25-27w
2	0	0	0	80	2	15	1	0	28-29w
5	0	0	0	80	2	13	0	0	30-31w
4	0	0	0	87	2	7	0	0	32-34w
7	0	0	0	92	0	1	0	<1	Full term

AUDITORY ORIENTATION	no reaction	auditory startle; Brightens and stills;	shifting of eyes, head might turn towards source	prolonged head turn to stimulus; search with eyes; smooth	turns head and eyes towards noise every time; jerky abrupt
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5	1	28	0	57	1	8	0	0	25-27w
2	0	23	10	50	6	9	0	0	28-29w
5	1	27	7	51	1	8	0	0	30-31w
3	0	14	0	73	3	7	0	0	32-34w
<1	0	30	0	50	0	20	0	<1	Full term

VISUAL ORIENTATION	does not follow or focus on stimuli	stills, focuses follows briefly to the side but loses stimuli	follows horizontal -ly and vertically; no head turn	follows horizontal -tally and vertically; turns head	follows in a circle
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6	0	7	2	25	3	26	9	22	25-27w
0	0	7	1	33	7	21	15	16	28-29w
1	0	9	0	27	5	25	10	23	30-31w
0	0	10	0	42	10	38	0	0	32-34w
<1	0	7	0	41	0	51	0	1	Full term

ALERTNESS	will not respond to stimuli	when awake, looks only briefly	when awake, looks at stimuli but loses them	keeps interest in stimuli	does not tire (hyper-reactive)
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6	0	22	1	48	3	20	0	0	25-27w
1	0	17	4	60	3	14	1	0	28-29w
0	0	21	1	43	2	33	0	0	30-31w
0	0	7	3	54	0	36	0	0	32-34w
1	0	2	0	48	0	49	0	<1	Full term

IRRITABILITY	quiet all the time, not irritable to any stimuli	awakes, cries some -times when handled	cries often when handled	cries always when handled	cries even when not handled
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12	1	52	0	31	0	3	0	1	25-27w
16	2	47	2	27	1	5	0	0	28-29w
27	0	47	1	22	0	2	0	1	30-31w
23	0	49	0	23	0	5	0	0	32-34w
<1	0	93	0	5	0	2	0	<1	Full term

CONSOLABILITY	not crying; consoling not needed	cries briefly; consoling not needed	cries; becomes quiet when talked to	cries; needs picking up to console	cries cannot be consoled
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10	0	29	0	29	3	29	0	0	25-27w
17	1	19	2	29	7	22	1	2	28-29w
27	0	18	0	28	2	22	1	2	30-31w
23	0	9	0	32	2	28	0	6	32-34w
1	0	41	0	45	0	12	0	<1	Full term

CRY	no cry at all	whimper -ring cry only	cries to stimuli but normal pitch		high pitched cry; often continuous
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11	0	11	0	78	0	0	0	0	25-27w
16	0	5	2	77	0	0	0	0	28-29w
26	1	3	1	69	0	0	0	0	30-31w
23	0	6	2	69	0	0	0	0	32-34w
<1	0	7	0	92	0	0	0	1	Full z

Reference

Ricci D, Romeo DMM, Haataja L et al Neurological examination of preterm infants at term equivalent age. *Early Human Development* 2008;84:751–761

Annexure 11

General Circular No. 01-64/2016

My No, FHB/CNU/WHO/26/PTGC/2016
Ministry of Health, Nutrition and Indigenous Medicine
No. 385
Rev. Baddegama Wimalawansa Thero Mawatha
Colombo 10.
09.11.2016

All Provincial Directors of Health Services
All Regional Directors of Health Services
All Heads of Institutions
All Medical Officers of Health

Guideline on Preterm Growth Charts

Ministry of Health has taken a decision to introduce preterm growth charts into the growth monitoring component of the National Maternal & Child Health Programme as a measure of improving the services offered to premature infants who constitute about 5-7% of the total births. This decision has been taken on the recommendation of the Technical Advisory Committee on Newborn and Child Health (TACNCH) of the Ministry of Health.

These charts which have been developed by the INTERGROWTH-21st study conducted by the University of Oxford, UK will complement the term charts with WHO new growth standards which have been already incorporated into the Child Health & Development Record (CHDR) and used in the assessment of growth of children from birth to 19 years since year 2006 in Sri Lanka. The guideline attached to this circular intends to introduce these preterm growth charts to the health system of Sri Lanka.

You are hereby instructed to bring the contents of this circular to the notice of all relevant healthcare staff in your institution/field and instruct them to closely adhere to this guideline on preterm growth charts in order to improve the quality of newborn health care services of the country.


Dr. P. G. Mahipala
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Director Maternal and Child Health
Director Nutrition
Director Nutrition Coordination

Director Non Communicable Diseases
Director Estate and Urban Health
Director Private Health Sector Development
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President – Sri Lanka College of Pediatricians
President – Perinatal Society of Sri Lanka
President – College of Community Physicians of Sri Lanka
President – Sri Lanka Medical Nutrition Association
President – Sri Lanka Medical Association
President – College of General Practitioners of Sri Lanka
President – College of Medical Administrators of Sri Lanka
President – Independent Medical Practitioners' Association of Sri Lanka
President – Nutrition Society of Sri Lanka

Guideline on preterm growth charts

Introduction

In the National Maternal & Child Health Programme in Sri Lanka the WHO new growth standards for term babies have been incorporated into the Child Health & Development Record (CHDR) and used in the assessment of growth of children from birth to 19 years since year 2006. With the improvement of quality of services, the need of preterm growth charts to be used for the 5-7% preterm births occurring in Sri Lanka has been felt. Therefore on the recommendation of the Technical Advisory Committee on Newborn and Child Health (TACNCH), the Family Health Bureau jointly with the Sri Lanka College of Paediatricians decided to incorporate preterm growth charts developed by INTERGROWTH-21st study in to the growth monitoring component of the National Maternal & Child Health Programme.

INTERGROWTH-21st study was conducted by the University of Oxford, UK with the main aim of studying growth, health, nutrition, and neuro development of babies from less than 14 weeks of gestation up to 2 years of age. It was a multicentre, multi-ethnic, population-based project with the same conceptual framework as the WHO Multicentre Growth Reference Study (MGRS). It was conducted in eight study sites: the cities of Pelotas (Brazil), Turin (Italy), Muscat (Oman), Oxford (UK), Seattle (USA), Shunyi County in Beijing (China), the central area of Nagpur (India) and the Parklands suburb of Nairobi (Kenya).

Foetal Growth Longitudinal Study (FGLS) was one of the main components of the INTERGROWTH 21st project for which a cohort of pregnant “healthy” women according to the INTERGROWTH-21st criteria were enrolled before 14 weeks of gestation and followed up to 2 years after delivery. Pre-term infants (<37 weeks’ gestation) born to these FGLS women were enrolled in the Postnatal Preterm Follow-up Study [PPFS] and their growth was closely followed up to 2 years of age. The present pre-term growth charts were derived from this PPFS component of the INTERGROWTH-21st Project.

Preterm growth charts

Four charts are available for currently monitored growth indicators;

- i. Weight for age chart
- ii. Length for age chart
- iii. Weight for length chart
- iv. Head circumference for age chart

These are sex specific charts; the charts for male infants are printed in a blue back ground and for female infants in a pink back ground keeping in line with the existing term growth charts used in the CHDR.

The preterm charts are to be used till the infant is 6 months of age, from which point onwards the WHO new growth charts in the CHDR are to be used.

These four growth charts come as a set of two sheets printed on both sides (one chart per page) and an adhesive tape on the gutter side of one sheet. Once the CHDR is issued to the

infant, the preterm charts should be attached to it using this double sided adhesive tape immediately before the existing two sheets of growth charts for children under 5 years of age.

Logistics

Family Health Bureau of the Ministry of Health is responsible for printing of these growth charts. These charts are issued free of charge to the curative institutions (in both government and private sector) where deliveries take place. At no occasion should money be charged for issuing of these charts.

Family Health Bureau will directly issue these charts to the Line Ministry institutions island wide and private hospitals within Colombo district. The institutions under the provincial government and private hospitals in the other districts will be issued their requirement through Medical Officer (Maternal and Child health) attached to the RDHS of the District.

Note: Preterm growth charts will not be issued to Medical Officer of Health areas.

The number of growth charts to be issued to each and every hospital should be determined by the number of pre term births delivered in the hospital annually. When estimating the requirement for each hospital the number of preterm births (male and female separately) occurred in the hospital in the previous year should be calculated and 10% added as a buffer. If the male and female preterm births do not differ significantly the ratio of male : female preterm births can be considered as 50:50. Sex specific charts will be issued as per the required number (male – blue charts, female – pink charts).

The officer responsible to obtain CHDRs for the hospital (e.g. officer in charge of the general stores of the hospital) is responsible to obtain the required amount of preterm growth charts and to distribute them to the relevant units (PBU, NICU, SCBU, postnatal wards). The relevant hospital staff is responsible to renew the stocks to avoid a stock out.

The Consultant Neonatologist/ Consultant Paediatrician / Medical Officers of the relevant units as instructed by the consultant are to decide which infants need preterm growth charts. The preterm infants (aged 27 weeks and above) admitted to the newborn care facility for observation/management of complications should receive a set of these charts at the time they are admitted to PBU/NICU/SCBU etc. For preterm infants who do not require admission for such specialised management and are discharged should receive it along with the CHDR, at the time of issuing of CHDR from the postnatal ward.

At the time of discharge of the preterm infant, the unit staff should check and confirm that each preterm infant has received a set of preterm growth charts, with all the relevant entries made accurately and the charts attached to the CHDR correctly (immediately before the existing term charts for children under 5years).

In the event of losing the preterm growth chart a new set of charts should be issued by the hospital.

Maintaining records in the preterm growth charts

Identification details

The nursing officer who issues the charts should enter the basic identification details in the relevant cages; in the first page (weight for age chart) - name of the mother (and infant if available), name of the hospital, ward/unit number and also the date of birth, time of birth, gestational age at birth (USS corrected). The anthropometric measurements - birth weight, length and the head circumference of the newborn should also be entered in the relevant cages of the respective charts at the same time by the issuing officer.

Recording the measurements

The medical officer of the relevant units should plot the birth weight, length at birth, weight for length and the head circumference at birth against the period of gestation at birth (in weeks and days) when starting the charts. The birth date should be written vertically in the X axis against the plotted point of measurement at birth (birth weight, length at birth, head circumference at birth). Thereafter during follow up, each and every measurement of the baby should be plotted in the charts accurately against the age calculated in weeks and days.

In the field the PHM, after registering the baby should continue to monitor the growth of the baby according to the recommended schedule even when the baby is being followed up by the neonatologist/paediatrician. When the baby is weighed/ measured for length in the field setting the PHM should continue the chart and plot the measurements of weight and length against the exact age calculated in weeks and days. The relevant measurements should be entered in the B portion of the CHDR. The codes for each colour zone should be as for the 'term' charts in the CHDR. Routine measurement and recording of head circumference by PHM is not expected unless requested by a medical professional.

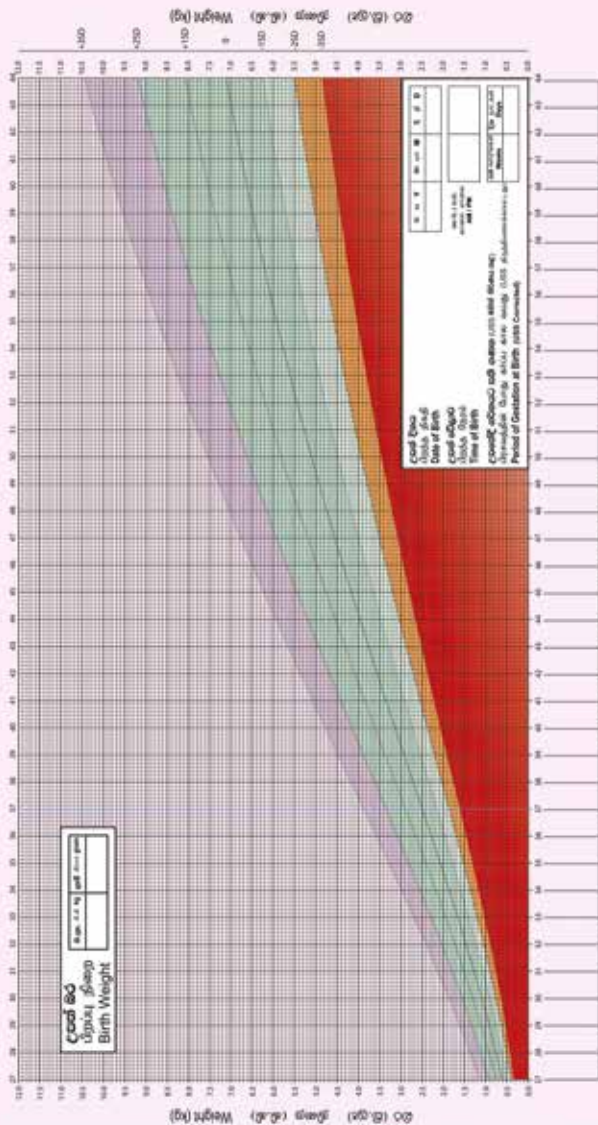
The preterm growth charts are to be used till the infant completes 6 months of age. From 6th month onwards the term charts of the CHDR should be used for the preterm babies.

References:

- Villar J, Papageorgiou AT, Pang R, et al. The likeness of fetal growth and newborn size across non-isolated populations in the INTERGROWTH-21 Project: the Fetal Growth Longitudinal Study and Newborn Cross-Sectional Study. *The Lancet Diabetes & endocrinology* 2014;2 (10):781-92doi: 10.1016/S2213-8587(14)70121-4
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- Villar J, Giuliani F, Bhutta ZA, et al. Postnatal growth standards for preterm infants: the Preterm Postnatal Follow-up Study of the INTERGROWTH-21st Project. *The Lancet Global Health* 2015;3(11):e681-e91 doi: [http://dx.doi.org/10.1016/S2214-109X\(15\)00163-1](http://dx.doi.org/10.1016/S2214-109X(15)00163-1)

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Study	Intervention	No. of weeks
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100%



Family Health Bureau

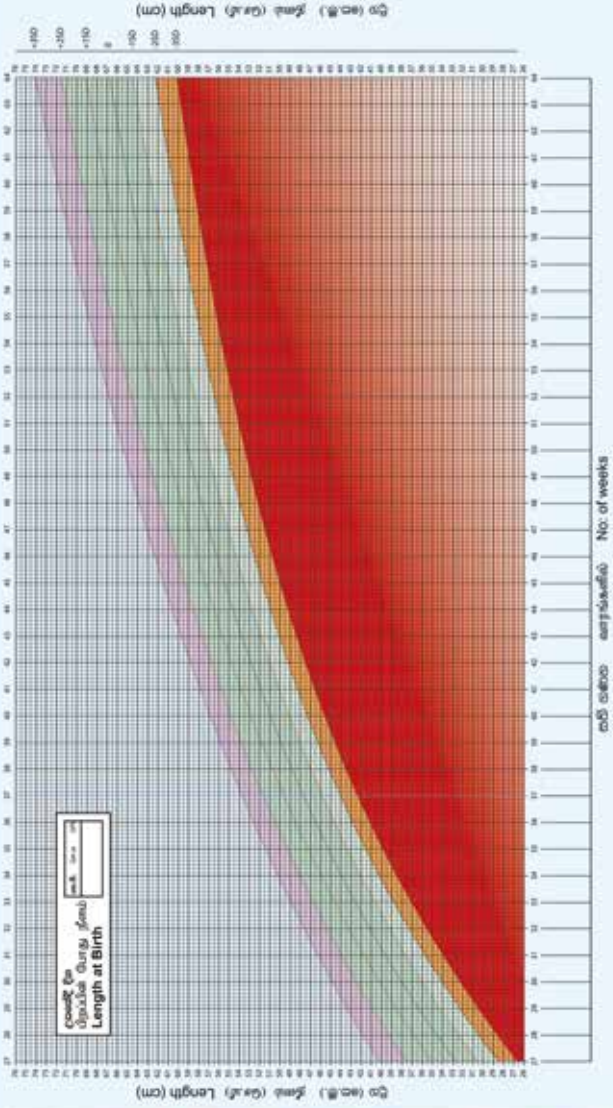

World Health Organization

University of Oxford



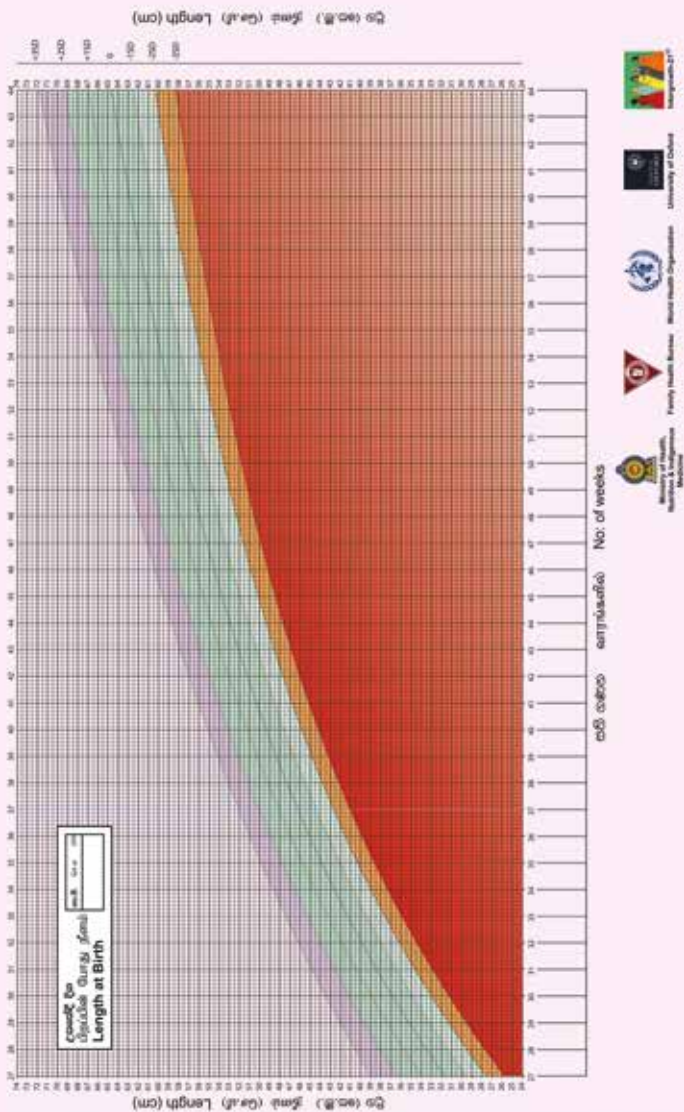
பூத வரலாறு தொடர்பான பல்வேறு தகவல்களைக் கிடைக்கப்பெறும் வகையில் இது ஒரு உதவியாக இருக்கக்கூடியதாகும். இது ஒரு உதவியாக இருக்கக்கூடியதாகும்.

Length for Age Chart for Pre Term Infants

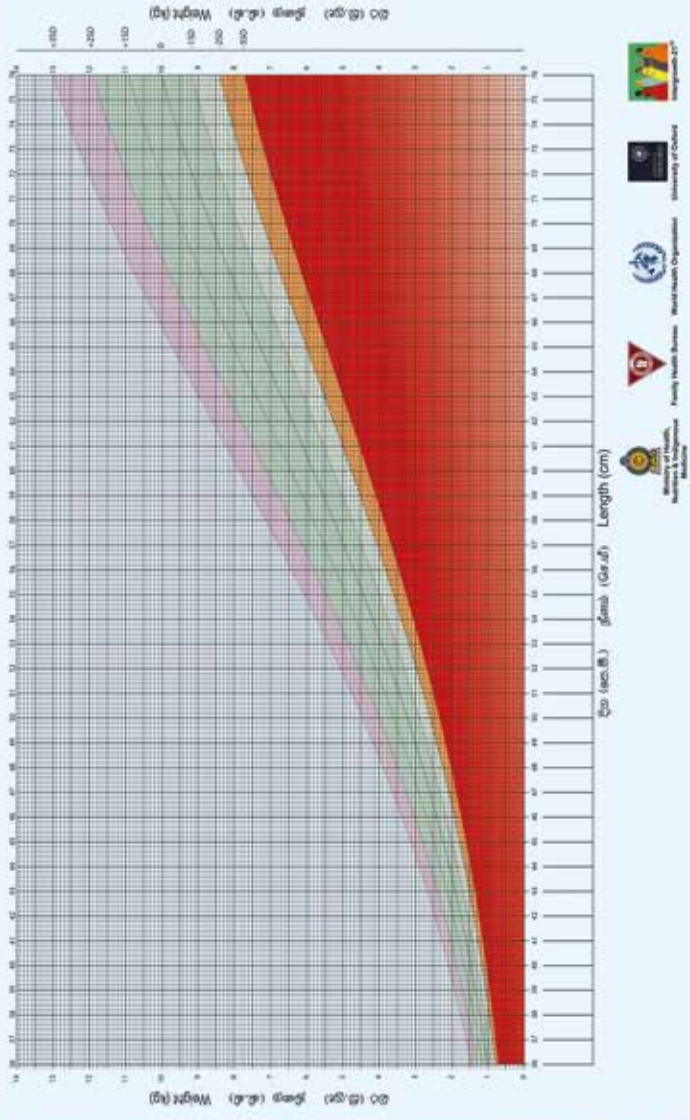


பித் பரணை லேட்டர்லுக் கட்டுவது எப்போது?

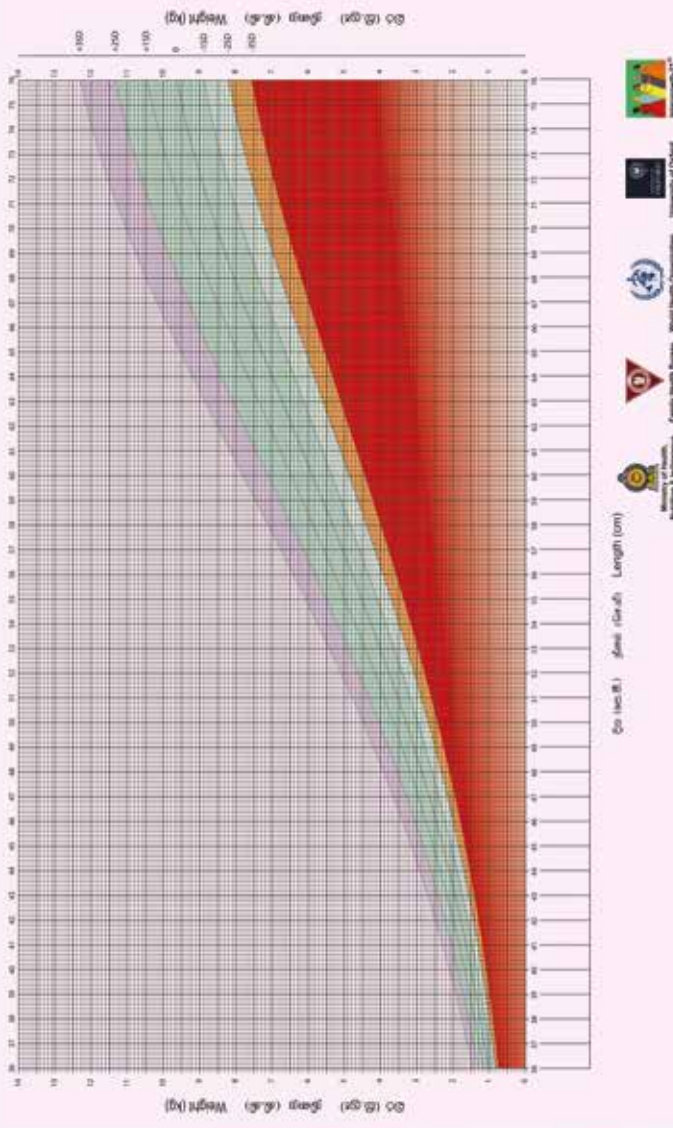
Length for Age Chart for Pre Term Infants



இந்த வரைபடம் 0-6 வயது குழந்தைகளின் எடையை அளவிடப் பயன்படும் வரைபடம். இது உலர்நிலை மற்றும் நரம்பு அமைப்பின் செயல்பாட்டை அளவிடப் பயன்படும் வரைபடம்.



புதிதான பிள்ளைகளுக்கு எடைய அளவு மற்றும் நீளம் அளவுகளைப் பற்றிய விவரம்
Weight for Length Chart for Pre Term Infants



இந்த வரலாறு பற்றிய செய்தி கிடைக்கவில்லை. இது ஒரு மிகவும் அரிதான நிகழ்வு. இது ஒரு மிகவும் அரிதான நிகழ்வு. இது ஒரு மிகவும் அரிதான நிகழ்வு.

