
UNIT 3 REFERRAL AND FOLLOW UP OF LOW BIRTH WEIGHT AND SICK NEONATE

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3.1 OBJECTIVES

After completing this unit, you should be able to:

- Describe an overview of the referral of low birth weight and sick neonate;
- Describe the transport of a low birth weight and sick neonate;
- Outline management procedure for low birth weight and sick neonate by referral unit;
- List the common clinical indications and requirements for neonatal transport;
- Discuss the management of low birth weight and sick neonates before and during transport.

3.2 INTRODUCTION

The neonatal period encompasses the highest incidence of mortality, if compared with any other period of individual's life span. The high risk infant once identified needs to be transported safely to next facility.

A great number of newborns at risk can be recognized before birth and can be delivered at institution with level II and tertiary level neonatal intensive care units but for various reasons this doesn't happen often. Perinatal period is the most hazardous one in which the neonate is vulnerable to rapid deterioration that can lead to irreversible damage. Transportation of the sick neonate from delivery room to NICU is of paramount importance because even the slightest delay in the required expert care would lead to permanent irreversible neurological deficit or death.

In India, 75 % of the total deliveries are conducted at home or small community hospitals or private nursing homes which do not have the personnels, expertise, space or facilities for adequate newborn critical care. About 30 % to 40 % of all births in India are low birth weight.

Out of this 8-10% are pre term and 20-30% are small for date. Therefore, transfer of these low birth weight and sick neonates to the regional health centre is frequently necessary. Satisfactory transport facilities are needed whether the neonate is being transferred from home or health facility to tertiary hospital or simply within the hospital from delivery room to NICU and from NICU to Operation Theater and X-ray department.

In this unit you will learn about the referral and management of transportation of low birth weight and sick neonates.

3.3 REFERRAL OF A NEONATE

Identify the babies who need referral

a) From community to SNCU

Any neonate who has

- Lethargy
- Refusal to feed
- Hypothermia
- Tachypnea, grunt, gasping, apnea
- Seizures
- Abdominal distension
- Bleeding
- Deep jaundice over palms and soles
- VLBW or premature should be transferred from community to the SNCU

b) From SNCU to tertiary centre

- Need of mechanical ventilation
- Unresponsive shock
- Jaundice needing exchange transfusion if facilities not available
- Refractory seizures
- Refractory hypoglycemia
- Need for surgical intervention

3.4 TRANSPORTATION OF LOW BIRTH WEIGHT AND SICK NEONATE

The ability to identify a neonate at risk in home or health facility and to provide effective transitional care will determine neonatal outcome. The referral hospital health facility stabilizes the neonate and then transports neonate to a level II or Level III hospital. The success of the transportation depends on the initial care given by the health personnel at referral centre.

Ensuring safe transport of the sick neonates is one of the important responsibility of neonatal nurse. If transportation is anticipated, it is much better to transport the baby as a fetus along with the mother before delivery. This in-utero transport is far easier than the transport of sick neonate after birth.

Constraints to the Safe Transport of Neonate are as following:

- Newborn beds are scarce and not easily available
- Families have poor resources and are not able to afford newborn care
- Organized transport services are not available. At times the baby may have to be transported on foot or on bullock cart
- No health provider is available to accompany the baby during transport
- Facilities are not fully geared up to manage sick neonates
- Communication systems are nonexistent or inefficient

Thus, transporting neonates in developing countries is a formidable challenge. In spite of the best planning, babies will develop serious problems requiring transport to a higher level of care. Care providers should , therefore, be ready and confident to handle this responsibility.

3.4.1 Indications for Neonatal Transport

Indications for transportation range from subtle signs of sepsis, temperature instability and occasional apnea to life threatening surgical emergencies e.g. tracheo esophageal fistula.

The success of transportation of a sick neonate depends on earlier identification, stabilization, referral and care during transport. The danger signs which should prompt the caregiver to refer the neonate to a health facility are lethargy, refusal to feed, hypothermia, tachypnea, grunt, gasping, apnea, seizures, abdominal distension, bleeding, deep icterus over palms and soles and VLBW and premature infants.

3.4.2 Requirements for Neonatal Transport

A well-organized transport system with basic life support equipments and a trained, skilled and dedicated team is utmost essential for having effective transitional care and optimal neonatal outcome.

Availability of an ambulance equipped with transport incubator and facilities for suction, bag and mask ventilation, equipments required to stabilize sick neonates along with physician and nurse are essential for safe transportation of an infant.

It is imperative that an inventory of all equipments and supplies should be maintained and inspected and replenished after each transport.

Equipments and supplies

Transport incubators, clothing, suction apparatus, resuscitation kit, oxygen source, pulse oximeter, infusion pump, blood glucose meter, I/V infusion set, syringes and needles (various sizes), adhesive tapes, gloves, torch, extra batteries, Endotracheal tube, nasal prongs.

Transport Isolette/ Portable Incubator / Transport Incubator

Transport incubator is ideal but is not affordable in developing countries. The transport incubator should be a completely self contained unit that provides clear visibility of the neonate, has adequate internal lighting, is easy to clean and provides the necessary heat to keep the infant warm.

The portable incubator provides an ideal micro-environment during transport. It is battery operated and has build in system for oxygen supply.

The transport incubator should be light in weight but sturdy and should allow sufficient access to manage a sick neonate.

Transport vehicles

The morbidity in the neonatal period requiring transport is related to the distance traveled and the duration of the time between the onset of illness and the transfer of the baby. These neonates deserve an appropriate transport facility for a safe transfer from place of birth to NICU.

The baby should be transported to the nearest facilities by fastest mode of transport by the shortest route, such as

- Cars
- Open jeeps
- Buses
- Rickshaws
- Ambulances

The ideal transport vehicle should provide adequate space, power sources and safety equipment to back life support system. Sufficient oxygen should be stored in each vehicle along with air tanks or compressors. Appropriate controls are essential especially when transporting small neonates.

**Take the neonate to the nearest referral facilities by the shortest route
using the fastest possible mode of transport**

Personnel

Resident doctor, nursing staff

Neonatal transport team

Registered nurse involved in primary health care services with basic knowledge of neonatal intensive care is a significant member of neonatal transport team. Other than this respiratory therapist with experience in neonatal ventilation and in rural areas, trained paramedics, local birth attendants, health care providers should be ready, competent and confident to handle the responsibility of neonatal transport.

Drugs and fluids

- Epinephrine
- Nalaxone

- Sodium bi carbonate
- Vitamin K
- Glucose (10% dextrose)
- Calcium gluconate

Scarce and inaccessible facilities, lack of organized transport system, non existent and poor road links and lack of organized communication system, ill equipped health facilities, poor resources of family, no care possible enroute are main constraints and pose a challenge to health care providers regarding neonatal transport in developing countries.

3.4.3 Preparation before Transport

You need to do following before transport of baby:

a) Assess :

Make careful assessment of the baby. Make sure that there is a genuine indication for referral.

b) Stabilize the neonate :

Stabilize with respect to temperature, airway, breathing, circulation and blood sugar.

c) Write a note :

Write a precise note for the providers at the referral facility with details of the baby's condition, reasons for referral and treatment given to the baby.

Referral note

- Name of the neonate
- Sex
- Gestational age
- Date and time of birth
- Birth weight
- Referral diagnosis
- Temperature, pulse, respiration
- Antibiotics
- Injection : Vitamin K
- Maternal Age
- LMP
- EDD
- Gravida and Para
- Prenatal care: Booked/Unbooked
- Maternal Diagnosis/ Risk factors

- Date and time of rupture of membranes
- Color
- Nature of delivery
- Health status of neonate
- Indications for referral
- Interventions carried out

d) Encourage mother to accompany

Mother should accompany the baby for breast feeding and for providing supportive care to the baby on the way and in the hospital. In case she cannot accompany the baby immediately, she should be encouraged to reach the facility at the earliest.

Arrange a provider to accompany.

A doctor/nurse/health worker should accompany the baby, if feasible, to provide care to the baby en route and to facilitate transfer to the referral facility.

Explain the condition of the baby, the prognosis and the reasons for transfer to the family. Explain where to go and whom to contact. This allays the anxiety of the parents and other family members. Prior information to the referral facility helps to build the confidence and removes the fears of unknown, thus positively motivating the family for transport. The referral facility should be given time to receive the baby and can be intimated for bed and time of referral.

Let us explain how you can stabilize the neonate before transportation:

1) Maintain temperature

For baby who is cold to touch both centrally and peripherally or temperature is less than 35.5 deg C, temperature to be maintained as the infant is hypothermic.

Grading of hypothermia

Normal temperature : 36.5 to 37.5°C

Cold stress : 36.4 to 36.0°C

Moderate hypothermia : 35.9 to 32°C

Severe hypothermia : < 32°C

Management of hypothermia

- Record the actual body temperature
- Re-warm a hypothermic baby as quickly as possible
 - o Severe hypothermia – Radiant warmer
 - o Mild to Moderate hypothermia –Kangaroo Mother Care or Radiant Warmer

Infection should be suspected, if despite taking above measures hypothermia still persists.

Management of Severe Hypothermia

- 1) Keep under radiant warmer

- 2) Reduce further heat loss
- 3) Infuse IV 10% Dextrose @ 60ml/Kg/Day
- 4) Inject Vitamin K 1.0 mg Intramuscular
- 5) Provide Oxygen
- 6) Consider and assess for sepsis

Use one of the following approaches to keep the baby warm during transportation:

- **Skin to skin care**

This is probably the most effective, safe and convenient method. Make baby wear cap and napkin. Baby is placed facing the mother in skin to skin contact between breasts. Baby's back is covered by tying the blouse or with a fold of gown/ chunari. The skin to skin contact can also be provided by another woman/man/father.

- **Cover the baby**

Cover the baby fully with clothes including the head and the limbs. Nurse the baby next to the mother or another adult during transport.

- **Improvised containers**

Thermocol box, basket, padded pouch, polythene covering can be used for ensuring temperature stability during transport. If available, you may use one of these methods.

- **Transport incubator**

This is ideal mode of transport, but is often not available.

The use of rubber hot water bottle is fraught with considerable danger due to accidental burns to the baby i.e., if the bottle is not wrapped properly or remains in contact with the baby's body. It is therefore best avoided. If no other means of providing warmth is available, method may be employed but with utmost caution. The accompanying members of the team should be explained about the care of the bottle.

Whatever method of keeping the baby warm is employed, make sure that the baby's feet are warm to touch. Warm feet means that the baby is not in cold stress. If the baby passes urine or stool, dry promptly. He should not remain wet, otherwise he will lose heat.

Prevent Hypothermia

- **Warm chain**

Baby must be kept warm at all times right from birth. The warm chain is a set of ten interlinked procedures carried out at birth and later as per the following:

- 1) Warm delivery room (>25°C)
- 2) Warm resuscitation
- 3) Immediate drying

- 4) Skin-to-skin contact between baby and the mother
- 5) Breastfeeding
- 6) Bathing and weighing postponed
- 7) Appropriate clothing and bedding
- 8) Mother and baby together
- 9) Warm transportation
- 10) Training/awareness-raising of healthcare provider

- **Check breathing**

Watch baby's breathing. If the baby stops breathing, provide tactile stimulation to the soles to restore breathing.

- **Provide feeds**

Breast-feed if baby is active.

Provider not accompanying the baby

In the event of health care provider not accompanying the transported neonate, it is in the best interest of the baby that there are not running intravenous fluids on the way, orogastric and nasogastric feeds are avoided and hot water bags are not used. These need supervision by a health care provider.

- **Family support**

One of the most important and often very difficult aspect of transport is the need for emotional support of the parents and family. Hospitalization and the need for transport of a newborn can precipitate a crisis of the entire family. Accepting emotional outbursts calmly and reassuring the parent that their child is being cared for can reduce parental anxiety. The common influencing factor is socio-economic status/poor education/traditions and lack of support system.

Interventions to reduce stress and support the grief response must be incorporated into the transport process by the following:

- Allow parents to see and touch their child prior to transport
 - Thorough explanation ought to be given of the clinical problems and anticipated transport care
 - Information about the receiving hospital including location, visiting policies and general NICU facts must be given
 - Consider maternal transport whenever possible
 - Consider a phone call to the parents shortly after the admission of the child
 - Neonatal stabilization before transportation of sick neonate
- Optimal neonatal stabilization requires skills in airway management including laryngoscopy, tracheal intubation and suctioning of the airway, oxygen administration and monitoring, assisted ventilation, chest compression, emergency administration of drugs and fluid and maintenance of thermal stability. **Efficient pre transport stabilization** is associated with decreased transport related mortality and improved outcome of transported neonates. Pre-transport stabilization includes the following:

- Assessment of neonate's condition before transport for hypothermia, apnea and hypoglycemia. Hypothermia, hypovolemia, hypoglycemia, acidosis and seizures should be treated before referring.
- The neonate should be as stable as possible before leaving the referral hospital.
- Intubate the neonate with the history of frequent apneic spells or severe RDS before referring.

A mnemonic **STABLE** expresses the principle of safe transport of sick neonate as follows:

S- Sugar

T- Temperature

A- Airway

B- Blood Pressure

L- Lab work

E- Emotional Support

- **Temperature stabilization and regulation**

Hypothermia has emerged as a major cause of morbidity and mortality especially in preterm babies during the transit. The most basic intervention that will reduce the transported neonate's mortality and morbidity is to prevent cold stress. A neonate that has cold stress has increased oxygen consumption and increased rate of glucose consumption, leading to metabolic acidosis. Providing a neutral thermal environment during transportation is one of the biggest challenge.

Maintenance of adequate temperature during transportation to prevent further morbidity can be achieved by the following measures:

- Adequate clothing with special attention to head, feet and palms
- Air tight transport vehicle
- Skin to skin touch during transport
- Transport incubator
- Use of radiant warmer at referral hospital if it is available

The short distance transport within the hospital can be accomplished in a pre-warmed incubator.

Since electronic incubators are expensive and require constant maintenance, various other indigenous ways for transportation in rural setting/community setting can be carried out by using a plastic basket with perforated sides and careful placement of hot water bottles. Other methods include the following:

- **Skin to skin contact (KMC)**

Neonate covered with **several layers of cotton** and carried next to skin.

- **Thermocol box**

Thermocol box is an improvised method of ensuring warmth to a newborn.

- **Silver swaddle**

Prewarm the transport incubator to the infant's thermal environment. Very low birth weight infant should be covered with bubble paper in the transport.

Caution must be observed when using hot water bottle for providing warmth since this source of heat can cause burns. The hot water bottle should be well covered to control the degree of heat to which the neonate's skin is exposed

At present Indian scenario reveals that neonates are usually brought to the emergency wrapped in cotton, blanket and quilt or just in towel without any external source to provide warmth. Very rarely kangaroo care is provided to keep the neonate warm during transportation

- Encourage mother to accompany.
- If possible, let care provider accompany the baby.
- Ensure warmth on the way.
- Explain care on the way to the family (keep baby's trunk and palms/sole warm to touch, keep airway open, provide physical stimulation if apenic).

2) Maintaining Airway

Maintaining patent airway is vital to ensure adequate oxygenation and ventilation. This can be achieved by proper positioning, oropharyngeal and nasal suction.

3) Maintain oxygenation/ ventilation

To maintain adequate oxygenation is of immense importance in the sick neonates during transport as quiet often the indication for transfer is respiratory distress. This can be ensured by:

- Free flow oxygen
- Oxygen by hood/nasal prong
- Bag and mask ventilation
- Endotracheal tube and manual ventilation
- Transport ventilator
- **Ensure an open airway**
 - Keep the neck of the baby in slight extension.
 - Do not cover the baby's mouth and nose.
 - Suction mouth and nose if necessary.
- **Check breathing**

Watch baby's breathing. If the baby stops breathing, provide tactile stimulation to the soles to restore breathing.

4) Provide feeds and fluids

Breast feed if baby is active.

Expression of Breast Milk

Breast milk expression is required for optimal feeding of newborns for preterm, LBW and sick newborns that cannot breastfeed but can tolerate assisted feeding.

Teach the mother the following:

- ✓ Wash hands with soap and water before expression. Hold, handle or cuddle the baby.
- ✓ Sit comfortably and hold the clean container near the breast.
- ✓ Put thumb and index finger on the breast at the rim of the areola opposite each other. Support the breast with other three fingers.
- ✓ Press thumb and index finger slightly inwards towards the chest wall.
- ✓ Press the breast between the fore-finger and thumb. Press and release, press and release. This should not hurt.
- ✓ Press the areola in the same way from the sides, this ensures that milk is expressed from all segments of the breast.
- ✓ Avoid rubbing or sliding fingers along the skin.
- ✓ Express one breast for at least 3-5 minutes until the flow slows; then express the other side; and then repeat on both sides.
- ✓ To express breast milk adequately, it may take 20-30 minutes.

Refer **Fig. 3.1** for expression of breast milk.

Storing expressed breast milk (EBM) can be done as per following:

- ✓ Cover the container of EBM with a clean cloth or a lid.
- ✓ EBM can be kept at room temperature for 8 hours and in the refrigerator for 24 hours.
- ✓ EBM stays in good condition longer than animal milk. Do not boil the EBM. For warming, place the container in a bowl of warm water.
- ✓ Before feeding, gently shake the container or use a stirrer to recombine the separated fat globules with the rest of the milk
- ✓ Feed with cup or spoon or paladai, never feed with bottle.

Assisted Feeding of Low Birth Weight Neonates

Newborns that require assisted feeding are as follows:

- Preterm < 34 weeks or birth weight < 1.8 kg
- Babies having mild respiratory distress
- Babies with inability to feed at breast or by Katori spoon / Paladai
- Oro-facial defects/malformation (Cleft lip or palate)



Table 3.1: Guidelines for the modes of providing fluids and feeding

Birth weight (gm)	<1200	1200-1800	>1800
Gestation (wks)	<30	30-34	>34
Initial feeding	Intravenous fluids and try gavage feeds if not sick	Gavage, try katori-spoon if not sick	Breast feeding, if Unsatisfactory ,try katori-spoon feeds
After 1-3 days	Gavage	Katori-spoon	Breastfeeding
Later (1-3 wks)	Katori-spoon	Breastfeeding	Breastfeeding
After some more time (4-6 wks)	Breastfeeding	Breastfeeding	Breastfeeding

Mode for providing fluids and feeds (Table 3.1)

Breast milk is the ideal feed for low birth weight babies.

Those unable to feed directly on the breast can be fed expressed breast milk (EBM) by Gavage or Katori-spoon or Paladai.

Techniques of assisted feeding

Gavage feeds

- Place an oro-gastric feeding catheter of size 5-6 Fr after measuring the correct insertion length from ala of nose to tragus and from tragus to midway between xiphisternum and umbilicus.
- Check correct placement by pushing in air with 10 ml syringe and listening with stethoscope over upper abdomen.
- Attach 10 ml syringe (without plunger) at the outer end of the tube, pour measured amount of milk and allow milk to trickle by gravity. Close outer end of tube after feeding.
- Place baby in left lateral position for 15 to 20 minutes to avoid regurgitation.
- Leave oro-gastric tube in situ.
- Pinch the oro-gastric tube during withdrawal.
- Measure pre-feed abdominal girth just above the umbilical stump. Do not attempt pre-feed aspirates.
- Evaluate baby for the cause of ileus, if abdominal girth increases by > 2 cm from baseline, it represents ileus.

Katori-spoon feeds

- Place the baby in a semi-upright posture.
- Take the pre-measured amount of milk in katori.
- Place the layer of cloth around the neck covering the chest.
- Place the milk filled spoon at the corner of mouth.
- Allow milk to flow into baby's mouth slowly, allowing him to actively swallow, avoiding the spill.
- Repeat process till required amount has been fed.
- Try gentle stimulation if baby does not actively accept and swallow the feed.
- Estimate the amount of spillage of milk.
- Record the exact amount of milk given to baby after subtracting the spillage.
- If unsuccessful, switch back to gavage feeds.

Intravenous Fluid Therapy for Newborns

Criteria for starting Intravenous fluids among newborns

- Neonates with lethargy and refusal to feed
- Moderate to severe breathing difficulty
- Babies with shock
- Babies with severe asphyxia
- Abdominal distension with bilious or blood stained vomiting

Choice of Intravenous fluids

- Determine required volume of fluid as per birth weight and age. (**Table 3.2**).
- Use 10% Dextrose for initial 48 hours of life.
- After 48 hrs, if baby is passing urine, use commercially available IV fluid, such as Isolyte P.
- If the premixed solution is not available or baby requires higher GIR (Glucose infusion rate):
 - Take normal saline (NS) 20 ml/kg body weight.
 - Add remaining fluid volume as 10% Dextrose.
 - Add 1ml KCl/100ml of prepared fluid.

Administration of IV fluid

- Use micro-drip infusion set (where 1 ml = 60 microdrops)
- In this device, mL of fluid per hour is equal to number of micro-drops per minute e.g. 6mL/hr = 6 micro-drops/minute
- Calculate rate of administration, monitor to ensure that micro-dropper delivers required rate.
- Change the IV infusion set and fluid bag every 24 hours.
- Before infusing IV fluid, carefully Check:
 - 1) Expiry date of the fluid
 - 2) Seal of the infusion bottle or bag
 - 3) Fluid is clear and free from any visible particles

Monitoring of babies receiving IV fluid

- Inspect infusion site every hour for redness and swelling.
- If present, stop infusion, remove cannula, and establish a new IV line in a different vein.
- Check the volume of fluid infused, compare to the prescribed volume and record all findings.
- Measure blood glucose every nursing shift i.e. 6 – 8 hours.
- If the **blood glucose is less than 45 mg/dl**, treat for low blood glucose.
- If the **blood glucose is more than 150 mg/dl** on two consecutive readings:
 - Change to 5% Dextrose solution - measure blood glucose again in three hours.
- Weigh the baby daily. If the **daily weight loss is more than 5%**, increase the total volume of fluid by 10 ml/kg body weight for one day.
- If there is no weight loss in the initial 3 days of life, do not give the daily increment.
- If there is excessive weight gain (3-5%) decrease the fluid intake by 15-20 ml/kg/day.
- Check urine output: Normally a baby passes urine 5 – 6 times everyday.

Table 3.2: Fluid requirements of newborns

Day of life	Amount of fluids required (ml/kg/day)	
	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
Day- 7 onwards	150	150

5) Maintain adequate circulation

Sick neonates are prone to develop peripheral circulatory failure and myocardial dysfunction.

Ensuring adequate perfusion prior to transport and on arrival at referral hospital is critical to survival of sick newborn babies. Inadequate perfusion will result in tissue hypoxemia and acidosis. If perfusion is not reversed in time, it will eventually result in organ dysfunction and/or cell death. Early recognition of poor perfusion is essential to initiate appropriate treatment.

Clinical recognition of poor perfusion is easy. It is possible at all levels of human care.

The simplest indicator of poor perfusion is a prolonged capillary refill time. Normally it should be less than 3 seconds. Other useful indicators include mottling of the skin, cool peripheral extremities, pallor and tachycardia (heart rate >180bpm). Decreased urine output, recorded by history or by measurements of urine output (such as at the district level or higher facility) would also indicate impaired perfusion. It is important to remember that blood pressure measurement and demonstrating hypothermia is not essential to the diagnosis of shock or poor perfusion.

Attention to additional clinical findings can provide clues to the etiology. Some of these include: distant heart sounds (as in pneumothorax or pneumomediastinum), heart sounds better heard on the right hemithorax (as in diaphragmatic hernia), absent femoral pulses (as in coarctation of aorta) and asymmetrical decrease in breath sounds (as in pneumothorax or pleural effusion).

At home look for cool extremities, pallor and decreased urine output. At health facility look for prolonged capillary refill time, mottling of the skin, cool extremities, pallor, tachycardia, decreased urine output, heart sounds, peripheral pulses and breath sounds.

Maintenance of adequate circulation can be achieved by securing an IV access and IV infusion with a syringe.

6) Management of Hypoglycemia:

Hypoglycemia in newborns is defined as blood glucose levels less than 45 mg/dl.

- Establish an IV line. Infuse a bolus of 2 ml/kg body weight of 10% glucose slowly over 5 minutes.
- If baby has convulsions, give bolus of 4 – 5 ml/kg of 10% glucose.
- If IV line is not present, administer 2 ml/kg body weight of 10% glucose by gastric tube.
- Start infusion of dextrose at the daily maintenance volume to provide at the rate of 6 mg/kg/min.
- Measure blood glucose after 30 minutes and then every four to six hours.
- If blood glucose <25 mg/dl:
 - Repeat bolus of glucose as above.
 - Increase to infusion rate of 8 mg/kg/ min.
- If the blood glucose > 25 mg/dl but <45 mg/dl:
 - Increase infusion rate by 2 mg/kg/min.
 - Measure blood glucose after 30 mts.
 - Continue the infusion at this rate until 2 consecutive values 6 hrs apart are above 45 mg/dl.
 - Begin breastfeeding as soon as baby is able to breastfeed.
 - If cannot be breastfed, give EBM by Spoon or paladai.
 - As feeding improves, slowly decrease (over 1-2 days) IV glucose and increase oral feeds.
- Do not discontinue the glucose infusion abruptly to prevent rebound hypoglycemia.

Refer **Table 3.3** for glucose infusion rates of D10 & D25.

Table 3.3: Achieving Appropriate glucose infusion rates using a mixture of D10 and D25

Volume required (ml/kg/d)	Volume of fluids(ml/kg/d)								
	Glucose Infusion Rate								
	6 mg/kg/min			8 mg/kg/min			10 mg/kg/min		
	D10	D25	NS	D10	D25	NS	D10	D25	NS
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	88	12	20	70	30	20
135	86	-	20	115	-	20	80	25	20
150	86	-	20	115	-	20	120	10	20

e) **Preparing a neonate with surgical defects for neonatal transport**

Surgical defects may be classified into open defects and closed defects/obstructions. Open defects are easily diagnosed and are quickly apparent where in the neonate will be transferred to another institution for further care. The principles of stabilizing open defects include:

- ✓ Covering the defects to protect it from trauma, heat loss and insensible fluid loss
- ✓ Providing orogastric suctioning for decompression
- ✓ Securing IV access

Suspicion of a closed defect or obstruction requires closed physical examination and observation.

Recognition of gastrointestinal pathology is the first step in preparing a neonate for transfer. For example, the newborns that are diagnosed with tracheo-esophageal fistula are at risk of aspiration of gastric content into the trachea. They require placement of suction catheter in the proximal pouch and use of continuous suction. Suction by hand from time to time. Immediate intubation is not necessary unless the newborn is in significant respiratory distress.

f) **Documentation/communication**

Reliable communication is the key to effective transport system. It is essential that the referring physician provides the referral institution with relevant information about the condition/health status of the neonate and the indication for transfer so that unit can be prepared to receive and provide immediate care without delay.

3.4.4 Care during Transportation/Enroute Management of Sick Neonate

The basic needs for the sick neonate during transportation are mentioned as follow:

- Thermoregulation
- Maintaining patent airway and respiration
- Maintaining adequate circulation
- Maintaining adequate metabolic homeostasis and adequate nutrition
- Medication

En route management requires close monitoring of the baby to prevent or treat complications as they may arise. Heart rate, respiration and temperature are continuously monitored. The respiratory status of a neonate is evaluated by observing his color, the quality of his respiration and the presence of retractions/chest indrawing because it is nearly impossible to evaluate breath sounds with a stethoscope in a moving ambulance. Oxygen, whether given by hood or mask is continuously analyzed and adjusted as the neonates condition dictates. The IV line is attached to the infusion pump to keep the line patent and to prevent accidental fluid overload. The baby is transported in the plastic swaddler; the port holes are opened as little as necessary during the trip in order to maintain the infant's temperature. Accurate recording of vital parameters, medications, treatment given, procedures performed and observations made during the transport

is necessary for the legal chart and is invaluable to those who will have ultimate responsibility for the newborn care.

Any problem that has occurred during the transport should be noted before it is forbidden. This includes any breakdown in communication between the hospitals, malfunctions of the transporter or inadequate emergency care given at the referring hospital.

Arrival at referral centre

Upon arrival at the NICU, the baby is attached to another set of monitoring devices, vital signs are checked, laboratory investigations are carried out and if necessary, treatment is given. When the neonatologist/nurse is satisfied, that the infant is stabilized, she calls the mother to allay her fear about the transfer and to give a progress report on the babies condition. The transport incubator is cleaned and kept ready for the next call and the medical and respiratory resuscitation kits are immediately restocked.

3.4.5 Return Transport

The return transport i.e. transfer of the convalescing neonate from hospital to the referring unit after resolution of the acute illness and before home discharge has been shown to improve the efficiency of neonatal bed in NICU. Other potential advantages of return transport includes a greater opportunity for parental visits with its beneficial effects on parent-infant attachment, an early involvement of the continuing care, health care personnel and substantial cost savings. The follow-up evaluation of the neonates includes neuro developmental assessment, ophthalmic examination, speech and hearing evaluation and pulmonary function testing at designated times throughout childhood.

Care during transport includes ensuring warmth by skin to skin care, adequately well wrapped baby, improvised transport containers, carriers, an open airway, checking breathing and stimulating the baby if apneic and providing feeds if baby is active.

3.5 FOLLOW UP

In case of these babies, when they are discharged from the hospital, responsibility of their care lies on to mother and family members. Health care personnel should inform them that extra care is required to maintain their body temperature. Baby should be provided with skin to skin contact (KMC). If this is not possible, the baby should be nursed next to the mother, as mother herself is a good source of heat to the baby. Further the room where the baby is kept should be warm. The baby should be clothed well. Two to three layers of clothes are generally required. 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 addition, mother and family must be provided counseling for care at home. They should be informed about:

- Exclusive breast milk to the baby for 6 months
- How to keep the baby warm at home
- Identifying 'Danger Signs' for seeking medical help.

Check Your Progress 1

1) List down types of hypothermia

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2) Describe the management of neonate with hypoglycemia

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3) Enlist the important points while transferring newborn with tracheo-
esophageal fistula

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3.6 LET US SUM UP

Neonate needs to be referred to a right place in right time with right management. The effectiveness of neonatal transport in lowering infant mortality depends on the efficiency of care by health team before and during transport. Communication and teamwork are the keynotes to a successful transport system. This requires a team not only trained in transport details but also to give emergency care to stabilize the infant prior to transport.

Transportation of neonates is a specialized task. Establishing an efficient and cost effective transport system is essential. A safe and effective means of transportation must be established.

Follow up of the neonate is as important as its management in the hospital. So adequate and clear discharge advices needs to be given to the mother and family to follow.

3.7 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) Cold Stress: 36.4 to 36.0° C, Moderate Hypothermia: 35.9 to 32.0°C , Severe Hypothermia: < 32.0°C.
- 2) Management of Hypoglycemia:
 - Establish an IV line. Infuse a bolus of 2 ml/kg body weight of 10% glucose slowly over 5 minutes.
 - If baby has convulsions, give bolus of 4 – 5 ml/kg of 10% glucose.
 - If IV line is not present, administer 2 ml/kg body weight of 10% glucose by gastric tube.
 - Start infusion of dextrose at the daily maintenance volume to provide at the rate of 6 mg/kg/min.
 - Measure blood glucose after 30 minutes and then every four to six hours.
 - If blood glucose <25 mg/dl:
 - Repeat bolus of glucose as above
 - Increase to infusion rate of 8 mg/kg/ min.
 - If the blood glucose > 25 mg/dl but <45 mg/dl:
 - Increase infusion rate by 2 mg/kg/min
 - Measure blood glucose after 30 mts.
 - Continue the infusion at this rate until 2 consecutive values 6 hrs apart are above 45 mg/dl.
 - Begin breastfeeding as soon as baby is able to breastfeed.
 - If cannot be breastfed, give EBM by Spoon or paladai.
 - As feeding improves, slowly decrease (over 1-2 days) IV glucose and increase oral feeds.
 - Do not discontinue the glucose infusion abruptly to prevent rebound hypoglycemia.
- 3) Recognition of gastrointestinal pathology is the first step in preparing a neonate for transfer. For example, the newborns that are diagnosed with tracheo-esophageal fistula are at risk of aspiration of gastric content into the trachea. They require placement of suction catheter in the proximal pouch and use of continuous suction. Suction by hand from time to time. Immediate intubation is not necessary unless the newborn is in significant respiratory distress.