TECHNIQUES IN NEWBORN AND INFANT CARE

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Neonatal and Infant survival depends on the skilled care. As one of the key health professionals you have to remain updated with new treatment modalities and advances in the care of newborn and infant. So, you need to improve your skills and knowledge by ongoing training programme. This practical manual will review your knowledge and help you to perform various procedures skillfully.

The block comprises ten practicals as:

**Block 1: Techniques in Newborn and Infant care:**

- Practicals 1 : Resuscitation of Newborn
- Practicals 2 : Care of Normal Newborn
- Practicals 3 : Assessment of Newborn
- Practicals 4 : Feeding in Newborn and Infants
- Practicals 5 : Administration of Medications and Intravenous Fluids
- Practicals 6 : Oxygen Therapy
- Practicals 7 : Monitoring of Sick Neonate
- Practicals 8 : Neonatal Procedures
- Practicals 9 : Neonatal Equipments
- Practicals 10 : Disinfection and Housekeeping
PRACTICAL 1 RESUSCITATION OF NEWBORN

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1.5 Activity and Guidelines
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1.0 OBJECTIVES

After completing this practical, you should be able to:

- Identify neonates who need resuscitation after birth;
- Prepare the equipments and environment for procedure;
- List the steps of resuscitation;
- Perform the steps of resuscitation procedure correctly and effectively;
- Demonstrate use of bag and mask ventilation on the manikin;
- Perform chest compressions; and
- Record appropriate information about resuscitation procedure.

1.1 INTRODUCTION

This unit discusses the resuscitation of newborn. This practical session will help you to learn how newborns should be resuscitated.

Oxygen is important for every part of the human body. Without oxygen the cells that make up our organs, brain and other body parts will die. During pregnancy baby receives oxygen from his/her mother through the placenta. After the baby is born, the baby starts to use his own lungs to get the oxygen he needs. For most babies this change happens without any problem, but some babies need help to start or continue breathing. The skill of newborn resuscitation gives that help.

The vast majority of newborn babies require no resuscitation except maintenance of temperature and cleaning of airways. However, about 5 – 10 % of newborns require some assistance to begin breathing at birth; about 1% need extensive
resuscitation to survive. In India, out of 26 million babies born annually, about 20-25 per cent of neonatal deaths occur as a result of birth asphyxia. The main reason for birth asphyxia and other associated problems is poor management during and immediately after child birth. You being crucial health care provider can contribute significantly in promotion of newborn’s health if you have adequate knowledge and skill in neonatal resuscitation. Hence, this practical will acquaint you with various skills needed to perform Neonatal Resuscitation with competency.

1.2 RESUSCITATION, DEFINITION AND INDICATIONS

**Definition** - Resuscitation involves series of steps taken to ensure the stabilization of newborn to life outside the uterus.

You have already studied resuscitation in your theory course.

Let us review the indications and purposes of neonatal resuscitation.

### 1.2.1 Indication and Purposes

Conditions predisposing babies to asphyxia and needing resuscitation are given below:

**Mother:** pregnancy induced hypertension, bleeding (placenta previa), prolonged or obstructed labour, fever in labour, post-term pregnancy.

**Umbilical cord:** cord around the baby’s neck, short cord, knot in the cord, prolapsed cord etc.

**During or after birth:** premature baby (before 37 weeks pregnancy), difficult delivery (breech, multiple birth, forceps etc.), congenital or genetic anomalies, meconium in the amniotic fluid, baby has too much fluid in its mouth and throat, emergency LSCS, prolonged labour >24 hrs.

**Purposes of Neonatal Resuscitation**

Purposes of neonatal resuscitation are to:

- Prevent heat loss
- Clear airways by suction
- Establish effective circulation
- Stabilize the newborn and avoid complications e.g. brain damage etc.

### 1.2.2 Preparation for Newborn Resuscitation

When a newborn needs resuscitation you must start resuscitation at right time and in right way. If things are not prepared properly or if there are delays, it may not be successful. Preparation for newborn resuscitation includes – personnel, equipments and environment.

**Personnel** – preparation for resuscitation requires having skilled persons for performing resuscitation. A team of 3 or more persons with designated role and preferably a separate team should be present for each newborn. Each team should have a leader and team members.
**Equipments** – a complete set of resuscitation equipment should be available in fully operational condition at the delivery site. The equipments should be checked for functioning in each shift.

**Essential resuscitation equipments are discussed below:**

**Suction equipment**
- De lee trap
- Mechanical suction
- Suction catheters, No. 12F, 14 F (oral suction); 5 or 6 F for pre-term and 8F for term baby for E.T. suction
- Feeding tube 6F and 20-ml syringe

**Bag and mask equipment**
- Neonatal resuscitation bag (250-750 ml) with oxygen reservoir
- Face masks, term (1) and pre-term (0) sizes
- Oxygen with flowmeter and tubing

**Intubation equipment**
- Laryngoscope with straight blades, No. 1 (term), No. 0 (preterm) and 00 for extremely pre-term baby
- Extra bulbs and batteries for laryngoscope
- Endotracheal tubes: 2.5, 3.0, 3.5, 4.0 mm internal diameter
- Endotracheal tube stylet (optional)

**Medications**
- Epinephrine
- Normal saline and Ringer’s Lactate
- Sterile water

**Miscellaneous**
- Watch with seconds hand
- Warm linen, shoulder roll
- Radiant warmer
- Stethoscope
- Adhesive tape
- Syringes 1, 2, 10, 20, 50 ml
- Gauze pieces
- Umbilical catheters 3.5 F, 5F
- Three-way stopcock
- Sterile gloves
1.3 STEPS OF RESUSCITATION PROCEDURE

The steps involved in neonatal resuscitation have been described in depth in Figure 1.1. Approximately 60 seconds (the golden minute) are allotted for completing the initial steps, re-evaluating the condition of the newborn and beginning ventilation and chest compression if required. The decision to progress beyond the initial steps is determined by simultaneous assessment of 2 vital characteristics: respirations (apnea, gasping, or labored or unlabored breathing) and heart rate (whether greater than or less than 100 beats per minute). Assessment of heart rate should be done by intermittently auscultating the precordial pulse. Palpation of the umbilical pulse at stump can provide a rapid estimate of the pulse and is more accurate than palpation at other sites.

A pulse oximeter at the time of delivery can provide continuous assessment of the pulse without interruption of other resuscitation measures, but the device takes 1 to 2 minutes to apply, and it may not function during states of very poor cardiac output or perfusion. Once positive pressure ventilation or supplementary oxygen administration is begun, assessment should consist of simultaneous evaluation of 3 vital characteristics: heart rate, respirations, and the state of oxygenation, the latter optimally determined by a pulse oximeter. The most sensitive indicator of a successful response to each step is an increase in heart rate.

Also keep in mind:

Environment: prevention of heat loss is important for the newborn. Cold stress can increase oxygen consumption and impede effective resuscitation.

Warmth: keeping a newborn baby warm saves the baby’s energy for breathing.

The ways to keep the baby warm:

- **Room**: keep room warm (at least 25°C).
- **Dry the baby**: dry immediately after birth with clean dry sheet and cover newborn by warm dry sheet.

1.3.1 Routine Care

Nearly 90% of newborns are vigorous term babies with no risk factors and clear amniotic fluid. These babies do not need to be separated from their mothers for initial steps of drying and covering with dry linen etc. Warmth is maintained by direct skin to skin contact. Clearing of the airway can be done by wiping the baby’s nose and mouth with sterile cloth. Follow the following steps:

- Note the time of birth
- Receive baby in dry warm linen
- Is baby breathing or crying?

“YES” or “NO”
If the answer is ‘YES’ follow routine care. The steps of routine care include:

- Dry the baby on mother’s abdomen
- Provide warmth by skin to skin contact
- Cut cord in 1-2 minutes
- Evaluate respiration and heart rate

![Resuscitation Flow Diagram (NRP-India)](image)
If the answer is “NO” to the asked question, begin initial steps of resuscitation. (refer to Fig. 1.1 & 1.2)

- Cut cord immediately
- Place under radiant warmer and provide initial steps (dry, position, clear airway and tactile stimulus)

**Fig. 1.2: Routine Care and Initial Steps**

### 1.3.2 Initial Steps

For the baby who needs initial steps of resuscitation, the cord of the baby should be cut without delay and baby should be placed under the radiant warmer. In all the deliveries the warmer should be pre-warmed for at least 20 minutes in manual mode (Fig. 1.3).

**Fig. 1.3: Placing the baby under radiant warmer**
Dry

The baby should be immediately dried with dry, pre-warmed towel.

Position

The baby should be positioned on the back with the neck slightly extended in the “sniffing position.” The goal is to move the nose of the baby as far as anterior as possible. Care should be taken to prevent hyper-extension or flexion of the neck, since either may restrict air entry. To attain a correct posture, a rolled piece of cloth/gauze piece (shoulder roll) may be placed under the shoulder of the baby (Figure 1.4 & 1.5).

This is particularly useful when there is a large occiput (back of head) resulting from moulding or edema.

An appropriate position as described facilitates an un-restricted air entry, by bringing the posterior pharynx, larynx and trachea in line. This alignment in the supine position is also the best position for assisted ventilation with mask or the placement of endotracheal tube.

![Fig. 1.4: Placing shoulder roll](image)

Clear airway

After the baby is positioned well, the presence of secretions may prevent the entry of air into the lungs. Hence, the clearing of the airway if required should
Techniques in Newborn and Infant Care

Immediately follow once the newborn has been positioned. One should remember that suction should not be done as a routine ritual in all cases.

Method of clearing airway depends upon

- Presence of meconium stained amniotic fluid at the time of delivery.
- The level of activity of the baby (is the baby depressed or vigorous at birth).

<table>
<thead>
<tr>
<th>Vigorous baby is defined as baby with strong respiratory efforts, good muscle tone and a heart rate greater than 100bpm.</th>
</tr>
</thead>
</table>

Clearing the airway when amniotic fluid is free of meconium

Secretions of the airway may be removed from the airway by wiping the nose and mouth with a towel or by suctioning with a mucus extractor or suction catheter attached to mechanical suction device. Turning of the head to one side will allow the secretions to collect in the cheek where they can be removed easily.

We should remember that when there are copious secretions, we need to use suction from the wall or from an electric suction machine at a pressure not more than 100mm of Hg.

The mouth is to be suctioned before nose, to ensure that there is nothing for the newborn to aspirate. An easy way to remember the same is that M comes before N in the alphabet.

<table>
<thead>
<tr>
<th>Caution: One should be careful while using the catheter. Stimulation of the posterior pharynx during the first few minutes after birth can produce a vagal response, causing severe bradycardia or apnoea.</th>
</tr>
</thead>
</table>

Clearing the airway, when meconium is present and baby is vigorous

In a baby born with meconium stained fluid, who is vigorous (having a normal respiratory effort, good muscle tone, and a heart rate greater than 100 bpm), the airway is cleared simply by use of mucus extractor or large bore suction catheter (12 or 14 F). The steps of clearance are similar to the baby born without meconium stained liquor.

Clearing the airway, when meconium is present and baby is not vigorous

In a baby born with meconium stained fluid, and non-vigorous, direct suctioning of the trachea soon after delivery is performed before any respiration has occurred. This will reduce the chances of the baby developing meconium aspiration syndrome. The steps to be followed are given below:

1) Insert a laryngoscope and use a 12 F or 14 F suction catheter to clear the mouth and posterior pharynx, so that glottis can be visualized.

2) Insert an endo-tracheal tube into the trachea and attach the endo-tracheal tube to a suction source (a special aspirator device).

3) Apply suction for several seconds when the tube is in trachea and continue as the tube is slowly withdrawn. One can count “one thousand one, one-thousand- two, one-thousand- three and withdraw” (Figure 1.6)

4) Repeat as necessary until little additional meconium is recovered, or until the baby’s heart rate indicates that resuscitation must proceed without delay.
Note: Harmful techniques like squeezing the chest, inserting a finger in the baby’s mouth or externally occluding the airway to prevent babies from aspirating meconium are harmful to the baby. Therefore, not recommended.

Tactile stimulation

Drying and suctioning stimulate a baby to breathe. For most of the newborns, these are sufficient to initiate respiration. If the baby does not have vigorous breathing, additional tactile stimulation may be briefly provided.

Stimulation may be useful not only to induce and begin breathing during the initial step of resuscitation but also may be used to stimulate continued breathing after positive pressure ventilation (PPV).

The safe and appropriate methods of providing tactile stimulation are (Figure 1.7):

1) Gently flicking or slapping the soles
2) Gently rubbing the back, trunk and the extremities of the baby.

Any form of stimulation will initiate breathing, if baby is in primary apnoea. Therefore 1 or 2 flicks or slaps to the sole or gently rubbing the back once or twice is sufficient. If baby remains apneic despite tactile stimulation, positive pressure ventilation should be immediately initiated.

Avoid vigorous stimulation like shaking baby or holding baby upside down, slapping in back, squeezing the rib cage, forcing thigh on abdomen or using hot or cold compress as they are very harmful to the baby.
Evaluation

Evaluate the baby to assess if further resuscitation is needed. The entire process of resuscitation should not take more than 30 seconds. This may take more time in case tracheal suctioning is needed in a baby born meconium stained and depressed. Evaluate respiration and heart rate.

- Assess the baby for good respiration, if there are good chest movements or not. The rate and depth of respiration increases after few seconds of tactile stimulation.

In some babies especially the pre-term, the respiration may be labored. Such breathing should be noted. These babies may require additional respiratory support and monitoring.

- Heart rate: This is done by auscultating the heart or by palpating the umbilical pulsations for 6 seconds. Whatever the number of beats/pulsations, it is multiplied by 10 to obtain the heart rate per minute (e.g. a count of 12 in 6 seconds is a HR of 120/min). The heart rate should be more than 100bpm.

What to do if the heart rate or respiration is abnormal?

On evaluation of breathing and heart rate after initial steps, if baby is apneic or has gasping respiration or heart rate less than 100, one should proceed to provide positive pressure ventilation (PPV).

If baby is breathing well and heart rate is above 100 but respirations are labored or you think that the baby is persistently cyanotic, such baby needs additional respiratory support (especially if pre-term) and tailored optimal oxygen delivery. If the CPAP machine for respiratory support and the blender with pulse oximeter for optimal oxygen delivery are not available, one can consider starting supplemental oxygen and shifting baby immediately to NICU (Figure 1.8).
Free-flow Oxygen

Free flow of oxygen can be provided by:

- Oxygen mask held over the baby’s face
- Flow inflating bag and mask
- Oxygen tubing cupped closely over the baby’s mouth and nose
- T piece resuscitator

If the central cyanosis persists, it would be ideal to attach a pulse oximetry probe to determine if the baby’s oxygenation is in the abnormal range. If the levels are below the saturation targets established for a normal baby during transition and are not increasing, we may have to think of providing supplemental oxygen (Figure 1.9).
The normal intra-uterine saturation is 60%, which increases gradually to 90% only by 10 minutes of birth. Because of the normal transition pattern and the possibility of oxygen toxicity, it is best to give oxygen to maintain the saturation of the baby in the acceptable ranges.

The saturation of the baby should be used to decide the duration of oxygen delivery. In case the same is to be given for a longer time then oxygen should be heated and humidified. Avoid flow rates that are more than 5 litres per minute, as this may cause significant convective heat losses.

When central cyanosis improves and the oxygen saturation of the baby are above 85-90%, supplemental oxygen is gradually decreased. If cyanosis or low oxygen saturation (<85%) persists in spite of giving free flow oxygen, the baby may have a significant lung disease and a trial of positive pressure ventilation (PPV) is justified. However, if ventilation is adequate and the baby still remains cyanotic, then a diagnosis of the congenital cyanotic heart disease or persistent pulmonary hypertension of the newborn should be considered.

### 1.3.3 Positive Pressure Ventilation (PPV)

Positive pressure ventilation is indicated if:

- Baby is apneic or gasping
- Heart rate is less than 100 bpm even with breathing, and/or
- Has persistent cyanosis or low oxygen saturation, despite free flow oxygen increased to 100%.

**Equipments available for PPV in newborns**

There are three types of equipments available for providing PPV in the newborns:

1) The self inflating bag
2) The flow inflating bag
3) The T piece resuscitator

**Bag and Mask Ventilation**

- Equipment
- Ventilation

**Equipment**

It is important that you become completely familiar with the specific equipment used where you work.
Self-inflating bag

The self-inflating bag is designed to inflate automatically as you release your grip on the bag. It does not require a compressed gas source to fill. You should be able to identify various parts of a self-inflating bag (Fig 1.10).

As the bag re-expands following compression, gas is drawn into the bag through a one-way valve that may be located at either end of the bag depending on the design. This valve is called the air inlet.

Every self-inflating bag has an oxygen inlet, which is usually located near the air inlet. It is a small nipple or projection to which oxygen tubing can be attached with oxygen as needed.

The patient outlet is where gas exits from the bag to the infant and where the mask or ET tube attaches.

In many self-inflating bags, the valve assembly allows gas to flow from the bag through the patient outlet only while bag is being compressed. Since oxygen flow is not continuous, these bags cannot be used to provide free-flow oxygen.

An oxygen reservoir is an appliance that can be placed over the bag’s air inlet. It helps in delivering a high concentration of oxygen to the baby and allows oxygen to be administered in a concentration as high as 90% to 100%.

A resuscitation bag used in neonatal resuscitation has a safety mechanism in the form of a pressure release valve to guard against inadvertent transmission of excess pressure to the baby’s lungs. Pressure release valves on self-inflating bags are generally set to release at 30 to 40 cm H₂O. If pressures greater than 30 to 40 cm H₂O are generated as the bag is compressed, the valve opens, limiting the pressure being transmitted to the lungs of infant. The ideal size of the bag for neonates is 240 to 500 ml capacity.

The Flow inflating bag

The flow inflating bag is also called anesthesia bag. It fills only when the source of compressed gas (oxygen, air, or a mix of two) is connected. They usually do not have a fixed safety pop off valve and may be used with/without an attached manometer. PEEP can be provided by adjusting the flow of gas out of the bag through the flow control valve. Large leaks at the face mask, or too low a flow,
will result in collapse of the bag and inability to deliver any positive pressure breath (Fig 1.11).

![Flow inflating bag](image)

**Fig. 1.11: Flow inflating bag**

**T piece resuscitator**

T piece resuscitator is a flow controlled pressure limited ventilator device (Fig 1.12). Piped compressed gas is delivered at one port of T piece. A preset peak inspiratory pressure (PIP), positive end expiratory pressure (PEEP) and maximum circuit pressure is set. With a T piece device, gas flows into a face mask or endotracheal tube through a patient supply line. Inflation is achieved by interrupting the escape of gas through an outlet hole on the T piece using a thumb so that the pressure rises and is displayed by a manometer. Adjusting the PEEP valve varies positive end expiratory pressure. The newborn is ventilated by placing a finger over the outlet aperture (hole in the PEEP valve) and removing it periodically at about 40-60 times a minute.

![T Piece Resuscitator](image)

**Fig. 1.12: T Piece Resuscitator**

**Resuscitation masks**

Masks come in a variety of shapes, sizes and materials. Resuscitation masks should have cushioned rim for better seal. The rim conforms more easily to the shape of the infant’s face, making it easier to form a seal. It requires less pressure on the infant’s face to obtain a seal. There is less chance of damaging the infant’s eyes if the mask is correctly positioned. Masks come in several sizes (Figure 1.13). Masks suitable for small, premature infants as well as for term infants
should be available for use. For the mask to be of correct size, the rim will cover tip of the chin, the mouth and the nose but not the eyes.

Fig. 1.13: Resuscitation masks

**Assembling equipment**

The bag should be assembled and connected to oxygen so that it will provide the necessary 90% to 100% oxygen. If a self-inflating bag is used, be sure the oxygen reservoir is attached. Connect the mask to the bag.

**Testing equipment**

To check a self-inflating bag, block the mask or patient outlet by making an airtight seal with the palm of your hand (Figure 1.14). Then squeeze the bag:

- Do you feel pressure against your hand?
- Can you force the pressure release valve open?
- Is the valve assembly present and moving as it should?

If not:

- Is there a crack or leak in the bag?
- Is the pressure-release valve missing or stuck or closed?
- Is the patient outlet completely blocked?

If your bag generates adequate pressure and the safety features are working, while the mask patient outlet is blocked check to see:

- Does the bag re-inflate quickly when you release your grip?

Fig. 1.14: Testing equipment
Preparation

The need for possible resuscitation of a neonate should be anticipated. Bag mask ventilation may be attempted in the spontaneously breathing infant who remains cyanotic despite administration of 100% free-flow oxygen.

Bag and mask ventilation is indicated if heart rate of baby after 5 inflations is less than 100bpm.

In diaphragmatic hernia, bag and mask ventilation is contraindicated.

In meconium stained non-vigorous baby, ventilation is carried out after tracheal suction (skilled professional is required).

(Non-vigorous baby has presence of any one of three signs – limp, cyanotic, HR<100/mt)

Select equipment

The first step is to select the appropriate equipment:

• Obtain a resuscitation bag with oxygen reservoir and connect it to any oxygen source
• Select a mask of the proper size
• Quickly check the bag to make sure that it functions properly (if you did not do so previously)

Fig. 1.15: Bag and mask ventilation

Position mask and obtain seal

The infant’s neck should be slightly extended to ensure an open airway (Figure 1.15).

Place the mask in position and check the seal by ventilating two or three times. Observe for an appropriate rise of the chest (Figure 1.16).
Ventilate the newborn

Rate: 40 to 60 breaths per minute

Pressure: the best guide to adequate pressure during bag and mask ventilation is an easy rise and fall of the chest with each breath. Usual pressure required for the first breath is 30 – 40 cm of water. For subsequent breaths, pressures of 15-20 cm of water are adequate.

40 – 60 breaths per minute

Breath —— two ——three —— Breath

For babies born at term, it is best to begin PPV with room air rather than 100% oxygen.

Assessing effectiveness of ventilation

- Provide up to 5-10 manual breaths looking for chest rise
- Ask assistant to check for heart rate
If there is no chest rise or no increase in heart rate take ventilation corrective measures (Table 1.1)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Remedial steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>M Inadequate seal</td>
<td>Mask adjusted to ensure airtight seal</td>
</tr>
<tr>
<td>R Inappropriate position</td>
<td>Reposition the head in sniffing position</td>
</tr>
<tr>
<td>SO Blocked airway</td>
<td>Suction the airway Open baby’s mouth and ventilate</td>
</tr>
<tr>
<td>P Inadequate pressure</td>
<td>Increase Pressure by squeezing the bag with more pressure till a chest rise is visible</td>
</tr>
<tr>
<td>T No improvement with above steps</td>
<td>Consider endotracheal intubation</td>
</tr>
</tbody>
</table>

Provide uninterrupted effective ventilation for 30 seconds and assess for spontaneous breathing and heart rate. If spontaneous breathing is present and heart rate is 100 or more, then gradually discontinue PPV.

Effective ventilation will promote increase in heart rate and spontaneous breathing, improvement in color and muscle tone.

**What to do if baby is not improving (heart rate is > 60 but less than 100bpm)?**
- Ensure effective ventilation.
- Reassess respiratory effort, heart rate every 30 seconds (oxygen saturation may be monitored continuously if available)
- If PPV is prolonged (over several minutes) place an oro-gastric tube to prevent distention of abdomen which may interfere with ventilation.

**When to stop PPV?**

PPV is discontinued when the heart rate is above 100bpm

There is sustained spontaneous breathing.

**Observational care**

Newborns that have required PPV for less than 1 minute should be provided observational care which includes:
- Provide warmth
- Initiate breast feeding
- Monitor newborn (temperature, heart rate, breathing, and color every 30 minutes for 2 hours).

**Post resuscitation care**

Babies who have received PPV for more than 1 minute or more extensive resuscitation like intubation, chest compression are at high risk of further deterioration. These babies should be managed in NICU.
1.3.4 Chest Compressions

Indications
Heart rate of baby less than 60 bpm despite at least 30 seconds of effective positive pressure ventilation.

What is Chest Compression?
Also referred as external cardiac massage (Fig 1.17). Rhythmic compressions of the sternum that
1) Compress the heart against the spine
2) Increase the intrathoracic pressure
3) Circulate blood to the vital organs of the body.

![Fig. 1.17: Phases of chest compression](image)

Why perform chest compression?
In severe asphyxia both heart rate and myocardial contractility are decreased resulting in bradycardia and less powerful contractions. Myocardium is depressed because of poor oxygen levels – Low cardiac output. Mechanical pumping of heart is required to improve perfusion to the lungs. This results in decreased tissue perfusion and hence decreased oxygenation to vital organs.

Chest compressions provide an artificial heartbeat, thus restoring circulation to life-sustaining level. Positive pressure ventilation with 100% oxygen must accompany chest compression to oxygenate circulating blood.

If in spite of being ventilated with 100% oxygen, a newborn fails to achieve an adequate heart rate, chest compressions must be performed. In most infants positive pressure ventilation (PPV) with 100% oxygen itself raises heart rate to adequate levels. Therefore, the decision to perform chest compression should be based on the heart rate obtained after 30 seconds of PPV and not on the heart rate obtained at delivery. If the heart rate is less than 60/min despite good assisted ventilation for at least 30 seconds, chest compressions should be started. Once the heart rate reaches 60, chest compressions are withdrawn.

Positioning for Chest Compression
By now, the baby is already positioned for PPV and is being ventilated with 100% oxygen. A person performing chest compression must gain access to the
Techniques in Newborn and Infant Care

chest and two persons should position in such a way that each one can do an effective job without interfering with the other (Figure 1.18).

![Diagram of chest compression technique](image1)

**Fig. 1.18: Position for chest compression**

Endotracheal intubation at this time may help to ensure adequate ventilation and facilitate the coordination of ventilation and chest compression.

**Techniques of Chest Compression:**

Two techniques are used:

1) Two thumb technique (Figure 1.19): two thumbs are used to depress the sternum while the hands encircle the chest and fingers support the spine.

2) Two finger technique (Figure 1.20): Tips of the middle finger and index or ring finger are used to compress the sternum. The spine is supported with other hand or by placing the baby on a hard surface.

![Diagram of two thumb technique](image2)

**Fig. 1.19: Two thumb technique**
Resuscitation of Newborn

**Location of Compression**

Pressure is applied to the lower third of sternum strictly avoiding applying pressure on the xiphoid. The lower third of sternum is just below the line joining the two nipples (Fig 1.21).

**Depth of Compression**

Enough pressure should be used to compress the sternum to approximately 1/3 of the antero-posterior diameter of the chest to generate a palpable impulse (Fig. 1.22). One compression consists of the downward stroke plus the release. Shorter compression phase than the relaxation phase has been proved to be more effective.
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Fig. 1.22: Depth of compression

Rate of Compression

Compression / release action should be repeated 90 times per minute and ventilation 30 times per minute making the ratio as 3:1. This will be done by counting 1-2-3 for three compressions and 4 for the PPV (interposed ventilation) which together should take 2 seconds (½ second for each event) (Figure 1.23).

Coordinating ventilation and chest compression

Chest compression should be accompanied by PPV. Avoid giving compressions and ventilation simultaneously, hence they require coordination. For every 3 compressions 1 breath is delivered (in a minute 90 compressions and 30 breaths are given)

Fig. 1.23: Coordinating ventilation and chest compression

Dangers of Chest Compressions

Chest compression can cause trauma to the baby. Improper placement of fingers or thumb can cause:

- Damage to xiphoid
- Injury to internal organs like liver, spleen or lungs
- Fracture of ribs

Precautions

- Do not remove the finger or thumb in between compressions
Resuscitation of Newborn

- Feel the pulse for effectiveness of compression
- Do not squeeze the chest
- Continue positive pressure ventilation. If using bag and mask, interpose a ventilation every third compression.

Checking effectiveness of Compressions

Heart rate should be checked every 30 seconds. It should be checked for no longer than 6 seconds (this causes minimal interruption in chest compressions).

Ventilation should be discontinued while the heart rate is being checked so that breath sounds do not obscure the heart sounds. It is important to know whether the blood is being circulated effectively as a result of chest compressions. The pulse should be checked periodically if at all possible. This can be done at carotid, brachial and femoral.

When to stop chest compressions?

After approx. 30 seconds of chest compression and positive pressure ventilation (PPV)

- Count heart rate
- If >60 bpm, stop chest compressions
- Continue PPV at 40-60 bpm till baby breathing spontaneously, heart rate >100 and baby begins to breathe spontaneously.

If child is not improving?

1) Check if PPV is effective; if baby is not intubated till now, consider intubating the baby. Assist in the procedure of intubation and collect all the articles required for intubation mentioned in preparation section.
2) Make sure that oxygen concentration is increased to 100%.
3) Check if depth of compression is adequate
4) Ensure that chest compression and ventilation are well coordinated.

1.3.5 Drugs in Neonatal Resuscitation

Neonatal resuscitation, as any other resuscitation procedure, is a team effort and before any medication is administered to a newborn, the team leader has to ensure that effective ventilation and compressions are being given to the baby.

Most newborns requiring resuscitation will improve without the need for medications, if timely and effective resuscitation steps are carried out.

When should medications be administered during resuscitation?

Medications should be administered during resuscitation when in spite of adequate ventilation and cardiac compression, together for more than 30 seconds, the heart rate remains < 60/min and is not improving or if there is initial asystole after 30 sec of BMV. Do not ‘wait’, to take ‘weight’, use approximation – 1, 2 or 3 kg?

Establishing intravenous access in newborn during resuscitation

Umbilical vein is the quickest venous access for neonatal resuscitation.
Steps of umbilical vein catheterization

1) Clean the cord with antiseptic solution

2) Place a loose tie of umbilical tape around the base of the cord. This can be tightened if there is excessive bleeding from the cut cord.

3) Pre-fill a 3.5 F or 5 F catheter with normal saline using a 2 ml syringe connected to a stopcock. The catheter should have a single end hold. Close stopcock of the catheter to prevent fluid loss and air entry.

4) Cut the cord using sterile technique with a scalpel, 1-2 cm from the skin line.

5) Umbilical vein can be located at 11 or 12 o'clock position. It is a thin walled structure.

6) Insert the catheter into the umbilical vein, towards heart. Continue inserting the catheter 2-4 cm (less in preterm baby) till you get the free flow of blood on gentle aspiration.

7) Inject appropriate dose of epinephrine or volume expander followed by 0.5-1.0 ml of normal saline to clear the drug from the catheter to the baby.

8) Once the baby is successfully resuscitated, either suture the catheter or remove the catheter and tighten the cord tie.

What drugs may be required by the neonate?

- Epinephrine
- Volume expanders
- Epinephrine

Epinephrine increases cardiac contractility and the cardiac output, which improves blood supply and oxygen to these organs.

Epinephrine is not indicated before you have established adequate ventilation

Epinephrine increases workload and oxygen consumption of the heart muscles, which, in the absence of available oxygen, may cause unnecessary myocardial damage.

How to prepare epinephrine?

Epinephrine is available as 1ml ampoule of 1:1,000 concentration, however for neonate take 1 ml of 1:1,000 solution and add 9 ml of normal saline. This makes 10 ml of 1: 10,000 concentration.

How to administer epinephrine?

Epinephrine should be given intravenously. If administration is delayed due to placement of intravenous access, endotracheal route may be used to administer the drug. But the endotracheal route has unpredictable blood levels that may not be effective.
**Dose of epinephrine**

The recommended intravenous dose in newborns is 0.1 to 0.3 ml/kg of a 1:10,000 solution (equal to 0.01 to 0.03 mg/kg). When giving epinephrine by endotracheal tube, be sure to give the drug directly into the tube (3 times the I/V dose i.e. 0.3-0.9 ml/kg), being careful not to leave it deposited in the endotracheal tube connector or along the walls of the tube.

Check the baby’s heart rate 30 seconds after administering epinephrine. Continue giving positive pressure ventilation and chest compressions. The heart rate should increase to more than 60 bpm within 30 seconds after the administration of epinephrine. If this does not happen repeat the dose every 3 to 5 minutes.

- **Volume expander**

Volume expander refers to saline or ringer lactate, indicated if the baby is in shock and is not responding to resuscitation. The baby appears pale, has weak pulse. O Rh negative packed red blood cells are also considered as part of the volume replacement when severe fetal anemia is expected.

**Dose of volume expander**

10 ml/kg is the initial dose. If baby shows minimal improvement after the first dose, another dose of 10 ml/kg can be given.

Volume expander is given through intravenous route. The umbilical vein is the most accessible vein in a newborn, therefore more commonly used.

**What to do in case no improvement?**

If the baby is severely compromised but all resuscitation efforts have gone smoothly, and baby’s heart rate continues to remain below 60bpm, you may consider mechanical causes of poor response such as air way malformation, pneumothorax, diaphragmatic hernia or congenital heart disease.

1.4 **RECORDING/MONITORING**

The entire process of neonatal resuscitation should be recorded in nurse’s record and these babies should be monitored regularly after resuscitation as described in the unit.

1.5 **ACTIVITY AND GUIDELINES**

**Activity 1**

Carrying out procedure of resuscitation:

i) Attend a case of normal delivery in labour room

ii) Receive the baby and maintain patency of airway at birth

iii) Provide routine care to the newborn baby

**Activity 2**

Observe the procedure of resuscitation of newborn on a manikin, practice and record the steps followed in resuscitation procedure as:

- Initial steps
Techniques in Newborn and Infant Care

- Bag mask ventilation
- Chest compression

**Activity 3**

Select two neonates in delivery room, observe/practice routine care and initial steps of resuscitation and record the procedure.

**Guidelines**

Record the procedure on work book as:

Name of the Newborn ........................................................................................................................................
Date of Birth ........................................................................................................................................................
Birth Weight ........................................................................................................................................................
Type of Delivery ...................................................................................................................................................
Method adopted to keep patent airway ...................................................................................................................
Steps of initial resuscitation .................................................................................................................................

1.6 LET US SUM UP

In this practical on resuscitation, you have learnt the definition, indications, purposes, preparation – personnel, equipment, environment, and steps of resuscitation, drugs used in resuscitation and recording and monitoring the resuscitation.
2.0 OBJECTIVES

After completing this unit, you should be able to:

- State the levels of newborn care;
- Enumerate the immediate needs of newborn;
- Outline the essential care of newborn at birth;
- Describe the principles of management of normal neonate;
- Assess physical and physiological parameters of the normal newborn; and
- Demonstrate nursing care of neonate.

2.1 INTRODUCTION

About 90% of babies born in India are full term (37 – 41 weeks). The remaining 10% of babies are born as premature (less than 37 weeks). A large number of newborn babies require minimal care which can be provided by mother under the supervision and guidance. The care of normal newborn can be given at home, sub centre, primary health centers or any other health facility. The care given to mothers and babies immediately after delivery and during the postnatal period will have greater impact in maintaining normal health and prevention of complications in them.

In India more than half of the infant deaths occur during newborn (first 28 days of life) period. Most of these deaths take place in the first week of life due to
birth asphyxia, hypothermia and infections. Babies born with a low birth weight (below 2500gms) are at a higher risk of dying. Provision of essential care to the newborn at birth and during the neonatal period will have a significant impact on reduction of neonatal and infant mortality rate.

In this practical you will learn about the care of normal newborn and assessment of newborn.

### 2.2 LEVELS OF NEONATAL CARE

Neonatal mortality and morbidity is directly related to the birth weight and gestational maturity of the newborn. High risk pregnancies (which are associated with the birth of high risk infant) must be identified during antenatal period and referred to an appropriate center for skill management. Based on birth weight and gestational age, three tier system of care is provided to the newborn babies.

#### Level-I Care

More than 80 percent of newborn babies require minimal care which can be provided by their mother under supervision of basic health professionals. Neonates weighing above 2000 gm or having gestational maturity of 37 weeks or more belong to this category. The care can be provided at home, sub centre and primary health centre level. Basic care at birth, provision of warmth, maintenance of asepsis and promotion of breast feeding are the main components of level I care.

#### Level II Care

Infants weighing between 1500- 2000gm or having gestational maturity of 32-36 weeks need specialized neonatal care supervised by trained nurses and pediatrician. District hospitals, teaching institutions and nursing homes should be equipped to provide intermediate neonatal care. Neonatal intermediate care is needed for about 10 to 15 percent of newborns. It should be available at all hospitals catering to 1000 to 1500 deliveries per year.

#### Level III Care

Intensive neonatal care is required for babies weighing less than 1500gm or those born before 32 weeks of gestation. Apex institutions or regional perinatal centers equipped with centralized oxygen and suction facilities, servo controlled incubators, vital signs and transcutaneous monitors, ventilators and infusion pumps etc. are best suited to provide intensive neonatal care. About 3 to 5 percent of newborn babies require intensive care.

### 2.3 IMMEDIATE NEEDS OF A BABY AT BIRTH

Every baby has four immediate needs after birth. They are warmth, normal breathing, mother’s milk and protection from infection. For meeting these needs, the baby is totally dependant on the mother and care providers. Hence it is important to provide essential care to the newborn immediately after birth, because the first hour after birth has significant influence on the survival and well being of newborn. Keeping the normal term baby with the mother soon after birth will facilitate early initiation of breastfeeding and emotional bonding between the mother and the baby. This will also prevent hypothermia and hypoglycemia in
Care of Normal Newborn

babies and increase self-confidence in mother. Good care given during this period can prevent infection in newborn period.

2.4 CARE OF NORMAL NEWBORN BABY AT BIRTH

It is important that the baby is received in a clean warm sheet and kept on the mother’s chest/abdomen. The umbilical cord should be tied using a sterile tie and cut using sterile blade about 2-3 cm (1 inch) away from the skin. The baby should be thoroughly dried and covered adequately with another clean, dry sheet to prevent heat loss. Blood and meconium on the baby’s body should be wiped away but not the vernix (the white greasy substance). It helps to protect the skin of the baby. The baby’s colour and breathing should be assessed. A normal newborn should be crying or breathing at the rate of 40-60 breaths per minute. If the baby is not crying or breathing well, the steps of resuscitation need to be carried out. The eyes of baby need to be cleaned with sterile gauze from medial side to the lateral side. Then, the baby needs to be placed in between the breasts of the mother to promote skin to skin contact and breastfeeding. The identity tag needs to be tied for both mother and baby to identify the baby.

2.4.1 Maintenance of Body Temperature

The mother and baby need to be covered with a warm and dry cloth, especially if the temperature of labour room is less than 25ºC. A baby who is small (less than 2.5 kg at birth or born before 37 weeks gestation) and sick needs additional thermal protection and warmth to maintain normal body temperature. These babies become hypothermic very quickly, and rewarming the baby can take a long time. The risk of complications and mortality significantly increases if the thermal environment is not optimal. To maintain warm chain, it is essential that the temperature maintenance is a continuous process and continued from the time of delivery till discharge of the baby.

General principles to maintain the body temperature of newborn:

- Keep the baby clothed or covered as much as possible at all times, including during procedures (e.g. when establishing an IV line, during resuscitation):
  - Clothe the baby and cover the head with a cap or hat.
  - Wrap the baby in a soft dry cloth and cover with a blanket.
  - Uncover only parts of the body that need observation or treatment.
- Care for a sick or small baby in a warm room (not less than 25ºC) that is free of draught.
- Do not place the baby near cold objects, such as a wall or window, even if the baby is in an incubator or under a radiant warmer.
- Do not place the baby directly on a cold surface (e.g. place a cloth or blanket under the baby before placing on a cold bed or examination table), and ensure that hands are warm before handling the baby.
- Keep the baby warm during transfer for diagnostic or treatment procedures. Use warming devices or transfer in skin to skin contact with the mother or another person.
Techniques in Newborn and Infant Care

- Ensure warmth during procedures (e.g. use a radiant warmer).
- Change napkins whenever they are wet.
- If anything wet is applied to the skin (e.g. moistened gauze), ensure that baby is warm.
- Avoid bathing the baby during the first six hours of life or until the baby’s temperature is stable, delay bath for a small baby until at least the second day of life.

The methods of warming the baby are given in Table 2.1.

Table 2.1: Methods of warming the baby and maintaining body temperature

<table>
<thead>
<tr>
<th>Method</th>
<th>Guidelines for Selection &amp; Use</th>
<th>Advantages</th>
<th>Risks / Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin-to-skin contact</td>
<td>a) Appropriate for all stable babies.</td>
<td>a) Mother can closely monitor baby.</td>
<td>a) Mother may not always be available.</td>
</tr>
<tr>
<td></td>
<td>b) Appropriate for re-warming a baby with moderate hypothermia (32ºC to 36.4ºC) particularly when other methods are not available.</td>
<td>b) Another person can provide skin-to-skin contact if the mother is unavailable.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Not appropriate for babies with life threatening problems (sepsis, severe breathing difficulty).</td>
<td>c) Babies usually maintain normal body temperature.</td>
<td></td>
</tr>
<tr>
<td>Kangaroo Mother Care (KMC)</td>
<td>a) Appropriate for stabilized babies weighing 1.5 to 2.5 kg but particularly recommended for continuous care of babies weighing 1.5 to 1.8 kg.</td>
<td>a) Mother can closely monitor baby.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Not appropriate for babies with life threatening problems (sepsis, severe breathing difficulty).</td>
<td>b) Babies usually maintain normal body temperature.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Not appropriate if mother has a serious illness or complication from labour or birth that prevents her from caring for the baby. In that case other family members can be involved.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiant warmer</td>
<td>a) Appropriate for sick babies and babies weighing 1.5 kg or more.</td>
<td>a) Allows observation of baby.</td>
<td>a) Baby can become hyperthermic if temperature is not monitored.</td>
</tr>
<tr>
<td></td>
<td>b) Used to keep baby warm during initial assessment, treatment and procedures and to re-warm a cold baby.</td>
<td>b) Many procedures can be performed while baby is under warmer.</td>
<td>b) Baby can become dehydrated.</td>
</tr>
<tr>
<td>Incubator</td>
<td>a) Appropriate for continuous care of babies weighing less than 1.5 kg who are not eligible for kangaroo mother care.</td>
<td>a) Maintains constant temperature.</td>
<td>c) Warmer is expensive to buy.</td>
</tr>
<tr>
<td></td>
<td>b) Appropriate for babies who have life threatening problems (sepsis, severe breathing difficulty).</td>
<td>b) Allows observation of baby.</td>
<td>d) Warmer requires reliable source of electricity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c) Oxygen can be easily provided.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>d) Baby can be naked, if necessary.</td>
<td></td>
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<tr>
<td></td>
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<td></td>
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</tbody>
</table>
2.4.2 Breast Feeding

Placing the baby between the breasts of mother promotes early initiation of breastfeeding. Initially the baby would be asleep for a period varying from 30-40 minutes. This time may vary from individual to individual. After this period, the baby is usually awake and opens his mouth and starts to move his head from side to side. This sign indicates that the baby is ready for breast feeding. Ensure that the baby is fed with breast milk during this period (within 1 hour of delivery).

The mother should be helped in breastfeeding her baby. The mother and the baby should be in a comfortable position. The baby needs to be placed next to the mother’s breasts with his mouth opposite the areola and nipple. The baby should attach to the breast by itself when it is ready. The positioning and attachment of baby with the breast should be checked.

Encourage early and exclusive breast-feeding. Explain to the mother and her family the benefits of early and exclusive breast-feeding.

<table>
<thead>
<tr>
<th>Method</th>
<th>Guidelines for Selection &amp; Use</th>
<th>Advantages</th>
<th>Risks / Disadvantages</th>
</tr>
</thead>
</table>
| Warm room       | a) Appropriate for care of babies recovering from illness and small babies who do not require frequent diagnostics and treatment procedures.  
                 | b) Not appropriate for babies with life threatening problems (sepsis, severe breathing difficulty). |                                                                            | d) Incubator is expensive to buy and maintain.                                         |
|                 |                                                                                               |                                                                            | e) Incubator requires reliable source of electricity.                                  |
|                 |                                                                                               |                                                                            | f) Personnel trained to care for baby and cleaning and maintaining incubator are required. |
|                 |                                                                                               |                                                                            | g) Mother and baby are separated.                                                      |
|                 |                                                                                               |                                                                            | h) Incubator is more difficult to clean than radiant warmer.                           |
| Other methods   | a) Appropriate for emergency situations when other methods are not available (e.g. during transport). |                                                                            | a) Baby can become hypothermic.                                                       |
| (e.g. hot water bottles or bricks) |                                                                                               |                                                                            | b) Room may be uncomfortable for adults.                                              |
|                 |                                                                                               |                                                                            | a) Baby can become hyperthermic.                                                      |
|                 |                                                                                               |                                                                            | b) Baby can be burned by objects. Be cautious while using these methods.               |
|                 |                                                                                               |                                                                            | c) Baby can become hypothermic if objects are not replaced after they cool.           |
|                 |                                                                                               |                                                                            | d) Constant temperature is difficult to maintain                                       |
|                 |                                                                                               |                                                                            |                                                                                      |

2.4.2 Breast Feeding

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Encourage early and exclusive breast-feeding. Explain to the mother and her family the benefits of early and exclusive breast-feeding.
Techniques in Newborn and Infant Care

- Breast milk contains all the essential nutrients that the baby requires for growth and development.
- Breast milk is easily digested and efficiently used by the baby’s body.
- Breast milk protects the baby from infections.
- Breast-feeding can be used as a contraceptive method.

Encourage the mother to breast feed the baby on demand, both day and night (8 or more times in 24 hours), for as long as the baby wants. Mother should offer the second breast once the baby releases the first breast on her/his own.

2.4.3 Skin Care and Baby Bath

Skin Care: Use clean soft cotton clothes to dress the baby. Change diapers soon after they are wet or soiled. Ensure that caregivers wash their hands before handling the baby. Watch out for Pustules especially in axilla, groin and neck. Do not use plastic nappies and harsh detergents to wash the nappies as it can cause irritation to the skin. Wash hands after changing the soiled nappies.

Baby Bath: First bath can be given after 24 hours using mild unmedicated soap. After one month, oil massage can be given. There after skin can be exposed to sunlight for added advantage of Vitamin D. Avoid use of talcum powder.

2.4.4 Care of Umbilical Stump

The umbilical cord is an important site for entry of spores of tetanus. Keep the cord clean and dry and wash hands before touching it. Tie napkin or diaper below the cord stump. Leave the cord dry. Bandages are unnecessary and may delay healing and introduce infection. Applying traditional remedies to the cord may cause infections and tetanus. Watch out for Pus discharge from the cord stump. Redness around the cord, swelling, high temperature (more than 38°C) or other signs of infection should be observed.

2.4.5 Care of Eyes

Observe for any discharge from the eyes, especially with redness and swelling around the eyes. Other signs of severe infection, such as fever (more than 38°C) and poor feeding should be observed for.

Remember: Do not put anything else in baby’s eyes.

2.4.6 Weight Record

Most babies lose weight during first 2 to 3 days of life. The weight varies between 5-10 percent of birth weight. The birth weight is regained by ten days of birth. The factors contributing to initial weight loss include removal of vernix, mucus, and blood from skin, passage of meconium and reduction of extracellular fluid volume. The transition from in utero placental nutrition to post natal oral feeding is associated with transient interruption in the physical growth of babies. During first year of life average daily weight gain is around 30g, 20g, and 10g during first, second, third and fourth month’s period respectively. Most infants double their birth weight by 5-6 months of age and triple it by their first birth day. It is mandatory that periodic weight record should be taken and charted on growth chart.
2.3.7 Immunization

BCG and first dose of OPV and hepatitis B vaccine (HBV) are given at birth or before the baby is discharged from the hospital. The OPV may preferably be given after 3 days because colostrum may interfere with its uptake. The BCG site should be checked for “take” response after 4 weeks. The modified National Vaccination Schedule is depicted in Table 2.2 below.

Table 2.2: Schedule of Immunization

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccination</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 7 days</td>
<td>BCG, OPV-1, HBV-1.</td>
</tr>
<tr>
<td>6 to 8 weeks</td>
<td>DPT-1, OPV-2, HBV-2.</td>
</tr>
<tr>
<td>10 to 12 weeks</td>
<td>DPT-2, OPV-3.</td>
</tr>
<tr>
<td>14 to 16 weeks</td>
<td>DPT-3, OPV-4, HBV-3.</td>
</tr>
<tr>
<td>6 to 9 months</td>
<td>Measles, OPV-5.</td>
</tr>
<tr>
<td>15 to 18 months</td>
<td>MMR, DPT-booster, OPV-6.</td>
</tr>
<tr>
<td>4 ½ to 5 years</td>
<td>DPT-booster, OPV-7.</td>
</tr>
<tr>
<td>10 years</td>
<td>TT-booster every 5 years, MMR-booster.</td>
</tr>
</tbody>
</table>

- Breast-feeding can be given after OPV and it does not interfere with development of satisfactory immunity.
- Most immunization can be given in the presence of a minor illness.
- Live vaccines should be avoided in immuno-compromised children and symptomatic HIV positive infants.
- When a dose of a vaccine is missed the remaining doses should be administered at the earliest opportunity while keeping in mind that the vaccine dose already given is valid.

2.5 ASSESSMENT OF NEWBORN

While caring for the newborn babies, it is important to assess them so that you know their physical and physiological characteristics. It helps to identify any deviation from normal which needs attention. In the following sub section, you will learn about the physical and physiological characteristics of the newborns. Before we go on to discuss the characteristics we shall focus briefly on general examination of the baby and assessment of gestational age. These are also part of assessment. Here we shall only acquaint you with the head to toe examination.

Examination of the Neonate

You should conduct the examination of the baby at birth and late examination i.e. within 24 hours, or next day and at the time of discharge. Take care that the room should be warm, comfortable and there should be good source of light. Examine the baby with clean and warm hands. While examining you should undress the baby and put him or her on a flat warm surface. We shall discuss the examination of baby under the two headings as mentioned above. We shall begin with examination at birth. At this point we shall only focus on parameters for which you have to look for:
A) Examination at birth

A detailed examination of the newborn should be carried out to identify any problem in air passages, serious congenital malformations and assess adjustment to outside uterine life. The areas of examination at birth are:

1) Birth weight and gestational age

You have to assess/ take birth weight and estimate gestational age because birth weight indicates the health status of newborn. Similarly you have to assess gestational age because the incidence of anomalies in preterm babies is twice as much as in term, appropriate for gestational age babies.

2) Examination of baby systematically from head-to-toe requires observation of:

a) General Appearance:
   - **Body structure**: Observe whether body structure is well developed (normal baby) or poorly developed (low birth weight baby).
   - **Skin**: Observe the skin for colour whether pink (normal baby), red (low birth weight baby), blue (cyanosed/asphyxiated baby) or yellow (jaundiced baby) or any cracks, spots or birthmarks.
   - **Cry**: Listen whether cry is loud and strong (normal baby), weak or whiny (low birth weight baby) or absent (asphyxiated baby).
   - **Activity**: Observe whether baby is active (normal baby), less active or in active (low birth weight/asphyxiated).

b) **Limb size and shape in proportion to body size and shape**: Observe whether the proportion between the two is normal or small (achondroplasia).

c) **Head, Face and Neck**:
   i) **Inspect the head for**:
      - **Hair**: whether present or not and if present, note the colour and texture of hair.
      - **Shape**: whether round (normal), oval (slight moulding or a small caput formation in normal labour), long (excessive moulding or a large caput formation in prolonged labour) or asymmetrical.
      - **Size**: whether small (microcephaly), medium (normal), large (hydrocephaly or prematurity) or unusual (anencephaly).
   
   ii) **Feel the head with hands for**:
      - **Sutures**, whether overriding (slight moulding or excessive moulding) and wide (hydrocephaly).
      - **Fontanellae** in front and back whether normal or tense (hydrocephaly).

   iii) Take the **head circumference** and note whether it is between 32.5-35 cm (normal), less (microcephaly) or more (hydrocephaly).
iv) Observe the face whether triangular (normal), round/being swollen (prolonged labour or hemolytic disease) or asymmetrical and eye brows and eyelashes present (normal baby) or not (low birth weight).

v) Observe the eyes whether normal, or slanting, normally spaced or not (chromosomal abnormality), opened or closed. Observe for any squint (normal) and subconjunctival bleeding (in the form of red patch or ring).

vi) Observe the ears whether flattened against head due to well formed cartilage (normal) or not (low birth weight baby).

vii) Observe the nose for shape and size. Normally it is flat except at the tip which is prominent.

viii) Observe the mouth for cleft lip and cleft palate, frothy mucus coming out (esophageal atresia), tongue tie, false teeth.

ix) Inspect the neck. Normally it is so short that head seems to rest on shoulders.

d) Arms:
- Inspect arms whether moving freely (normal baby), less freely (low birth weight or asphyxiated baby) or not at all (paralysis, dislocation of shoulder or fracture). Observe hands for any folded digit or finger, any extra finger or fused finger, complete nails (normal baby) or incomplete nails (low birth weight babies).

e) Chest and Abdomen:
- Inspect nipples whether well formed (normal baby), poorly formed or absent (low birth weight baby), normally spaced or not (chromosomal abnormality).
- Palpate around one nipple to feel for small nodule of breast tissues whether present (normal baby) or absent (low birth weight baby).
- Count respiration and heart rate (apical pulse) – observe rise and fall of chest or abdomen. Normal rate of new born respiration is 40 – 60 per minute. More rate and difficult respiration is for LBW or irregular with period of apnea, chest in-drawing is for Asphyxiated baby.
- Measurement of chest circumference. It is 30.5 – 33cms in term baby.
- Observe the cord stump for any oozing/bleeding, presence or absence of any of the blood vessels. Normally there are two umbilical arteries and one umbilical vein. Absence of an artery indicates renal or cardiac abnormality.

f) Genitalia:
- Inspect the external genitalia to establish Sex and detect condition like inter-sex, epispadias, hypospadis. The labia of female or scrotum of male baby may appear large. The labia majora is poorly developed in female and does not cover the minora in low birth weight baby.
- Feel the scrotum on both sides in male to detect whether the testicles (nodular structures) are descended or not.
• Observe for phimosis. A slight degree is natural but of more degree interferes with cleaning of penis and requires circumcision.

g) Legs:
• Observe the legs whether the baby is moving both legs freely (normal baby), less freely (LBW) or not at all (paralysis, dislocation of hips or fractures).
• Observe the feet whether normal or bent inwards and downwards or out wards or up wards (club feet).
• Observe the soles for lines (creases) whether deep (normal baby), faint or absent (LBW).
• Count and inspect the toes for any extra toes or fused toes, complete or incomplete nails.

h) Back and Anus:
• Inspect the back for any congenital defect like spina bifida, meningocele, myelomenigocele.
• Observe for anal opening (imperforate anus or any others). Absence of anal opening is serious anomaly.

i) Length and breadth:
   a) Take length (refer practical 3 for procedure of taking length) whether it is between 11 – 20 inches/ 45 – 50 cm (normal baby) or below (LBW).
   b) Take the weight (refer practical 3 for procedure of taking weight) and see whether it is between 2500 – 4000 gm (normal baby) and 2500 gm or below (LBW).

j) Reflexes:
While examining the baby, simultaneously observe the baby for the following reflex Responses:

   a) Sucking Reflex: - Observe the baby whether it is sucking on fist, finger, nipple or anything else that has come in to the mouth of the infant. This is the sucking reflex response.
   b) Rooting Reflex: - Gently strike the baby’s cheek with the tip of your finger; it turns its head in that direction in search of nipple. This is the rooting reflex response.
   c) Swallowing Reflex: - Put the baby on breast (usually it is put on breast soon after birth) or place little expressed breast milk with a dropper or spoon far back on the baby’s tongue. The baby swallows it. This is the swallowing reflex response.
   d) Gagging Reflex: - Note if the baby gags in case the mouth is too full to allow swallowing. This is the gagging response.
   e) Coughing Reflex: - Observe the baby as it may sneeze or cough to remove small obstructions such as mucus or gauze fibers from the nose or throat. This is the sneezing or coughing reflex response.
f) **Grasping Reflex**: - Place your one finger in the baby’s hand and see if it holds the finger momentarily. This is the grasping reflex response.

g) **Moro Reflex**: - Observe the baby when a loud noise is made or its sheet is suddenly moved, there is drawing up of the legs and bringing the arms upwards and forward. This is the Moro or startle reflex response.

h) **Tonic neck Reflex**: - Position the baby on its back with head turned to one side and observe for partial or complete extension of the arm and leg on the side it is facing and flexion of arm and leg on the opposite side. This is the tonic neck reflex response.

i) **Step or dance Reflex**: - The infant makes stepping movements when held in up right position. The reflex disappears by 6 months of age.

j) **Babinski’s Reflex**: - The toes flare open when the lateral planter is stroked. This reflex disappears by the end of first year.

**B) Late examination:**

The late examination means the examination of neonate within 18 – 72 hours of birth. Now we shall discuss the late examination of neonate in the following paragraphs. The purposes of conducting late examination are –

1) To assess adjustment of newborn to independent life in terms of temperature maintenance, respiration and feeding.

2) To assess breast feeding.

3) To find out about passage of meconium and urine.

4) To detect occurrence of any superficial infection.

5) To educate the mother about newborn care.

**Look for**

1) **General appearance:**

   a) Skin: - Observe the skin for colour whether pink (normal), yellow (jaundice) or pale (anaemia) and any boils (infection).

   b) Activity: - Observe whether baby is active (normal) or inactive (jaundice or hypoglycemic).

2) **Head, face, neck and arms:**

   a) Inspect head for shape whether moulding and caput have reduced or relieved.

   b) Feel the head for overriding whether reduced or relieved.

   c) Inspect the face whether any swelling, if it was present at birth, is reduced or relieved.

   d) Observe the eyes for sticking of eye lids due to eye discharge (eye infection) and inspect the conjunctiva for yellowish-ness (jaundice), redness (infection), red patch or ring (sub conjunctival bleeding), if it was present at birth, is reduced or relieved.
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3) **Chest and abdomen:**
   a) Inspect the breast nodules for engorgement, some enlargement occurs on 3rd or 4th day.
   b) Observe and count the respiration and heart rate whether normal or not.
   c) Examine the abdomen whether soft or distended.
   d) Inspect the cord stump for redness, absence of discharge (healthy) or presence of discharge (infection).

4) **Genitalia, Legs and back:**
   a) Examine the genitalia whether it is clean or not, labia/scrotum is reduced to normal size if it was large at birth.
   b) Examine the legs and back for any abnormality.

5) **Temperature:**
   Take axillary temperature. Axillary temperature below 36.5°C (Hypothermia) and above 37.5°C (hyperthermia) are abnormal.

6) **Weight:**
   a) Take weight.
   b) Ask the mother whether baby passed urine and stool or not. And also baby taking breast feed well or not.

7) **Recording:**
   Record the following in the baby’s health card.
   a) Date and time of examination.
   b) Skin colour and condition, activity, vital signs, weight, urine and stool, acceptance of feeds, other findings indicating baby’s recovery from effects of birth and others indicating infection etc.
   c) Treatment given if there is eye or cord infection.
   d) Any instructions given to mother and family.
   e) If referred.

**2.6 NURSING CARE OF NEONATE**

a) **Establishment and maintenance of respiration:**
   - Assess the cry of the baby (failure to cry may be due to obstruction of the air passage with mucus).
   - Suck the oro-pharynx and naso-pharynx with bulb syringe or a catheter connected to suction as soon as the infants head is delivered.
   - Position on the back or the abdomen with the head lowered 15 – 30° to facilitate mucus drainage.
   - Keep the newborn warm.
b) **Stabilization and maintenance of body temperature:**

- Assess the body temperature of newborn.
- Dry the hair & skin with warm soft dry towels.
- Drape the neonate in blankets or put the neonate in heated environment.
- Don’t give bath until body temperature is normal and stable.
- Don’t expose the newborn.
- Dress the infant and cover with blankets.
- Head can be covered with cap and feet with booties, if heat loss is a problem.

c) **Provision of optimal nutrition:**

- Feed baby within one hour of delivery.
- Explain mother regarding importance of breast feeding & teach breast feeding technique.
- Feed child on demand for 2 – 3 days and thereafter burp the newborn after breast feeding.
- Advice parents and relatives to feed neonate exclusively with breast milk.

d) **Prevention of infection and injury:**

- Keep the baby’s environment clean and tidy.
- Hand-wash before handling the baby.
- Use clean clothes, linen and equipments only.
- Give injection Vit-K if prescribed.
- Assess the condition of umbilical cord, wash umbilical area gently with water and dry well. Apply any solution to promote drying and prevent growth of organism depending on policy of institution.
- Teach parents to tie diaper below the cord.
- Give baby bath in the midmorning. Give special attention to groin, axilla and anal regions.
- Change napkin whenever soiled.
- Don’t apply powder in excess on skin.

e) **Establishment of mother child bonding:**

- Place the baby over the mother’s abdomen immediately after delivery.
- Promote rooming-in by advising mother to put the baby near her.
- Assess maternal attaching behaviour by watching for gazing, kissing and holding the infant.
- Advice mother to talk to the infant.
- Assess infant attachment behaviour like sucking, crying, body and eye movements.
2.7 ACTIVITIES AND GUIDELINES

Activity 1
Select a neonate weighing 1800 to 2000 grams and perform assessment as per guidelines and show to your supervisor.

Guidelines
Follow the given guidelines to record your assessment findings.

Place of examination .................................................................

1) Identification data:
   Name ............................................. Age ................. Sex ............
   Date of Birth ........ Time of Birth ............ Birth Weight.....................
   Gestational Age .................................................................
   Time of examination from ................. to ......................
   Category according to birth weight and gestational age .............

2) Head to Toe examination
3) Newborn Care

<table>
<thead>
<tr>
<th>Type of Care</th>
<th>Procedure</th>
<th>Observation and Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td></td>
<td></td>
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<tr>
<td>Cord</td>
<td></td>
<td></td>
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<tr>
<td>Eye</td>
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</table>

Signature of the Assessee/Examiner.................................

Activity 2
Repeat the above activity with assessment done on baby chosen by you.

2.8 LET US SUM UP

In this practical you have learnt about the examination and care of term baby at birth and after 24 hours. The main focus is given on head to toe examination that includes somatic and physiological measurement, general appearance and assessment of neurological reflexes. The care of the newborn is explained under two sub-sections. The first sub-section is on early care of newborn and second sub-section is related to maintenance of temperature, breast feeding, care of skin, eye and umbilical cord. We have discussed nursing care of neonate which focused on establishment of respiration, providing thermo-neutral environment and maintaining body temperature, promotion of exclusive breast feeding, maternal infant bonding and providing information to parents about various components of new born care.
3.0 OBJECTIVES

After completing this practical you should be able to:

• Explain purpose of assessment;
• Perform initial assessment of a newborn;
• Assess gestational age of the newborn;
• Perform first day examination; and
• Detect any abnormality.

3.1 INTRODUCTION

New born period is a very crucial period. About half of the infections take place in the Newborn period with most of deaths taking place in 1st week of life. Therefore, as a neonatal nurse you have to take special care of the newborn to prevent mortality which can be done by thorough assessment of the newborn at the time of birth and subsequently. The period of first 24 hours being more crucial.

In this practical you will learn to perform examination of the newborn, initial assessment and gestational assessment. You will also learn to perform examination from day one (first 24 hours) to examination at discharge.

3.2 ASSESSMENT OF NEWBORN

One of the basic purpose of assessment is to observe for adjustment of newborn to extra uterine life and identify the normal expected deviations which may at times hinder smooth progress towards early postnatal period. The assessment includes thorough maternal and perinatal history, examination of records and head to toe examination. Physical assessment can be divided into four phases:

• Initial examination
• Assessment of Gestational age
• First day (within 24 hours) detailed examination
• Examination at discharge
3.2.1 Initial Assessment

Quick but thorough clinical screening is essential to identify any life threatening congenital anomalies at birth and birth injuries. The cut end of the umbilical cord should be inspected for the number of vessels. Normally there are two umbilical arteries and one umbilical vein. The presence of a single umbilical artery is associated with internal congenital malformations in 15 to 20 per cent of cases. The commonly associated malformations include esophageal atresia, Imperforate anus and genito-urinary anomalies. Single palmar crease (Simian crease) has increased association with additional anomalies including Down Syndrome. The face and head should be closely observed for any asymmetry and dysmorphic features. While crying, if the angle of the mouth and the mandible are pulled down and the infant has asymmetric crying it is indicative of hypoplasia of the depressor angularis oris muscle. This is a useful marker of associated cardiovascular anomalies and congenital dislocation of hips. The infant should be examined for location and patency of all the orifices because anomalies are frequently encountered around the orifices. The oral cavity must be examined to exclude cleft palate. The Patency of the esophagus should be checked by passing a stiff rubber catheter into the stomach in the following conditions:

i) Small-for-dates baby
ii) Single umbilical artery
iii) Polyhydramnios
iv) Excessive drooling of saliva

If there is no esophageal atresia and the catheter has reached the stomach, gastric contents should be aspirated. If gastric aspirate exceeds 20 ml in volume it is strongly suggestive of high intestinal or duodenal atresia. The anomalies are concentrated over the mid-line areas in the front and back e.g. spina bifida, menigomyelocele, ambiguous genitalia, hypospadias, exomphalos, cleft lip, cleft palate etc. The abdomen should be palpated for masses and heart examined for its position and any displacement of heart towards the right side in association with respiratory difficulty and resuscitation problem, is suggestive of either diaphragmatic hernia or pneumothorax on the left side.

3.2.2 Assessment of Gestational Age

The gestational age and birth weight of newborn are important indicators not only to determine the morbidity and mortality status in the first week of life but also provide guidelines for management. Classification of infants by birth weight and gestational age helps to predict mortality risks.

When a baby is born, 2 parameters should be considered.

1) Birth weight of the baby (normally babies weigh more than 2500 gms)
2) The gestation or the maturity of the baby
   Pre-term : < 37 completed wks
   Term : 37 to 41wks+6 days
   Post-term : > 42 completed wks

Note: The baby is 40 wks on the EDD (Expected Date of Delivery).
Depending upon the weight and gestational age the newborn can be classified to one of the following groups as explained below:

**Classification of a baby**

We classify the babies to determine the risk of problems. The babies who are preterm as well as SGA are more at risk than the baby who is only preterm. We classify as:

- **Appropriate for Date (AFD) of Gestational Age (AGA)**
  The babies whose birth weight is between 10th and 90th percentile can be presumed to have grown at a normal rate for their period of gestational age.

- **Small For Date (SFD)**
  The babies whose birth weight is less than 10th percentile for the period of their gestational age.

- **Large for date**
  The babies whose birth weight is more than 90th percentile for the period of their gestational age.

Newborn baby can be LBW because of two reasons:

1) Preterm
2) Intrauterine growth retardation (IUGR).

The babies are defined as small for gestational age (SGA), if their weight is below the 10th percentile on the chart, for that gestational age. Two thirds of our LBW neonates fall in this category.

**Note:** At times, a LBW neonate may be both preterm as well as SGA.

**Refer Fig. 3.1** for classification of baby according to intrauterine growth chart.

Gestational age of a fetus or of a newborn can be assessed currently by three different methods: the mother’s menstrual history, prenatal ultrasonography and the postnatal maturational examination

**Identification of a preterm baby**

The gestational age of a baby can be estimated by LMP, antenatal sonography (especially 1st trimester), however accurate estimation is possible by doing a
detailed physical and a neuromuscular examination. An illustrated scoring system like, Expanded Ballard Score (EBS) can be used for this purpose. The following are some of the parameters used in gestational assessment:

**A) Physical maturity**

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

**Hair and Lanugo:**

Hair are wooly and fuzzy. The back of the preterm babies 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 (Fig 3.2).

**Breast Nodule:** Breast nodule measures less than 5mm in preterm neonates and 5 mm or more in term babies (Fig. 3.3).

**Sole Creases:** Anterior one third of the sole reveals a transverse skin crease in preterm neonates and in term neonates they are present over the anterior two-third area. (Fig. 3.4)
**External Genitalia:** In preterm males, the scrotum does not have rugae and testes are not descended into the scrotum. In female infants, the labia are widely separated, not covering the labia minora, resulting in the prominent appearance of the clitoris (Fig. 3.5).

![Fig. 3.5: External genitalia-male and female](image)

Assessment of maturity of the neonate is fairly reliable on the basis of physical characteristics. But they are of limited value to assess the gestational age in less than 36 weeks of maturity.

**B) The neurological characteristics** are more reliable for the precise assessment of maturity, the neurological assessment is performed based on four fundamental observations, i.e. muscle tone, joint mobility, certain automatic reflexes and fundus examination.

1) **Muscle tone** of the newborn baby is assessed by three parameters, i.e. posture or attitude, passive tone (popliteal angle and scarf sign) and active tone (recoil).

2) **Joint mobility** is less in preterm babies. A term baby has more flexed and relaxed joint. The degree of flexion at ankle and wrist (square - window) is limited due to stiffness of joint in early gestation.

3) **Automatic reflexes** like Moro reflex, pupillary response to light, blink response to glabellar tap, grasp response, rooting reflex with coordinated sucking efforts are assessed to detect the specific age of gestational maturity based on appearance of these reflexes.

4) The **fundus examination** for disappearance of anterior vascular capsule of the lens is done to assess the gestational age.

**New Ballard Score for Gestational Age Assessment**

The Ballard Maturational Assessment, Ballard Score, or Ballard Scale is a commonly used technique of gestational age assessment.

The new ballard Scale, a revision of the original scale, can be clinically used with newborns as young as 20 to 44 week of gestation. It has six physical and six neuromuscular characteristics. Each sign has a number score from -1 to 5, and the cumulative score relates with a maturity rating from 20 to 44 week of gestation. It also includes signs of extremely premature newborns, such as fused eyelids, imperceptible breast tissue, sticky friable breast tissue, sticky friable transparent
skin, no lanugo, and square window (flexion of wrist) angle of greater than 90 degrees. The examination can be performed at a postnatal age less than 12 hours after birth.

The scoring relies on the intra-uterine changes that the fetus undergoes during its maturation. Whereas the neurological criteria depend mainly upon muscle tone, the physical ones rely on anatomical changes. The preterm neonate (less than 37 weeks of age) is in a state of physiological hypertonia. This tone increases throughout the fetal growth period, meaning more premature baby would have lesser muscle tone.

**Physical Characteristics**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Technique for assessment</th>
<th>Observation and characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Skin</td>
<td>Observe and feel the skin. For scoring purposes, the square which describes the infant most closely should be selected.</td>
<td>Maturation of fetal skin involves the development of its intrinsic structures concurrent with the gradual loss of its protective coating, the vernix caseosa. Hence, it thickens, dries and becomes wrinkled and/or peels, and may develop a rash as fetal maturation progresses. Before the development of the epidermis with its stratum corneum, the skin is transparent and adheres somewhat to the examiner’s finger. Later it smoothes, thickens and produces a lubricant, the vernix, that dissipates toward the end of gestation.</td>
</tr>
<tr>
<td>2. Lanugo</td>
<td>Observe the upper and lower areas of the infant’s back for relative amount of lanugo</td>
<td>Lanugo is the fine hair covering the body of the fetus. In extreme immaturity, the skin lacks any lanugo. It begins to appear at approximately the 24th to 25th week and is usually abundant, especially across the shoulders and upper back, by the 28th week of gestation. Thinning occurs first over the lower back, wearing away as the fetal body curves forward into its mature, flexed position. Bald areas appear and become larger over the lumbo-sacral area. At term, most of the fetal back is devoid of lanugo, i.e., the back is mostly bald. Variability in amount and location of lanugo at a given gestational age may be attributed in part to familial or national traits and to certain hormonal, metabolic, and nutritional influences. For example, infants of diabetic mothers characteristically have abundant lanugo on their pinnae and upper back until close to or beyond full-term gestation.</td>
</tr>
<tr>
<td>3. Plantar creases (Fig. 3.6)</td>
<td>Observation of the creases on the sole of the foot. Measurement is done by placing the infant’s foot on a metric tape measure and noting the distance from the back of the heel to the tip of the great toe.</td>
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![Fig: 3.6 sole crease](image)

This item pertains to the major foot creases on the sole of the foot. The first crease appears on the anterior sole at the ball of the foot. Very premature and extremely immature infants have no detectable foot creases. To further help define gestational age of these infants, measuring the foot length or heel-toe distance is helpful. For heel-toe distances less than 40 mm, a minus two score (-2) is assigned; for those between 40 and 50 mm, a minus one score (-1) is assigned.

<table>
<thead>
<tr>
<th>4. Breast (Fig. 3.7)</th>
<th>The examiner notes the size of the areola and the presence or absence of stippling (created by the developing papillae of Montgomery). The examiner then palpates the breast tissue beneath the skin by holding it between thumb and forefinger, estimating its diameter in millimeters, and selects the appropriate square on the score sheet.</th>
</tr>
</thead>
</table>

![Fig.3.7: Breast nodule](image)

The breast bud consists of breast tissue that is stimulated to grow by maternal estrogens and fatty tissue which is dependent upon fetal nutritional status. Under- and over-nutrition of the fetus may affect breast size variation at a given gestation.

<table>
<thead>
<tr>
<th>5. Eye/Ear</th>
<th>Assessment includes palpation for cartilage thickness, then folding the pinna forward toward the face and releasing it. The examiner notes the rapidity with which the folded pinna snaps back away from the face when released, then selects the square that most closely describes the degree of cartilagenous development. In such infants, the examiner notes the state of eyelid development as an additional indicator of fetal maturation. The examiner places thumb</th>
</tr>
</thead>
</table>

The pinna of the fetal ear changes its configuration and increases in cartilage content as maturation progresses. In very premature infants, the pinnae may remain folded when released. The slightly more mature infant will have one or both eyelids fused but one or both will be partly separable by the light traction of the examiner’s fingertips. These findings will allow the examiner to select on the score sheet a minus two (-2) for slightly fused, or minus one (-1) for loosely or partially fused eyelids.
and forefinger on the upper and lower lids, gently moving them apart to separate them.

6. Genitals-
   Male
   (Fig. 3.8)

   Observe and palpate the testicles

   Fig. 3.8: Male genitalia

   The fetal testicles begin their descent from the peritoneal cavity into the scrotal sac at approximately the 30th week of gestation. The left testicle precedes the right and usually enters the scrotum during the 32nd week. Both testicles are usually palpable in the upper to lower inguinal canals by the end of the 33rd to 34th weeks of gestation. Concurrently, the scrotal skin thickens and develops deeper and more numerous rugae.

   Testicles found inside the rugated zone are considered descended. In extreme prematurity the scrotum is flat, smooth and appears sexually undifferentiated. At term to post-term, the scrotum may become pendulous and may actually touch the mattress when the infant lies supine.

7. Genitals-
   Female
   (Fig. 3.9)

   To examine the infant female, the hips should be only partially abducted, i.e., to approximately 45° from the horizontal with the infant lying supine.

   Fig. 3.9: Female genitalia

   In extreme prematurity, the labia are flat and the clitoris is very prominent and may resemble the male phallus. As maturation progresses, the clitoris becomes less prominent and labia minora become more prominent. Nearing term, both clitoris and labia minora recede and are eventually enveloped by the enlarging labia majora.

### Neuromuscular Examination

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Technique of assessment</th>
<th>Observation and Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Posture</td>
<td>To elicit the posture item, the infant is placed supine. Gentle manipulation (flex if extended; extend if flexed) of the extremities will allow the infant to seek the baseline position of comfort. Hip flexion without adduction results in the frog-leg position as depicted in posture square #3. Hip adduction accompanying flexion is depicted by the</td>
<td>Total body muscle tone is reflected in the infant’s preferred posture at rest and also resistance to stretch of individual muscle groups. The preterm infant primarily exhibits unopposed passive extensor tone, while the infant approaching term shows progressively less opposed passive flexor tone.</td>
</tr>
<tr>
<td>Assessment of Newborn</td>
<td>acute angle at the hips in posture square #4 (Refer Fig. 3.13). The figure that most closely depicts the infant’s preferred posture is selected.</td>
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<tr>
<td>2. Square Window (Fig. 3.10)</td>
<td>The examiner straightens the infant's fingers and applies gentle pressure on the dorsum of the hand, close to the fingers. Measure the angle of flexion. The appropriate square on the score sheet is selected.</td>
<td></td>
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<tr>
<td>3. Arm Recoil</td>
<td>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, and the appropriate square is selected on the score sheet. The extremely pre-term infant will not exhibit any arm recoil. Square #4 is selected only if there is contact between the infant’s fist and face. This is seen in term and post term infants.</td>
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<tr>
<td>4. Popliteal angle (Fig. 3.11)</td>
<td>With the infant lying supine, and with diaper 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. 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. An angle of less than 90 degree has score of 5</td>
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<tr>
<td>5. Scarf Sign (Fig. 3.12)</td>
<td>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 and the thumb of the examiner’s other hand is placed on the infant’s elbow. The examiner gently pulls the elbow across the chest, feeling for resistance to extension of posterior shoulder.</td>
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<tr>
<td>6. Heel to Ear</td>
<td>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.</td>
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</table>

This maneuver tests the passive tone of the flexors about the shoulder girdle. The point on the chest to which the elbow moves easily prior to significant resistance is noted. Landmarks noted in order of increasing maturity are: full scarf at the level girdle flexor muscles of the neck (-1); contralateral axillary line (0); contralateral nipple line (1); xyphoid process (2); ipsilateral nipple line (3); and ipsilateral axillary line (4).

The examiner feels for resistance to extension of the posterior pelvic girdle flexors and notes the location of the heel where significant resistance is appreciated. Landmarks noted in order of increasing maturity include resistance felt when the heel is at or near the: ear (-1); nose (0); chin level (1); nipple line (2); umbilical area (3); and femoral crease (4).
Assessment of Newborn Neuromuscular Maturity

Fig. 3.13: New Ballard Scale for assessment of Maturity

Summary of the New Ballard Score

The sum of all 12 criteria represents the neuromuscular and physical maturation of the fetus. When compared to the grid on the score sheet, the score denotes the infant’s gestational age by maturational examination.

The maturational assessment of gestational age is a clinical tool that may be influenced by certain biological factors. A working knowledge of the assessment tool includes a knowledge of the standardized method for performing the
Techniques in Newborn and Infant Care

examination, and an awareness of those intrauterine factors that influence the neuromuscular and physical maturational rates of the fetus. This approach increases the accuracy and validity of the tool and facilitates the examiner’s understanding and interpretation of the score (Fig. 3.13).

3.2.3 First Day (within 24 hour) Examination

The purpose is to record certain measurements, to detect any left over anomaly, to inquire about feeding behavior and passage of first meconium and urine etc.

1) Vital Signs

Vital signs are recorded when baby is quiet. Record temperature to detect cold stress and hypothermia. Temperature is measured by axillary method. The axillary temperature is slightly lower than core temperature i.e. 0.2ºF. The core temperature is usually between 36.5 to 37.5ºC.

Both heart rate and respiratory rate should be counted for full one minute to detect physiological status. Heart rate is around 120-140 beats per minute. Respiratory rate is 40-60 breaths per minute. Breathing is periodic and irregular. Average blood pressure in a term baby is around 60/40mmHg.

2) Physical Measurements

- Length:
  Take length using tape measure to assess crown heel length. Average length at birth is 47-50 cm.

- Weight:
  The normal birth weight varies between 2800-3200 gms. The first weight should be taken soon after birth and if not taken than within first 12 hours of birth.

- Head Circumference:
  The average head circumference is between 33-35.5 cm (13-14 inches). Soon after birth the measurement may be less than the average due to moulding process in vaginal delivery. By second and third day the head contour and size becomes normal.

  In small hydrocephalic babies head circumference is more than 3 cm bigger than the chest.

- Chest Circumference:
  The average chest circumference is 30.5-33 cms (12-13 inches). The head circumference is usually about 2-3 cm (1 inch) greater than chest. At birth because of moulding both the circumference may appear equal.

3) Head to Toe Assessment

- General behavior:
  Posture, color, activity and general alertness sleep patterns, crying etc. should be assessed carefully.

  The behavior of the newborn demonstrates neurological status. In general the neonate appears drowsy, calm, quiet and sleepy most of the day and night time. Note sign of irritability and degree of alertness. Assess the level of satisfaction
after feeding, comfortable with rocking and cuddling, is awakened by loud noise, disturbed by any stimuli.

**Fig. 3.14: Flexed posture**

- **Posture:** Most of the full term neonates are born in a vertex presentation with head flexed, chin resting on the upper chest, arms flexed, hands clenched, legs flexed at knees and hips and feet dorsiflexed. The vertebral column is also flexed (Fig. 3.14).

**Fig. 3.15: Cry and activity at birth**

- **Cry:** Record and report if newborn cried immediately after birth. Listen whether cry is loud and strong (normal baby), weak or whiny (low birth weight baby) or absent (asphyxiated baby) (Fig. 3.15).

- **Activity:** Observe whether baby is active (normal baby), less active or in active (low birth weight/asphyxiated).

- **Skin:** Texture of the skin i.e. velvety, smooth and good turgor indicates healthy skin. The colour of the skin is usually pink to red, by second to third day it turns to natural tone and is dry and flaky. The colour of the skin however, depends on the racial and familial background. Babies born by breech presentation, assisted deliveries may have ecchymosis or petechia caused by birth trauma. Lanugo it is the presence of fine hair on the body and is present in term infant. Check for “vernix” distribution all over the body and in skin folds. As baby comes to term it decreases.

Some normal variations observed in newborn that do not require any treatment are:

- **Milia:** These are distended sebaceous glands seen as white small papules on cheeks, chin and nose.

- **Miliaria or sudamina:** These are distended sweat glands seen as small vesicles on face.

- **Erythema Toxicum:** The pink, papular rashes with vesicles superimposed are seen on thorax, back, buttocks, and abdomen. These rashes appear in 24-48 hrs after birth and get resolved after several days.
Harlequin Colour Change: These appear as clear demarcated change in colour as infant lies on side. Lower half of the body becomes pink and upper half is pale.

Mongolian Spots: These are deep blue pigmented irregular patches seen on gluteal and sacral region.

Telangiectatic Nevi: These are flat, deep pink localized areas seen in back of neck.

After assessing the neonate for appearance and behavior continue with head to toe examination as given below:

- **Head**
  
  **Inspect the head for:**
  
  **Hair** - whether present or not and if present, note the colour and texture of hair. Hair are silky and black in appearance in term infant and woolly and fuzzy in preterm infant.
  
  **Shape** - whether round (normal), oval (slight moulding or a small caput formation in normal labour), long (excessive moulding or a large caput formation in prolong labour) or asymmetrical.
  
  **Size** - whether small (microcephaly), medium (normal), large (hydrocephaly or prematurity) or unusual (anencephaly).

Observe for caput succedaneum and cephalhematoma (Fig.3.16 and Fig. 3.17). Palpate the skull for sutures and fontanels, noting size, moulding or any abnormal closure. The sutures feel like cracks in between the skull bones whereas, fontanels feel like wide spots at the junction of the sutures. The anterior fontanel is diamond shaped and posterior is triangular. The fontanels feel flat, firm and well demarcated, at times pulsation can be felt at the anterior fontanel.
Assess the degree of head control, the head lag is a normal finding in the newborn, but has ability to control the head in certain positions. In ventral suspension, head is held in straight line with the spinal column. When put on abdomen can lift the head slightly and turn it from side to side.

- **Face**
  Observe the face whether triangular (normal), round being swollen (prolonged labour or hemolytic disease) or asymmetrical and eye brows and eyelashes present (normal baby) or not (low birth weight). While crying, if the angle of the mouth and the mandible are pulled down and the infant has asymmetric crying, it is indicative of hypoplasia of the depressor angularis oris muscle. This is a useful marker of associated cardiovascular anomalies and congenital dislocation of hips.

- **Eyes**
  Observe the eyes whether, normal or slanting, normally spaced or not (chromosomal abnormality), opened or closed. Observe for any squint (normal) and subconjunctival bleeding (in the form of red patch or ring).

  Eyes appear edematous for the first two days after delivery. Infant keeps eyes tightly closed. Tears may be present at birth. Any purulent discharge is a sign of infection (Ophthalmia neonatorum). Assess the color of sclera that appears whitish, bluish and clear. Cornea is examined for any haziness. Nystagmus or strabismus is normally seen at birth.

- **Ears**
  Ears should be examined for formation, size, shape, sufficient cartilage, position (low set ears indicate chromosomal anomaly), Skin tag and periauricular sinus etc.

  The top of pinna lies in the horizontal plane to the outer canthus of the eye. The pinna is seen flat against the side of the head due to well formed cartilage. Pinna is firm, cartilage felt along with edges. Draw an imaginary line backward from outer corner of eye towards the pinna. If more than 90% of the ear is below this line, it is said to be a low set ear. Instant recoil of ear pinna is present in term baby (Fig. 3.18).

  The auditory ability of the neonate can be assessed by eliciting startle reflex. Absence of startle reflex in response to solid noise may indicate loss of hearing and should be reported.

- **Nose**
  The nose appears flat after birth. Observe the nose for shape and size. Normally it is flat except at the tip which is prominent. Nasal passage is patent at birth.

**Fig. 3.18: Ear cartilage in preterm and term neonate**
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- **Mouth and Throat**

The anomalies are commonly seen around orifices. Any gross anomaly would be evident like cleft lip and palate.

Some abnormalities seen in mouth and throat include presence of cleft lip, cleft palate (either single or in combination, unilaterally or bilaterally) (Fig. 3.19), posterior (backward) displacement of tongue (glossoptosis), abnormal smallness of the jaw (micrognathia), indicative of Pierre-Robin syndrome.

Presence of white adherent patches on tongue, palate and buccal surfaces means presence of candidiasis (oral thrush).

Excessive salivation, drooling, inability to pass nasogastric tube, respiratory distress and choking with cyanosis are suggestive of esophageal atresia with tracheoesophageal fistula.

**Sucking and rooting reflexes** are explained along with neurological assessment.

- **Neck**

Neck should be examined for mobility, fracture clavicle, stiffness, hyperextention, torticollis (spasmodic, unilateral contraction of neck muscle resulting in head tilted to one side), any cyst or mass (thyroglossal cyst, cystic hygroma) and webbing.

Palpate lymph nodes in the neck and postauricular area. Also check for range of motion of the neck.

- **Chest**

A look at the chest of the neonate shows circular shape because of equal anteroposterior and lateral diameter.

Development of nipple and breast tissue should be checked to assess gestational age. Inspect nipples whether well formed (normal baby), poorly formed or absent (pre term baby). Palpate around one nipple to feel for small nodule of breast tissues whether present (normal baby) or absent (pre term baby). Measure the diameter of areola, it is 5-10 mm in term baby (Fig. 3.20).

Auscultate the chest for equal air entry in both the lungs.

Check for the heart sounds, if there is extra murmur or extra beat. Observe the infant for cyanosis when cries.
• Abdomen

Abdomen is soft, symmetrical, slightly round and moves synchronously with chest in movement. In premature neonates abdomen is distended due to poor muscle tone. If the abdomen is concave, it is indicative of diaphragmatic hernia. Check for exomphalos or omphalocele which is protrusion of the intestinal organs outside the abdomen. Inspect the umbilical cord for two arteries and one vein.

Palpation of abdomen for liver, spleen or any lump. Liver edge is normally palpable, 2 cm below costal margins. Check for the pulsation of the femoral artery on both the legs.

• Genitalia

Genitalia Female

The labia majora covers the labia minora completely in full term babies. The vernix caseosa is present between labial folds (Fig. 3.21). A hymen tag is visible from the posterior opening of the vagina and disappears in several weeks. In the first week of life vaginal discharge is seen (Pseudomenstruation) that disappears by 2-4 weeks. Presence of any fecal discharge from vaginal orifice may be due to rectovaginal fistula.

Genitalia Male - The urethral opening is located at the tip of the penis, covered by prepuce. The scrotum is large, pendulous with dark pigmentation of the overlying skin. The testis can be palpated bilaterally in the scrotal sac.

Presence of urethral opening on ventral surface of penis (hypospadias), on dorsal surface of penis (epispadias), unpalpable testis in scrotum (true undescended testis), absence of testis masses in the scrotum, fluid in the scrotum (hydrocele), meconium from scrotum, ambiguous genitalia are some of the abnormal findings needing further assessment.
- **Anus**
Check for anal opening (imperforate anus and passage of meconium). Absence of anal opening is serious anomaly.

- **Back**

![Fig.3.22: a) Meningocele Fig. 3.22: b) myelomeningocele](image)

Inspect the back for any mass, dimple, tuft of hair indicating spina bifida occulta. Congenital defect like spina bifida, meningocele, meningomyelocele, anencephaly are usually detected during initial assessment (Fig. 3.22). Back to be checked for abnormal curvature of the spine.

- **Hips**
Examination of hips to be done to detect congenital hip dislocation. Positive Ortolani’s sign and symmetrical gluteal folds are indicative of the condition.

- **Extremities**
Extremities are examined for fractures, paralysis, range of motion and irregular position. Fingers and toes to be checked for missing digits, extra digits (polydactyly) or fused digits (syndactyly). Feet to be looked for structural or positional abnormalities mainly club foot (talipes equinovarus) (Fig. 3.23).

![Fig.3.23: Club foot](image)
Observe the foot for sole crease whether deep, faint or absent (pre term) and presence over the entire sole (term) (Fig. 3.24).

![Fig. 3.24: Sole crease](image)

4) **Neurological Assessment:** Neurological assessment is the most critical part of the newborn assessment. Most of the reflexes are examined while doing the head-to-toe assessment. Some general reflexes are assessed at the end as they disturb the infant and interfere with the examination.

- **Blinking or corneal reflex:** Blinking/closing of the eyes on appearance of sudden bright light. It persists throughout life.
- **Papillary reflex:** It is constriction of pupil in response to bright light and dilation upon removal of light. It persists throughout life.
- **Doll’s eye:** Inability of eyes to adjust immediately to the right or left turning of head. It disappears when fixation of eyes develops. If persists it indicates neurologic damage.
- **Glabellar reflex:** Tapping at glabella (bridge of nose) results in closing of eyes tightly.
- **Sneezing reflex:** It is spontaneous response of nasal passages to any irritation or obstruction. It persists throughout life.
- **Sucking reflex:** Sucking movements of circumoral area in response to stimulation or even without stimulation as during sleep. It is seen in infants.
- **Rooting reflex:** Turning of head by infant to the side of stimulation made on circumoral area, or cheek. It disappears by 3-4 months of age, but may appear throughout infancy.
- **Gag reflex:** Stimulation of posterior pharynx by food, tube (while doing suction, passing nasogatric tube) causes infant to gag. It persists throughout life.
- **Yawn reflex:** Attempt to inspire air in spontaneous response to decreased oxygen. It persists throughout life.

![Fig.3.25: Grasp reflex](image)
• **Grasping reflex:** It is flexion of hands and feet whenever the base of the digits is touched. Place your one finger in the baby’s hand, it holds the finger momentarily. This is the grasping reflex response (Fig. 3.25).

• **Babinski reflex:** It is hyper extension of toes and dorisflexion of hallux (great toe) when outer of foot is stroked upward from heel across ball. It disappears by first year of life.

• **Moros reflex:** Sudden movement or change in equilibrium of the neonate causes sudden extension and abduction of extremities and fanning of fingers. The index finger and thumb form ‘C’ shape. The movements are followed by flexion and adduction of extremities. Legs may weakly flex. Infant may cry. It disappears after 3-4 months of age (Fig. 3.26).

![Fig.3.26: Moros Reflex](image)

• **Startle reflex:** Sudden loud noise causes abduction of the arms with flexion of elbows. Hands are clenched. It disappears by four months of age.

• **Tonic neck Reflex:** Position the baby on its back with head turned to one side and observe for partial or complete extension of the arm and leg on the side it is facing and flexion of arm and leg on the opposite side. This is the tonic neck reflex response.

• **Dance or Step reflex:** Reciprocal flexion and extension of the legs when infant is held with soles touching the hard surface. It appears like walking movements. It disappears by 3-4 weeks, and is replaced by deliberate movements (Fig. 3.27).

![Fig.3.27: Dance reflex](image)
3.2.4 Examination at Discharge

Purposes of examination at discharge are:

- To assess adjustment of newborn to independent life in terms of temperature maintenance, respiration and feeding
- To detect any missed anomaly
- To assess breast feeding
- To detect occurrence of any superficial infection and
- To educate the mother about newborn care.

At the time of discharge from the hospital all neonates should be examined in detail to detect any missed anomaly and birth injury. A neonate who is feeding well on the breast, has warm and pink palms and soles and having no danger signs is a healthy infant. Mother should be advised during discharge about essential care of neonate, danger signs and need for follow up at regular interval.

3.3 ACTIVITIES AND GUIDELINES

Activity 1
Observe the first day examination of Newborn. Select a normal newborn and practice the first day examination. Record your findings.

Activity 2
Select a newborn weighing 1800-2000gm. Assess the gestational age and record your findings.

3.4 LET US SUM UP

In this practical you have learnt about examination of baby from head to toe. You also learnt about assessment during first 24 hours and at the discharge. Hope you will use this information in performing assessment of baby.
4.0 OBJECTIVES

After going through this unit, you should be able to:

- List principles of feeding;
- Describe feeding techniques in newborn and infants;
- Enumerate the equipments required for feeding with cup and spoon and tube (gavage);
- Help the mothers to perform the correct technique of breast feeding; and
- Perform the correct technique of tube feeding.

4.1 INTRODUCTION

Nutrition is a major concern of the mankind beginning from the time of conception and extending through the entire life span of the individual. Nutrients are necessary for maintaining growth of the baby. The illness and hospitalization has impact on nutritional intake of the child. There may be restriction of food items in certain illness e.g. nephrotic syndrome. It is the responsibility of the nurse to assist the child in maintaining or improving the level of growth and development and prevent problems of severe depletion/under nutrition/malnutrition.

In this practical section, you will learn about the breast feeding, naso-gastric/oro-gastric feeding and gastrostomy feeding.

4.2 PRINCIPLES OF FEEDING

- The neonatal reflexes such as sucking reflex and rooting reflex indicates newborn’s ability and readiness to feed. Sucking and swallowing reflex is coordinated at 34 weeks of gestation.
• The tongue protrusion reflex must not be mistaken for the infant’s refusal of food.
• The number of feedings decrease as the infant grows older.
• Infants need to satisfy their sucking urge.
• The effectiveness of feeding is influenced by environment and attitude of the care giver.
• Feeding technique should foster growth and development.
• It is much simpler and more logical to feed when the baby wants rather than when mother or clock dictates.
• Do not force the feed.

4.3 BREAST FEEDING

The health status of the child also determines the ability of the child to accept and retain feed. When the child is sick, appetite is often adversely affected. Breast milk is best for all babies whether healthy or sick, premature or low birth weight. It contains all the essential nutrients for normal growth and development of a baby from the time of birth to the first six months of life. Although breast feeding is natural and physiological, if the correct position and attachment is not maintained for breastfeeding, it may lead to sore nipple, refusal to feed and the feeling that there is not enough milk. This may lead to engorged breasts. It is essential to teach the mother to feed the baby on demand schedule. The demand schedule feeding facilitates meeting physiologic requirement of the baby. In this practical session, let us focus on procedure of breast feeding.

Procedure:
• Motivate mothers to breast feed their infants.
• Assist and teach the mother about the correct technique of breast feeding.
• Ask mother to wash her hands with soap and water and breast with wet soft cloth.
• Ask mother to take any position i.e. comfortable and convenient to her and her baby. She could sit down with the back well supported or lie down.

Fig. 4.1: Correct positions (a,b) and incorrect position (c)
- Ensure that the mother maintains proper position of baby while breast feeding (Fig. 4.1). The correct position is as follows:
  - Supporting whole of baby’s body
  - Baby’s head, neck and back are in same plane
  - Baby’s entire body facing the mother
  - Baby’s abdomen touches mother’s abdomen

- Ensure baby’s body faces mother and baby’s abdomen touches mother’s abdomen.

- Explain the mother that she should support her breast with the other hand by
  - putting her fingers below her breast
  - using her first finger to support the breast
  - putting her thumb above the areola
  - Not keeping her fingers near the nipple

- Ask mother to express a little milk on to her nipple then touch the baby’s lips with her nipple.

- Ask mother to wait until the baby’s mouth is opening wide and the tongue is down and forward.

- Ask mother to move the baby quickly on to her breast ensuring the nipple towards the baby’s palate and his lower lip below the nipple.

- Ensure that the baby is attached nicely on mothers breast. The signs of good attachment are
  - Baby’s mouth is wide open
  - Lower lip turned outwards
  - Baby’s chin touches mother’s breast and
  - Majority of areola is inside baby’s mouth (Fig. 4.2)
• Assess whether the baby is suckling and swallowing effectively by taking several slow deep sucks followed by swallowing and then pauses.

• Mother should feed the baby on alternate breast at each feeding as this ensures baby gets fore milk and hind milk also at each feed.

• Ask the mother to nurse infant for 5 – 10 minutes on each breast and then increase nursing time to 15 minutes. A feeding time of 15 – 20 minutes is usually enough for baby.

• Help the mother to break the suction by asking her to put a finger into the corner of infant’s mouth.

• Instruct the mother to burp infant by putting gently on the back or hold infant in upright position (Fig.4.3).

![Some different ways to hold a baby after breastfeeding](image)

Fig. 4.3: Burping the baby

• Help the mother to place infant on right side-lying position after feeding.

• Instruct the mother to observe for abdominal distention and regurgitation.

• Instruct the mother to continue breast feeding during diarrhoea as well as other illness. It helps the baby to get optimal nutrition and recover from the illness faster.

Remember

Correct positioning and attachment will ensure effective suckling and prevent sore nipples and breast engorgement.
4.4 FEEDING EXPRESSED BREAST MILK (E.B.M)

Ask the mother to empty her breasts with her hands by expressing breast milk, when the infant is unable to suck the breasts.

4.4.1 Indications

- To feed a low birth weight/ sick baby who cannot breast feed
- To feed a baby who has difficulty in coordinating suckling
- To relieve engorgement / blocked ducts / leaking breasts
- To feed a baby while he/she learns to suckle from inverted nipple
- To maintain the supply of breast milk when the baby or mother is ill
- To store breast milk for a baby when the mother goes out to work.

4.4.2 Procedure of Expression of Breast Milk

- Advise the mother to take warm milk before expressing breast milk.
- Ask mother to wash her hands thoroughly.
- Expression of breast milk can be done by hands or hand pump or electrical pump.
- Provide quiet place and ensure privacy.
- Make her sit comfortably and hold the container near her breasts.
- Warm the breast with wet warm towel and wrap it around the breast for 1 minute.
- Ask the mother to massage the breast gently towards the nipple and stroking the nipple and areola gently with two finger tips or gently rolling a closed fist over the breast.
- Ask her to put one thumb on her breast above the nipple and areola and her first finger on the breast below the nipple and areola, opposite the thumb.
- Ask her to support the breast with her remaining fingers.
- Ask her to press her thumb and first finger slightly inwards towards the chest wall.
- Ask her to press her breast behind the nipple and areola between her finger and thumb.
- Ask her to press and release repeatedly.
- Ask her to press the areola in the same way from the sides, to make sure that milk is expressed from all segments of the breast.
- Instruct her not to rub or squeeze the nipple.
- Instruct her to express one breast for at least 3 – 5 minutes until the flow slows and then express the other side, and then repeat both sides.
- Explain to her that to express adequate breast milk 20 – 30 minutes may be needed. Fluid intake, having the baby close before expression of breast milk may help her to have a good let down reflex.
4.4.3 Preparation of Container for Expressing Breast Milk

- Ask mother to choose a cup with wide mouth and a cover.
- Wash the cup with soap and water.
- Pour boiling water into the cup and leave it for few minutes so that the germs are killed.
- When ready to express milk, pour the water out of the cup.

4.4.4 Storage of Expressed Breast Milk

Expressed breast milk can be collected in a clean container and stored for 6 – 8 hours at room temperature and up to 24 hours in the fridge. Stored milk should not be boiled or directly warmed before feeding as it will reduce the protective properties.

4.4.5 Feeding with Cup and Spoon/Paladi

Expressed breast milk can be given either by cup and spoon/ paladi feeding or through nasogastric/orogastric /gastrostomy tube depending on the weight of the baby at birth and gestation of the baby.

Let us first see how to give expressed breast milk by cup and spoon/ paladi.

Cup and Spoon/ paladi Feeding

This mode of feeding serves as an intermediate step between breast feeding and tube (gavage) feeding.

Indications

- To provide expressed breast milk to low birth weight babies with limited/ sluggish sucking and swallowing coordination
- Babies with gestation age 31 – 32 weeks who are not accepting direct breast feeds adequately
- Babies above 34 weeks or term babies in conditions where mother is unable to breast feed

Equipments

- Cup and spoon/paladai (a small bowl with a long pointed tip)
- Cotton napkin or towel

Procedure of Cup and Spoon Feeding

- Sterilize the cup and spoon or paladai by boiling in a closed clean pan for 20 minutes. After the water starts boiling, let the contents cool.
- Keep the cup and spoon or paladai ready for feeding.
- Instruct the mother to wash her hands and breasts before expressing breast milk.
- Help the mother to express the breast milk into the cup.
- Place the baby comfortably in the lap with the head slightly elevated.
• Place the cotton napkin around the neck to mop up the spillage.
• Take small amount of milk into spoon and pour directly into the side of the mouth.
• In case of paladai, place it at the lower lip of the baby in the corner of the mouth and let the milk flow into the baby’s mouth slowly.
• Wait till the baby swallows the milk before the milk is poured into the mouth again. When the baby has had enough, he will close his mouth and will not take any more.
• Give feeds two hourly. Start with a small quantity and increase by 1 – 2 ml till the desired volume is reached.
• Do not force feed the baby.
• Burp the baby.
• To estimate the intake, subtract the milk left in the cup from the original amount. The spilled milk should also be taken in to account.
• After use, wash the utensils thoroughly with soap and water and boil the utensils for 10 minutes and keep it in a covered container ready for next use.

Advantages
• Simple and effective method to feed babies who are not able to suck directly at the breast.
• Easy to practice and hygienic.
• Does not cause nipple confusion when the baby is ready to suck directly from the breast feeding.

Precautions
• Do not attempt to feed when the infant is crying.
• Low birth weight babies may take time to swallow. Never hurry such babies as they may aspirate the milk.
• If the baby is sluggish, do not insist on this method but switch over to gavage feeding.

4.4.6 Feeding with Tube (Gavage)

It is the administration of liquid nourishment through a tube that has passed via the nares/mouth, pharynx, oesophagus into the stomach or through an opening made on the abdominal wall.

Purposes
• To introduce liquid food into the stomach in order to meet nutritional needs
• To give the required amount of fluids safely
• To prevent the dangers of parentral feeding
• To avoid overloading of stomach
• To provide nutrition when sucking and swallowing reflexes are weak or absent
Indications

- Premature infant who is unable to suck or swallow
- Small for date infants who become fatigued
- Congenital anomalies e.g. cleft palate
- Respiratory distress
- Severe malnutrition
- Altered sensorium/level of consciousness
- Unable to retain feed e.g. vomiting

Contraindications

- Gastric surgery
- Tracheo oesophageal fistula
- Paralytic fistula

Types of Tube Feeding

Based on the route of insertion and method of administration, it is divided as follows:

Naso-gastric tube feeding: A tube is passed through the nose, pharynx and oesophagus into the stomach. It is also called as nasal feeding.

Oro-gastric feeding: A tube is passed through the mouth and oesophagus. So the food reaches the stomach.

Gastrostomy tube feeding: Giving a liquid through a tube which is introduced into the stomach through the abdominal wall is called gastrostomy feeding.

Methods of Administration

- Continuous feeding method: The gravity flow of fluid by an infusion pump.
- Intermittent feeding method: feeding given periodically.
- Bolus feeding method: prescribed amount of fluid is poured slowly into the barrel of a syringe attached to the end of the tube. The fluid flows by gravity into the stomach.

Equipments

- Naso-gastric tube (size 5 – 6 Fr for babies less than 2000gm and 8Fr for more than 2000gm)
- Clamp
- Sterile water
- Appropriate size syringes
- Clean closed container
- Tape and scissors
Procedure for insertion of feeding tube

- Wash hands thoroughly.
- Position baby on right side or in a supine position with head elevated. Baby can also be held in a sitting position in the mother’s arms.
- Select the size of tube (size 5-6 Fr for the babies below 2000 gms and size 8 Fr for over 2000 gms).
- Estimate the length of the tube. For nasogastric route, start at the tip of the tube, measure from the bridge of the nose to the tip of the earlobe down to the tip of the xiphisternum (Fig. 4.4)
- Mark the tube with tape or maintain measurement with thumb and finger.
- For orogastric route, measure the distance between the angle of the mouth to the tragus of the ear and to xiphisternum.
- Add 1 cm to the estimated length of the tube and mark the tube with tape as this indicates the approximate distance the tube must be passed to enter the stomach.
- To insert an oro-gastric tube, hold the feeding tube 1 – 2 inches from the tip, use the natural bend of the tube to follow the natural curves of the mouth and throat.
- After lubricating with sterile water/ expressed breast milk, insert the tube in the mouth and towards the back of the throat, gently pushing it down the esophagus till it reaches the pre measured mark on the tube.
- Ensure that the tube is in the correct position by connecting the syringe to other end of feeding tube and gently aspirating the content which would appear like curdled milk, if the tube is in the stomach.
- Secure the tube by adhesive tape across the cheek.
- Observe the baby for choking, gasping or cyanosis during insertion of tube. Withdraw tube immediately if baby appears to be in any distress.

Procedure for giving oro-gastric tube feeding

- Ensure that the tube is in position before each feed by checking the mark on the tube.
- Check the residual gastric contents before giving the feed.
- If gastric residue is more than 20% of previous feed, with hold the feed.
• Administer the feed after removing the plunger from the barrel.
• Attach the barrel of the syringe with the feeding tube to allow the milk to flow down by gravity (Fig. 4.5).
• Do not force milk through the gastric tube by using the plunger.
• Hold the syringe 5-10 cm above the baby until the syringe is empty.
• It should take about 10-15 minutes for the milk to flow into the infant’s stomach.
• Do not leave the baby unattended during feeding. If the baby has breathing difficulty, cyanosis, vomiting: stop the tube feeding.
• Detach the syringe and rinse both the syringe and plunger in boiled and cooled water and leave it in a covered clean container for reuse.
• Cap the end of the gastric tube between feeds.

[Image]

Fig. 4.5: Gavage feeding

Precautions
• Check the position of the tube before each feed.
• Check the residual gastric contents before each feed in case of subsequent feeds.
• Do not force the milk down with the plunger.
• Use separate syringe for each baby.
• If syringe is reused, change it after a day.
• Observe the baby before, during and after feeding for abdominal distension, vomiting or regurgitation, poor tolerance to tube feeding.

Equipments for gastrostomy feeding
• 20 – 50 cc syringe
• Sterile water
• Warm feeding formula
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• Mackintosh and towel

**Procedure for gastrostomy feeding**

The method of gastrostomy feeding is same as tube (gavage) feeding. The other features are given below:

• The gastrostomy tube may be left opened and elevated to allow air to escape and decompress the stomach.
• Secure the tube in place and avoid excessive traction.
• Keep the area/skin around the gastrostomy clean and dry to prevent infection and irritation.
• Before feeding, place the mackintosh and towel on child’s abdomen.
• Attach tubing to 10 – 50 cc syringe.
• Hold the baby elevated.
• Elevate the syringe to 10 – 12 cms.
• Aspirate gently.
• Pour feed and allow flow with the help of gravity.
• Do not push or apply pressure.
• Feed for 20 – 30 minutes.
• At the end of each feed, irrigate with clear water.
• After feeds, the tube may be left unclamped and elevated to provide constant decompression.
• Record type, amount of feed and baby’s activity.
• After feed, keep the baby in fowler’s position or turned right.

4.5 **ACTIVITIES AND GUIDELINES**

**Activity 1**
Select a newborn in a postnatal ward and demonstrate the technique of breast feeding to mother.

**Activity 2**
Select a postnatal mother of low birth weight baby and help her to express breast milk.

**Activity 3**
Visit a nursery and practice the method of orogastric and naso gastric intubation and administer feeds as per schedule. Record the procedure.

**Activity 4**
Select a preterm baby getting gavage feeding. Insert the feeding tube and administer feeding. Record the procedure.

**Activity 5**
Observe a baby getting gastrostomy feeding, practice/perform the procedure and record.
4.6 LET US SUM UP

This practical dealt with the procedure of breast feeding, technique of expression of breast milk, technique of feeding with cup and spoon and tube feeding.

This practical presented you with a learning regarding the skills required for helping the mother to breast feed efficiently and effectively. Now you should be able to help the mother to express breast milk. You should also be able to feed the infant with cup and spoon or with tube feeding.
PRACTICAL 5  ADMINISTRATION OF 
MEDICATION AND 
INTRAVENOUS FLUIDS

Structure
5.0  Objectives
5.1  Introduction
5.2  Safety Measures and Possible Errors in Administration of Drugs
5.3  Drug Calculations
5.4  Routes for Administration of Drugs
  5.4.1  Factors for Determining Route
  5.4.2  Oral Route
  5.4.3  Parenteral Route
  5.4.4  Inhalation Route
  5.4.5  Topical Route
  5.4.6  Rectal Route
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5.11  Let Us Sum Up

5.0  OBJECTIVES

After completing this practical, you should be able to:

- Administer drugs through various methods to the pediatric patients;
- Calculate and administer accurate dose as required;
- Become familiar with the actions of the commonly used group of drugs;
- Recognize the fact that narrow margins exist between therapeutic level and toxic level of same drugs for neonates/children;
- Practice the safety principles so that drug error is avoided;
- Identify importance of drug interaction;
- Identify situations requiring intravenous fluid therapy;
• List common fluids used for newborn;
• Calculate fluid requirement for newborn;
• Prepare different types of fluids used for newborn e.g.- N/5,N/3,N/2 in 10%, 5% dextrose;
• Calculate and regulate accurate flow rate for newborn;
• Perform procedure step by step effectively; and
• Monitoring/recording of IV therapy for newborn.

5.1 INTRODUCTION

In this practical, we will learn about administration of medication and drug supplement. The safe administration of medication to children presents a number of problems that are not encountered when giving medications to adult since we need to consider multiple effecting factors like body surface area and the ability to absorb, metabolize and excrete medications when administering the medications to the neonates. Nurses must be particularly alert when calculating and administering drugs to infants and children.

In the case of very sick or premature newborn, parenteral route is used to maintain fluid and electrolyte within normal range. Intravenous fluid is given to ensure that the newborn baby receives necessary fluid, recommended calories and electrolytes. IV fluids may be either plain IV fluids or parenteral nutrition fluids. IV fluids are usually glucose and electrolyte solutions e.g. – Isolyte P, Ringer’s lactate, and glucose. And neonates may also be given drugs through this route. Therefore, it is essential for the nurse to understand her responsibility in maintaining proper administration of fluids and medications.

5.2 SAFETY MEASURES AND POSSIBLE ERRORS IN THE ADMINISTRATION OF DRUGS

Safety Measures

It is essential to revise the seven ‘Rights’ before administration of medication to the paediatric group. These as you know are:

i) The right patient
ii) The right drug
iii) The right dose
iv) The right route
v) The right time
vi) The right documentation
vii) The right of parents and child/baby

Possible Errors in Drug Administration

There can be various reasons for error in administering drugs:

i) Poor communication of intention by the prescriber
ii) Failure to keep an established routine when administering therapy
iii) Lack of understanding of the objectives of therapy
iv) Failure of the nurse to recognize that the medical officers and pharmacy departments may make errors
v) Poor concentration or constant interruption
vi) Ignoring the need for an experienced person to double check the drug, the dose, identification of the patient and any previously administered preparation
vii) Failure to calculate to one’s own satisfaction
viii) Failure to learn appropriate pediatric doses of commonly used medications
ix) Lack of knowledge regarding drug interaction and side effects
x) Inadequate security of drug storage
xi) Failure to record administered doses

• If you are in doubt, do not give the medication, however no medication should be omitted without the pediatrician’s order.
• If an error is made, doctor must be informed and action prescribed to be carried out. An incident form is to be completed. It is necessary to report this incident to your sister incharge/senior nursing staff/doctor.

5.3 DRUG CALCULATIONS

On admission, the baby/infant can be weighed as required during his stay in hospital. It is also essential to remember while using age of the child as a method of drug calculation that children of the same age group vary considerably in size. So age alone may prove a poor guide to drug calculation especially where the child is very sick.

• See the dose required for the child on the leaflet provided by the manufacturer.
• Read the manufacturer’s instruction carefully before preparing the drug.

5.4 ROUTES FOR ADMINISTRATION OF DRUGS

There are various routes by which we can administer drugs, and you are already highly skilled in administering drugs by various routes.

5.4.1 Factors for Determining Route

Factors that are considered when selecting the route for an infant or a child include the following:

• The amount and character of the medications to be given
• The general condition of the baby
• Factors that may interfere with the absorption and distribution of drugs
• The child’s ability to tolerate the drugs.

5.4.2 Oral Route

The oral route is prepared for administering medications to children whenever possible because in case of administration of oral medications most of the drugs
are dissolved or suspended in liquid preparations. Most pediatric medications come in palatable and colorful preparations.

They can be made acceptable if given along with fruit flavored syrups. But do not mix the medication with food as the infant may develop aversion to particular food if mixed with the medicine. Capsules should not be opened and administered as the powder is unpalatable. If child cannot swallow; open the capsule and mix powder with the honey/sugar or other sweetened syrups.

**Equipments**

A tray containing

- Prescription sheet
- Oral medication e.g. tablets, syrup etc.
- Medicine measures /Milliliter measures
- 1 ml syringe/ 5 ml spoon, plastic dropper (preferable calibrated)
- Medicine tray with medication card
- Glass of fruit juice or sweets( in case of older children)
- Glass of water

**Procedure**

- Explain the procedure to mother or the caregiver.
- Read the prescription sheet carefully.
- Confirm that medicine contained in the bottle is prescribed one for example, if liquid, shake the bottle first to mix the content.
- Hold the measure at eye level and keep a finger at the appropriate graduation and pour the medication.
- While pouring ensure the bottle label is upper most.
- Replace the stopper and place the measure containing medicine on a small tray and take to the newborn’s bedside with the medicine card.
- If the quantity of medicine is small then use a spoon.
- In case of tablet, remove the tablet from the packet and crush it between two spoons.
- Mix crushed tablet with jam or fruit juice.
- Rinse the measuring glass to wash off the residue e.g. if elixir of digoxin is to be measured the best is to use 1 ml syringe for accurate dose.
- Record it in medication card and nurses note.

- As a nurse you must remember to talk to the baby/child before administering the medicine. Make the baby/child sit in mother’s lap to achieve better control or the baby can be restrained in a blanket or sit with his right arm tucked under your (nurse’s) left arm. Then you can control his left arm as you administer the medicine.
- You should take care that the baby does not ingest the medicine when he is struggling.
Provide something pleasant after the medicine is administered.

- After medicine is administered orally, wipe bottles and close container and replace in the cupboard. The used measure glass, spoon, dropper are thoroughly washed, rinsed and dried before replacing in the cupboard.

### 5.4.3 Parenteral Route

An injection is an unpleasant experience for a person at any age and is particularly traumatic to the small child who often lives in fear of the next “needle prick”.

To allay fear and anxiety, the drug should be prepared away from the bed side so that the procedure is over before the baby is fully aware of the situation. It is essential that you have another nurse to help restrain the baby while you administer the drug. The most commonly used syringe in pediatric unit is of 2 ml. It is graduated in 0.1 ml (1/10 ml) division, so that drug dosage requiring multiples of 0.1 ml can be accurately administered.

For administration of a drug in less than 0.1 ml, 1 ml Mantoux syringe bearing 0.01 ml (1/100 ml) graduation is essential. Special syringes for administration of insulin are graduated in 20 units/ml.

Needles used should be disposable, sharp and straight for each injection.

It is essential to remember the colour code used by each manufacturer for their own brand of needle according to the diameter of the needle lumen and length. Injections, can be administered intramuscular, subcutaneous, intra-venous, hypodermic and intrathecal depending on the type of drug to be administered.

**Equipments**

Tray containing

- Sterile equipment: syringe, needle, spirit swab
- Injection card
- Drug vials
- Pair of sterile gloves
- Sterile distilled water ampoule
- File
- Kidney tray

**Procedure**

- This method requires strict asepsis. As the protective skin is punctured and micro-organisms can easily gain entry.
- Ensure that the articles are sterile and hands thoroughly washed and dried before you handle the syringe.

**Remember**

- Do not touch the sterile needle.
- Read the patients prescription sheet carefully.
- Take out the appropriate drugs and once again check with patients papers/injection card.
Now we shall see how to use multidose and single dose vials

Using a Multidose Vial

- Dilute the drug according to the manufacturer’s recommended quantity of diluent.
- The quantity of diluent added is of considerable importance particularly as a single dose container intended for one dose for an adult may well be used for fractional doses for children. For example, Ampicillin 250 mg is diluted with 1.8 ml of water for injection to give a resulting strength of 125 mg in 1 ml.
- Insert the needle through the rubber diaphragm at right angle and inject air.
- Apply negative pressure by withdrawing the piston to the appropriate level.
- Read the syringe at eye level and adjust with the point of the needle still in the bottle.
- Do not eject excess air into the drug.
- Reinsert the needle into the sheath until ready for use.

Using a Single Dose Ampoule

- Collect the drug into the body of the ampoule.
- With a file snap off the neck.
- Draw the medication in required amount in the syringe and eject the excess back into the ampoule.
- Reinsert the needle into its sheath until ready for use.
- Place the syringe in the injection tray.
- Take a swab of spirit and the tray and go to patient’s bed side. Check once again if it is right patient, drug and dose.
- Appropriate site is selected and after immobilizing the newborn, inject the drug. The right technique should be used when administering the drug.
- Withdraw the needle and apply firm pressure at the site with a swab to enhance circulation and quick absorption of the drug; discard the swab in a kidney tray or dustbin.
- Record in nurses notes and chart in order book or TPR chart, if required.
- Wash the syringe, if disposable then dispose the needle separately in a sharp instrument bin and the syringe separately in another bin.

Now we shall focus on various routes of giving injections

1) Subcutaneous injection:
   It is the injection given below skin not in the muscles.

Site

- the upper outer area of the arm
- the front and outer sides of the thighs
- the abdomen, except for a 2 inch area around the navel
Techniques in Newborn and Infant Care

- the upper outer area of the buttocks
- the upper hip

Equipments
- Prescribed medication
- Alcohol swab or 70% alcohol and cotton ball
- Syringe and needle
- Container for disposal

Procedure
- Wash your hands with soap and water. Rinse and dry with clean paper or cloth towel.
- Find a site for the injection. This is usually the upper part of the thigh or upper arm.
- Check the medication before using it. Look at the label and check that you have the correct medication and concentration. Make sure that the expiry date has not passed and that the top of the bottle is not damaged. Make sure the medication has not changed color or consistency. Follow the given instructions for mixing the medication prior to use.
- Clean the top of the bottle with an alcohol swab or a cotton ball dipped in alcohol. Allow it to dry.
- Remove the needle cover from the syringe by pulling it straight off. Lay the cover on a flat surface.
- Draw air into the syringe by pulling back on the plunger to the amount of medication to be given. Insert the needle of syringe, push the air in the medication vial and with draw medicine, change the needle, thereafter.
- If needed, have your baby straddle or sit on the lap of a known adult. This person can hug and stabilize arms and legs not being injected.
- Clean the site with alcohol using friction. Let the alcohol dry.
- With your thumb and index finger, pinch a small area of skin (fat tissue).
- Insert the needle through the skin into the fat tissue at a 45 degree angle if you use a long needle (1/2 inch or 5/8 inch long). Insert the needle through the skin into the fat tissue at a 90-degree angle if you use a short needle (5/16 inch long).
- If the medicine in the syringe is clear of blood, slowly push all the medicine into the tissue.
- After you remove the needle, gently press on the site with a dry gauze or tissue until the bleeding stops.
- Wash your hands well again.

Remember
Do not give the injection in the same spot each time. Write down the site you use each time and give each injection in a new site
2) **Intra-Muscular Route of Injection**

It is the injection given into the muscles.

**Site:**

✅ **Vastus lateralis**

**Location:** Palpate to find greater trochanter and knee joints, divide vertical distance between these two landmarks into thirds, inject into middle third.

**Needle insertion and site:** Insert needle at 45 degree angle toward knee (22-25 gauge, 3/4 to 1 inch)

**Advantages**

- Large well developed mass that can tolerate upto 0.5 ml of fluid
- Easily accessible
- A trochanter can be applied above injection site to delay drug hypersensitivity reaction if necessary

**Disadvantages**

- Thrombosis of femoral artery from injection in mid-thigh area
- Sciatic nerve damage from long needle injected posteriorly and medically into small extremity

**Purpose**

- When rapid action is required
- When drug would prove irritating to the subcutaneous tissue
- Site selected should be such where there is a reasonable amount of muscle with no underlying nerves or blood vessels that can be damaged

**Equipments**

- Disposable or sterile glass syringe with needle size 24 or 26 G
- Cotton swabs
- Alcohol/spirit
- Medication

**Procedure**

- Follow asepsis and universal precautions.
- Attach a needle and load the syringe with the required accurate dose.
- Attach a fresh needle.
- Restrain the baby.
- Expose the thigh and identify the injection site.
- Cleanse the site with alcohol and wipe.
- Grasp & extend the muscle in between the thumb and the finger and insert needle into the middle of the vastus lateralis muscle at right angle (90°).
- Aspirate the syringe to see that the needle is not in the blood vessel. (if blood is aspirated then take out the needle and reinsert it at a separate point).
- Inject the required amount.
- Withdraw the needle
- Wipe with alcohol swab and press with dry cotton. Don’t rub.

3) **Intravenous Administration**

This route of administering drugs is becoming more popular in the paediatric practice.

**Purpose of this Route**
- When rapid action is required
- High serum concentration required of the drug
- Babies who cannot absorb drugs from gastro-intestinal route because of continuing diarrhoea, dehydration or other problems

**Equipment**
Tourniquet, scalpvein or veinflow, spirit swab, adhesive

**Procedure**
- Select the vein. A vein in the antecubital fossa i.e. the cephalic or median basilic is usually selected and the elbow extended.
- Make the vein prominent by constriction above the site with the hand of the assisting nurse or a rubber tourniquet can be used. If the vein on the dorsum of the hand is selected and digital constriction is applied around the wrist, precaution should be taken not to occlude the radial pulse.
- Once the vein is prominent clean the area and let it dry.
- Gently enter the vein, once blood is seen in the scalp vein/veinflow tubing release the pressure.
- Secure the scalp vein/veinflow with adhesive.
- Inject the drug kept ready and close the opening, two way set can also be connected and kept.
- When intravenous drugs are discontinued, the needle should be withdrawn and firm pressure applied over the site and the limb may be elevated for one minute.

**Key points to remember in this method of administration**
- It is essential not only that the correct drug and volume of drug dosage be used but also that the desired concentration of the drug reaches the site where it can be most effective.
- If the infusion of fluid is slow, then the drug actually reaching the child is delayed and hence there can be mistiming of peak level in the blood.
- Do not change the set immediately after injecting the drug as there can be some loss of drug with the discarded set.
• Multiple drugs can be administered sequentially.
• It is essential to remember the rate of infusion of a drug influences the effect of a drug on the baby/newborn.
• Faster the rate of infusion, greater would be the peak concentration of a drug in the vascular system.
• If the rate of infusion is almost the same as the rate of clearance, the drug serum level may be close to non-existent. Hence, those drugs with high rate of clearance should not be administered by this method.
• When administering drug by this route, it is essential to remember the expected action of the drug, untoward reaction, side-effects and their antidotes.
• Check and cross check the amount of drug prescribed.
• Check the solution in which it is to be diluted, compatibility of the drug and intravenous solution, the precise dilution of the drug for effectiveness, the length of time needed to infuse the drugs e.g. drugs like calcium gluconate, soda bicarbonate are to be given slowly.
• Drugs designed for intravenous administration should only be given by this route.
• Some drugs given intravenous are very toxic or irritating to body tissues outside the intravascular system. Hence, it is important to check the site of infusion for proper placement and signs of infiltration.
• Do not administer intravenous drugs with blood or blood products like lipids etc.
• Administer the drug within the stability time period when mixed.
• Do not mix antibiotic with each other or with vitamins and any other supplements as they may inactivate them.
• As there is no control over a drug administered intravenously, therefore, continuous monitoring is essential for drug reaction.
• Ensure that the arm is well immobilized by strapping to the arm board.

5.4.4 Inhalation Route
Therapies that can be administered by inhalation are oxygen, humidification-cool mist and steam, administering local medication. The medication is commonly administered through inhalation by using ultrasonic nebulizer/ jet.

Purpose
To relieve nasal congestion and sinusitis.

5.4.5 Topical Route
The medication in topical route is administered through ear, nose and eye.
Drops are instilled into the nose, ear and eyes of the baby in much the same way as they are in the adult with the following exceptions:
• The dose of medication may be smaller than the amount the adult receives
• The use of a medicine dropper that has a smooth tip to prevent injury
Techniques in Newborn and Infant Care

- Medication warmed to room or body temperature before administration
- The young baby head must be immobilized to prevent any accidents

1) **Nose Drops**

Instillation of medication in the nose.

**Purpose**
- To relieve nasal obstruction
- To shrink the mucous membrane
- To relieve the stuffed feeling
- To reduce excessive nasal discharge
- To relieve bronchospasm

** Equipments**
Nasal drops, dropper, medication card

** Procedure**
- Explain the mother or caregiver.
- Hold the infant in cradle position when administering nasal drops.
- Tilt his head back and stabilize it in the crook of your arm by pressing it between your arm and body.
- Squeeze drops into each nostril as prescribed.
- Ask to sniff after you instill the drops.
- Ensure that the baby does not sneeze; as the medication will be sprayed out.

** Points to remember**
- Ensure the drops come in contact with the surface of the posterior portions of the nose.
- If nose is filled with secretions suction with a soft rubber bulb nasal syringe.
- Keep drops and dropper separate for individual infant or at least use separate dropper for several infants.
- Rotate the head when drops are instilled in the right nostril to right side similarly when drops are instilled in left nostril rotate head to left side.

2) **Eye Drops**

Medication is instilled in the form of drops or ointment into eye.

**Purpose**
- To dilate pupil e.g. Atropine 1%, drosyn 5% or 10%
- To constrict the pupil e.g. Pilocarpine 0.5%
- To prevent or control infection e.g. antibiotics
- To lubricate eye ball e.g. caster oil or paraffin
- Prior to examination of the cornea e.g. flouresicine 2%
- To induce local anaesthesia prior to removal of foreign body e.g. cocaine hydrochloride
Administration of Medication and Intravenous Fluids

- To reduce inflammatory response e.g. Sofracord Hydrocortisone eye ointment

**Equipments**

Eye drops, pipette/tube with ointment, sterile cotton wool, medication card, kidney tray for soiled swabs

**Procedure**

- Explain the mother or caregiver.
- Clean the eye using sterile distilled water or boiled cooled water.
- Position the baby in supine position. Preferably mummify the baby with blanket or baby sheet.
- Check the prescription.
- Wash and dry your hands.
- Fill the pipette or dropper with the required medication.
- Rest your right hand on the forehead of the baby and with the index finger and thumb using mild traction hold both lids apart.
- The dropper is held a few millimeters over the lower-fornix and while the baby looks upward the medication is expressed within the conjunctival sac.
- An alternative to instill drops is when the baby looks downwards. The solution is expressed into the upper fornix.
- Mop the excess medication from the cheek.
- Apply slight pressure on the conjunctival sac or position the face upwards for 2 – 3 minutes to discourage the drainage into lacrimal passage and also to prevent dilution of the drug with the tears.
- In case of ointment, wipe the nozzle with a cotton swab.
- Apply a thin strip of ointment to the exposed lower fornix of the conjunctiva.

**Precaution**

- Do not touch the tip of dropper or nozzle to the conjuctiva or the eye.
- Do not put solution drop directly into the cornea.

3) **Ear drops**

Now we shall discuss the procedure of instilling ear drops.

**Purpose**

- To soften wax (4% sodium bicarbonate, olive oil, wax solvent etc.)
- To relieve the pain of otitis media (phenoldrops etc.)
- To treat infection of the external auditory meatus (e.g. chloramphenicol or neomycin ear drops etc.)
- To float out small insect (e.g. olive oil)
**Techniques in Newborn and Infant Care**

**Ear Drops, Pipette/Dropper, Medication Card.**

**Procedure**

- Examine the ear to ensure it is clean.
- Exclude ear perforation.
- Position the baby in supine position and restrain.
- Place the baby laterally on his unaffected side or in a sitting position with his head tilted toward the unaffected side.
- Instill the warm ear drops holding the dropper to the edge of the meatus.
- Maintain the position of the infant for 5 to 10 minutes to ensure the medication remains in contact with the ear drum for few minutes.
- Place a small well loosened cotton wool in the outer meatus to absorb the excess solution.

**Points to Remember**

- Do not insert the dropper into the ear canal nor hold it too far from the ear.
- Do not instill cold drops as when it comes in contact with the tympanic membrane the child can experience pain or severe vertigo.
- Do not tightly plug the ear as it can block the free flow of discharge from the ear canal.

**5.4.6 Rectal Route**

A drug may be administered by rectal route in the form of suppository or enema for either systemic or local effect.

1) **Suppositories** are cone-shaped gelatinized preparation sometimes containing medicine.

**Purpose of Giving Suppositories**

- To evacuate the bowel
- To administer a drug which is unpleasant to take orally (aminophylline)
- In the relief of rectal or anal discomfort e.g. Anmol (Paracetamol)

**Equipments**

Tray containing

- Prescribed suppositories and medication card
- A bowel of warm water
- Pair of gloves
- Kidney tray to receive used gloves

**Procedure**

- Explain the procedure to mother and caregiver.
- Provide privacy.
• Relax the infant.
• Place the infant in left lateral position with flexed lower limb, draw the buttocks to the edge of the bed, place a mackintosh under the buttocks, baby is well draped leaving the buttocks exposed.
• Lubricate the suppository.
• Separate the buttocks and visualize the anus.
• With the gloved hand insert the lubricated suppository through the anal sphincter to the length of index finger. The anal area is cleansed and the glove and gauze piece discarded. If there is tendency for the suppository to be expelled, the buttocks may be held together for few minutes.
• The baby is made comfortable and kept with the mother.

Special Point to Remember
• Glycerine Suppositories to be lubricated by dipping the tip in warm water and bowel action occurs 20 to 30 minutes later.
• For Dulcolax suppositories lubricate with KY jelly or Vaseline. Bowel action can be expected in 5 to 10 minutes.
• Suppositories containing drugs like aspirin preparation in case of pyrexia should not be rejected. Therefore, should be inserted deep in the anus. The mother and baby to be ensured that a bowel action is not necessary.

2) Enema
• Enema may be given for the purpose of cleansing for therapeutic uses; to relieve intra-cranial pressure, abdominal distension, intussusception and for diagnostic purpose.
• The procedure has to be done in the same way as for an adult patient. But it is essential to remember that small tubing will be required and more precaution to be taken and the amount of fluid required is less. The tube should be inserted 2 to 4 inches only.
• The equipments used should be thoroughly washed, dried and replaced.

5.5 ADMINISTRATION OF MEDICATIONS IN SPECIAL CONDITIONS

If the baby is unable to take medications through oral route because of various conditions like post-operative phase, poor sucking and swallowing reflex etc. then the medication can be given through various methods like:
• Nasogastric medication administration
• Gastrostomy medication administration
• Orogastric medication administration

Articles
Tray containing medicine, syringe, kidney tray, paper bag and water
Techniques in Newborn and Infant Care

**Procedure**

- Explain and reassure the mother.
- Pour the medication in the container keeping 7R’s in mind.
- Confirm that the tube is properly positioned.
- Remove the plunger of a sterile syringe and connect barrel of the syringe with the tube.
- Pour 3-5 ml of water then give the required amount of medication.
- Flush the syringe with 2-3 ml of water.
- Make the baby comfortable.
- Do accurate recording and reporting.

**Points to be kept in mind for nasogastric, orogastric or gastrostomy medication administration in children:**

- Use elixer or suspension preparations of medications whenever possible.
- Dilute viscous medication or syrup if possible with a small amount of water.
- If administering tablets, crush tablet to a very fine power and dissolve drug in a small amount of warm water (drug can be sent for fraction to Pharmacy if possible).
- Never crush enteric coated or sustained release tablets or capsules.
- Avoid oily medications because they tend to cling to side of tube.
- Do not mix medication with enteral formula unless fluid is restricted.
- Have medication at room temperature.
- Measure medication in calibrated cup or syringe.
- Check for correct placement of nasogastric or orogastric tube.
- Add syringe to the tube (without plunger).
- Pour medication into syringe.
- Unclamp the tube and allow medication to flow by gravity.
- As soon as syringe is empty, pour in water to flush tubings. The amount of flush solution usually is 1½ times the volume of drug.
- With certain drug preparation more fluid may be needed.
- If administering more than one drug at the same time, flush tube between each medication with clean water.
- Clamp tube after flushing, unless tube is left open.

### 5.6 COMMON DRUGS ADMINISTERED TO NEONATES

Following are some drugs commonly used in nursery, presented in alphabetical order. Simple formula for calculation of drug amount is given below:

\[
\frac{\text{Desired strength of the drug}}{\text{Drug strength in hand}} \times \text{Quantity} = \text{Amount required}
\]

\[
\frac{D}{H} \times Q = A
\]
### I. Adrenaline

<table>
<thead>
<tr>
<th>Presentation</th>
<th>1 mg/ml (1:1000 concentration).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dosage</td>
<td>0.1-0.3 ml/kg/dose of 1:10,000 dilution, repeat every 3-5 minutes, if necessary</td>
</tr>
<tr>
<td>Route</td>
<td>Intravenous or endotracheal route</td>
</tr>
<tr>
<td>Directions for use</td>
<td>Take 0.1 ml in 1 ml syringe. Dilute it with 0.9 ml water for injection (10 times dilution) to make 1 ml, the resultant concentration is 1:10,000 solution.</td>
</tr>
</tbody>
</table>

### II. Aminophylline

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Injection 250 mg in 10 ml ampoules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses</td>
<td>Apnea of prematurity</td>
</tr>
<tr>
<td>Dosage</td>
<td>Loading dose: 5.0-8.0 mg/kg/ IV, maintenance: 1-2.5 mg/kg/dose q 8 hourly IV, PO.</td>
</tr>
<tr>
<td>Route</td>
<td>Intravenous or oral route</td>
</tr>
<tr>
<td>Directions for use</td>
<td>Take 0.1 ml of solution in 1ml syringe. Dilute with 0.9 ml to make 1 ml with water for injection. Resultant concentration is 2.5mg/ml. Administer required dose IV over 20 minutes.</td>
</tr>
<tr>
<td>Compatible</td>
<td>With 5% dextrose, normal saline, ringer lactate</td>
</tr>
<tr>
<td>Incompatible</td>
<td>Sodium bicarbonate</td>
</tr>
<tr>
<td>Caution</td>
<td>Never give by intramuscular route.</td>
</tr>
</tbody>
</table>

### III. Ampicillin

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Injection 100, 250 &amp; 500mg vials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses</td>
<td>Sepsis, pneumonia, meningitis etc.</td>
</tr>
<tr>
<td>Dosage</td>
<td>Sepsis/pneumonia: 50-100 mg/kg/day divided q8-12 hourly IV, IM; meningitis: 100-200mg/kg/day divided q6-8 hourly IV.</td>
</tr>
<tr>
<td>Directions for use</td>
<td>250 mg vial: add 5.0 ml water for injection, resultant concentration 50mg/ml, administer the required quantity IV slowly.</td>
</tr>
</tbody>
</table>

### IV. Calcium gluconate

<table>
<thead>
<tr>
<th>Presentation</th>
<th>9 mg/ml ampoules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses</td>
<td>Treatment of low blood calcium level</td>
</tr>
<tr>
<td>Dosage</td>
<td>1-2 ml/kg/dose every 6-8 hourly</td>
</tr>
<tr>
<td>Route</td>
<td>Intravenous route only</td>
</tr>
</tbody>
</table>
### V. Gentamicin

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Injection 80mg, 40mg and 20mg/2ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses</td>
<td>Sepsis, pneumonia, meningitis etc.</td>
</tr>
<tr>
<td>Dosage</td>
<td>Conventional: &lt;7days: 2.5mg/kg/dose q12 hourly IV, IM; &gt;7 days: 2.5 mg/kg/dose q8 hourly IV, IM; single dose: preterm: 4mg/kg/dose 24 hourly IV, IM; Term: 5mg/kg/dose 24 hourly IV, IM</td>
</tr>
<tr>
<td>Route</td>
<td>Intravenous, intramuscular routes</td>
</tr>
<tr>
<td>Directions for use</td>
<td>20mg/1ml (40mg/2ml) ampoule: Take 0.1 ml and dilute with 0.9 ml with water for injection to make 1 ml. Resultant concentration is 2mg/ml</td>
</tr>
<tr>
<td>Compatible</td>
<td>With 5% dextrose, normal saline</td>
</tr>
<tr>
<td>Incompatible</td>
<td>Sodium bicarbonate, heparin, chloramphenicol</td>
</tr>
</tbody>
</table>

### VI. Phenobarbitone

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Injection 200mg/ml in 1ml ampoules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses</td>
<td>Neonatal seizures</td>
</tr>
<tr>
<td>Dosage</td>
<td>Loading dose: 15-20mg/kg IV, maintenance: 3-5mg/kg/day IV, PO in 1-2 divided doses</td>
</tr>
<tr>
<td>Route</td>
<td>Intravenous and per oral</td>
</tr>
<tr>
<td>Directions for use</td>
<td>Take 0.1 ml of solution and dilute with 0.9 ml of water for injection to make 1 ml, give required amount slowly over 15-20 minutes</td>
</tr>
<tr>
<td>Caution</td>
<td>May cause respiratory arrest</td>
</tr>
</tbody>
</table>

### VII. Phenytoin

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Injection 100 mg/2ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses</td>
<td>Neonatal seizures</td>
</tr>
<tr>
<td>Dosage</td>
<td>Loading dose 15-20 mg/kg IV</td>
</tr>
<tr>
<td>Route</td>
<td>Intravenous route only</td>
</tr>
<tr>
<td>Directions for use</td>
<td>Dilute in normal saline, give slowly at a rate 1 mg/kg/min infusion over 15-20 minutes</td>
</tr>
<tr>
<td>Compatible</td>
<td>Normal saline only, incompatible with all other solutions.</td>
</tr>
<tr>
<td>Caution</td>
<td>After giving, flush the cannula with saline to prevent phlebitis. Do not use cloudy solutions.</td>
</tr>
</tbody>
</table>
5.7 INTRAVENOUS FLUID THERAPY

Intravenous fluid therapy refers to the infusion of fluid directly into venous system which may be accomplished through the use of needle, canula or venous cut down.

**Purposes**
- To provide electrolyte and maintain acid/base balance and/or correct imbalances.
- To meet nutritional requirement by infusion of parenteral fluids
- To administer blood and blood products
- To provide intravenous medication

**Indications for intravenous fluid**
- Entire intake cannot be met orally e.g. extreme prematurity, GI hypomotality
- Feeding contra-indicated e.g. Necrotising enterocolitis, intestinal obstructions, some inborn error of metabolism
- Correction of a deficit e.g. dehydration, hypoglycemia, severe dyselectrolytemia
- As a channel for drug administration e.g. morphine etc.

5.7.1 Types of Fluid used for Newborn
- 5 % dextrose, 10 % dextrose
- Isolyte – P, N. Saline, R. Lactate
- N/5 in 10 % Dextrose

**Constituents of fluids**

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Na (mEq)</th>
<th>K (mEq)</th>
<th>Glucose (gms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 % Dextrose</td>
<td>-</td>
<td>-</td>
<td>5 gms</td>
</tr>
<tr>
<td>10% Dextrose</td>
<td>-</td>
<td>-</td>
<td>10 gms</td>
</tr>
<tr>
<td>Isolyte-P</td>
<td>2.5</td>
<td>2</td>
<td>5 gms</td>
</tr>
<tr>
<td>N-saline</td>
<td>15</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>R. Lactate</td>
<td>13</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>N/5 in 5% Dx</td>
<td>3</td>
<td>-</td>
<td>5 gms</td>
</tr>
<tr>
<td>N/5 in 10% Dx</td>
<td>3</td>
<td>-</td>
<td>10 gms</td>
</tr>
</tbody>
</table>

5.7.2 Preparation of Different Types of Fluids used for Newborn

**How to prepare N/5 in 5% or 10% Dextrose**

For preparing N/5 in 5% or 10% Dextrose

**You should take**
- One bottle of 10% Dextrose
- One bottle of N. Saline
- I.V set
Techniques in Newborn and Infant Care

Method – 500 ml of N/5 in 10% Dextrose

N/5 = 1 part Normal Saline + 4 parts of 10% Dextrose

If you are having 500 ml bottle

Remove 100 ml of 10% Dextrose from the bottle

And add 100 ml of Normal Saline in it

Ideally 500 ml of N/5 in 10% Dextrose should have 0.18 gm/100 ml of sodium chloride (NaCl) i.e. NaCl 0.9 gm/500 ml

and 10 gms/100 ml of 10% Dextrose i.e. 50 gms/500 ml.

The solution that we have made has

0.9 gm NaCl/500 ml and

40 gms of 10% Dextrose/500 ml.

There is a deficit of 10 gms (50-40 gms)

This deficit is to be corrected by using either 50% or 25% Dextrose.

As we know that 50% Dextrose is 50 gm/100 ml &

25% Dextrose is 25 gm/100 ml.

So the final solution should be

100 ml of Normal saline + 400 ml of 10% Dextrose and 2 ml of 50% Dextrose or 4 ml of 25% Dextrose.

You will get 500 ml N/5 in 5% or 10% Dx

Other method: You can convert N/5 in 5% Dx to 10% Dx by adding 50% Dextrose ampoule

N/5 in 5% Dx means 25 gm of Dx is already there in bottle, we have to add 25 gm more to convert into 10% Dx, so you should add 2 ampoules of 25ml 50% Dx because one ampoule contains 12.5 gm Dx, so you should add 2 ampoules of 25ml of 50% Dx to convert N/5 in 5% Dx to N/5 in 10%. (You can also add ampoules of 50ml 50% Dextrose)

Sometimes readymade fluids are not available in neonatal units like for example neonatologist advised you to start – N/5 in 10% Dextrose 100 ml/8 hourly and it is not available in your unit so you should know how to prepare N/5 in 10% Dextrose

5.7.3 Fluid Requirements for Newborn

The average requirement of fluid for 24 hrs in neonates is as follows:

<table>
<thead>
<tr>
<th>Age of Neonate</th>
<th>Amount of fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>60 – 80 ml/kg</td>
</tr>
<tr>
<td>Day 2</td>
<td>80 – 100 ml/kg</td>
</tr>
<tr>
<td>Day 3 and thereafter</td>
<td>100 – 150 ml/kg</td>
</tr>
</tbody>
</table>
According to the birth weight day 1 the requirement are as follows:

<table>
<thead>
<tr>
<th>Age of Neonate</th>
<th>Amount of fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1.5 kg</td>
<td>60 ml/kg</td>
</tr>
<tr>
<td>1 – 1.5 kg</td>
<td>80 ml/kg</td>
</tr>
<tr>
<td>&lt; 1 kg</td>
<td>100 ml/kg</td>
</tr>
</tbody>
</table>

On day 1 – 2 the baby needs Dextrose, but no electrolytes.

After day 1, the fluids are increased at 15-20 ml/kg/day to reach a total of 150-180 ml/kg/day. By 1st week of life potassium is added after urine output is established. Sodium is added after weight loss is established.

**Dextrose requirement**

The normal physiological requirements are 4 – 5 mg/kg/min, this amounts to 5.8 – 7.2 gm/kg/day

This amount of daily dextrose can be provided by any of the following:

1) 120 – 150 ml/kg/day of N/5 in 5% Dx or
2) 120 – 150 ml/kg/day of isolyte-P or
3) 60 – 70 ml/kg/day of N/5 10% Dx

Depending on the day of life

**Sites Used for Infusion in Newborn**

Common veins used for infusion in newborn and infant are:

- Scalp veins – frontal, superficial, temporal vein
- Umbilical veins – during 1st few days of life
- Superficial veins of hands, wrist, arms, foot
- Infant and older children – on the basics of accessibility of veins
- Intraosseous route used only in emergency

**5.7.4 Regulation of Flow rate for Newborn**

After knowing about types of fluid your baby is getting and how much e.g. – you got order you should start N/5 in 10% Dextrose 100 ml/12 hourly

So the calculation of flow rate of fluids is your responsibility for infusing correct amount of fluid in right duration of time because a small error can create severe problems for neonates. Formula for calculating flow rate as:

\[
\frac{\text{Total volume to be infused}}{\text{Time in minutes}} \times \text{Drop factor} = \frac{\text{Drops}}{\text{Min}}
\]

Drop factor – if you are using micro dripset 1ml= 60 drops while in adult 1ml = 20 drops
For example – neonatologist prescribed 100 ml of N/5 in 5% Dextrose in 8 hours
Amount to be infused – 100 ml
Drop factor – 60
Time – $8 \times 60$ mts
On putting the values in the formula
Flow rate to be regulated in 12 – 13 drops/min (figure is rounded up to 13)
For accuracy in the case of small amount or drop rates are less than 20 drop/min refer to use of infusion pump for more precise/accurate infusion.

5.7.5 Equipments Required
- Fluid prescribed by neonatologist/facilitators
- I.V infusion set (micro drip set) (Fig. 5.1)
- Adhesive tapes
- Padded splint
- Spirit swabs
- Vein flow/cannula/scalp vein/butterfly needle
- Kidney tray
- Infusion pump
- IV stand
- Syringe 50 ml

5.7.6 Procedure
- Explain the need for the infusion and the procedure to the parents/relatives.
- Assemble all the equipments at the bed side.
- Do calculations in advance about flow rate etc.
- Wash hands and dry them.
• Prepare baby for procedure considering developmental supportive care, oxygenation, thermoregulation, pain, safety and comfort measures.

• Have second person to hold newborn in position.

• Identify a suitable vein.

• Prepare site or shave the hair if scalp vein is chosen.

• Put on gloves.

• Cleanse the area with alcohol and allow it to dry.

• Ensure skin is stretched.

• Assist the paediatrician in insertion of canula.

• Secure this with occlusive dressing and tape being sure to maintain visibility of insertion site.

• Turn on infusion pumps and connect pressure monitoring line (PMO) to I/V cannula.

• Ensure correct flow rate e.g. – 15 ml/hour or 15 ml/min.

• Apply padded splints to protect from accidental dislodging of the needle.

• Settle the baby.

• Remove gloves and wash hands.

• Documentation – location, time, size of needle, I.V. initiator, I.V. solution, flow rate etc.

5.8 RECORDING/MONITORING

Babies on intravenous fluids require careful monitoring of hydration for which day to day monitoring is important. This should be modified depending on hydration status of the baby as shown by:

• Weight change

• Urine output

• Urine sp gravity

• Serum Na

• Urea

• Clinical Signs

Monitoring is essential for proper I.V fluid therapy

• Inspect the infusion site every hour

• Look for redness, swelling around the insertion site of the canula

• Check the volume of fluid infused and compare to prescribed volume

• Record all findings

• Assess hydration daily

• Weigh the baby daily
5.9 TOTAL PARENTRAL NUTRITION (TPN)

TPN meets the total nutritional requirements of those who cannot receive feedings by ways of the gastro-intestinal tract.

**Indications**
- Very premature babies
- Congenital gastrointestinal anomalies
- Diarrhoea and vomiting
- Chronic bowel obstruction

**Differences between I.V fluid therapy and TPN**

<table>
<thead>
<tr>
<th>I.V. Therapy</th>
<th>TPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Contain electrolytes and sugar</td>
<td>• Contain electrolytes, sugar and fat</td>
</tr>
<tr>
<td>• No protein and fat</td>
<td>• Vitamins, minerals and trace elements</td>
</tr>
</tbody>
</table>

5.10 ACTIVITIES AND GUIDELINES

**Activity 1**
Select a newborn receiving nasal decongestion drops and administer the same

**Activity 2**
Select two newborns receiving eye ointment and practice administering the same

**Activity 3**
Practice administering eye drops to two newborns and write down the steps used

**Activity 4**
Select a newborn baby receiving intravenous fluid therapy from neonatal nursery
- Identify the type of fluid the newborn is getting
- Check the requirement of fluid prescribed by paediatrician
- Calculate flow rate
- Inspect I.V site for any problem
- Do monitoring
- Do recording
  - Prepare N/5 in 5% Dx or 10 Dx if not available in NICU
**Activity 5**

Assess a neonate for hydration level

- Select a newborn who is receiving I.V. fluid therapy
- Administer I.V. fluid therapy

Submit the report to the supervisor

Name of the baby : ________________________
Date of birth     : ________________________
Birth weight      : ________________________
Current Weight of the newborn : ________________________
Indication for I.V. therapy  : ________________________
Amount of fluid prescribed : ________________________
Flow rate         : ________________________
Comments on I.V. site for any problems : ________________________
Record/monitor    : ________________________

---

**5.11 LET US SUM UP**

In this practical you have learnt various methods of administering medications namely, oral, rectal, injection, inhalation and local application to eye, ear and nose. It is very important to remember the 7R’s. Always record the drugs administered to avoid repetition or re-administration.

It is essential to be aware of side effect and complication and the antidote that can be given for side effect and reaction. If precautions are followed and drugs are administered with skill and right technique, they can be made less painful for newborn/infants.

We have also learnt about monitoring I/V fluid therapy, indications, types of fluids, fluid requirement and preparation of different fluids in this unit.
6.0 OBJECTIVES

After completing this unit you will be able to:

- List down purposes, indications and the contraindications of oxygen therapy;
- Demonstrate and perform various methods of oxygen therapy in newborn;
- Observe flow, concentration of oxygen therapy;
- Provide medication by nebulization; and
- Perform the steps of procedure of oxygen and nebulization therapy.

6.1 INTRODUCTION

Oxygen is a colourless, odourless, tasteless and combustible gas. As you know oxygen is given when there is interference with the normal oxygenation of body tissues.

In this practical you will acquire skills in giving oxygen therapy to newborn by different methods. You will also gain knowledge and skill in nebulization. You will also review the indications, contraindications, procedures and role of nurses in oxygen therapy.
6.2 ADMINISTRATION OF OXYGEN

Oxygen therapy is defined as the administration of oxygen by inhalation from a cylinder, piped in system liquid oxygen reservoir or oxygen concentration by various methods to relieve hypoxia/anoxia.

6.2.1 Purposes

The purposes of oxygen therapy are:
- To facilitate metabolism in the tissues
- To reduce/correct arterial hypoxaemia and tissue hypoxia
- To maintain an atmosphere of moist oxygen to facilitate normal breathing

6.2.2 Indications of Oxygen Therapy

The indications for oxygen therapy are as follows:
- Birth asphyxia
- Cyanosis (exclude congenital cyanotic heart disease without heart failure)
- Respiratory distress due to hyaline membrane disease, pneumonia, cardiac failure and congenital malformation or worsening respiratory distress
- Clinical features of hypoxia are evident
- Arterial oxygen tension is less than 40 mm Hg or arterial oxygen saturation is less than 85 per cent
- Hypothermia
- Recurrent apnea attacks
- Pneumothorax or pneumomediastinum

6.2.3 General Guidelines

- Check name, bed no., and other identification marks of the newborn.
- Check doctors orders for initiation of the therapy and dosage.
- Assess the baby’s vital signs and breathing pattern carefully before starting therapy.
- Careful explanation of all the equipment involved is also very important to minimize anxiety and fear of parents.
- Careful explanation to parents for the need of oxygen therapy will help to maximize cooperation.
- Oxygen should be treated as a drug, the seven rights of medication administration should be followed while giving oxygen therapy.
- Use regulator and humidifier while using oxygen cylinder or central supply of oxygen.
- Every part of apparatus should be cleaned to prevent infection.
- Watch the baby receiving oxygen therapy continuously to detect early signs of oxygen toxicity.
- Take precaution specially when oxygen is on flow e.g. smoking, use of matches, lighters etc. should be avoided.
6.2.4 Equipments

- Oxygen cylinder with stand, central supply of oxygen with a flow meter, humidifier/wolf’s bottle and connecting tubings
- Nasal catheter/prongs
- Mask, head box
- Incubator
- Water-soluble lubricating jelly
- Adhesive tape
- A bowl of water
- Swabstick and normal saline in a container
- Servo heater controller for humidification with aerosal tubings
- Oxygen analyser
- Pulse oximeter and probe.

6.2.5 Steps of Administration

<table>
<thead>
<tr>
<th>Steps</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash hands</td>
<td>Reduces transmission of micro-organisms. Soap and water reduce surface tension and thus remove dirt and check the growth of micro-organisms</td>
</tr>
<tr>
<td>Attach cannula/catheter/mask to oxygen tubing and humidified oxygen source adjusted to the prescribed flow rate</td>
<td>Prevents drying of nasal and oral mucous membranes and airway secretions. Use of humidifier prevents drying of mucus membranes</td>
</tr>
<tr>
<td>Place tips of cannula into the patient’s nares. If mask, apply snuggly to face.</td>
<td>Directs flow of oxygen into the upper respiratory tract. Prevents loss of oxygen</td>
</tr>
<tr>
<td>Check cannula/equipment every eight hours</td>
<td>Ensures patency of cannula and oxygen flow. Also ensures safe delivery of prescribed oxygen</td>
</tr>
<tr>
<td>Keep the humidification jar filled at all times</td>
<td>Prevents inhalation of dehumidified oxygen. Prevents drying of mucus membranes</td>
</tr>
<tr>
<td>Observe the patient’s nares and superior surface of both ears for skin breakdown</td>
<td>Oxygen therapy can dry nasal mucosa. Pressure on ears from cannula tubing/elastic can cause skin irritation</td>
</tr>
<tr>
<td>Check the oxygen flow rate and the physician’s orders every eight hours</td>
<td>Ensures delivery of the prescribed oxygen flow rate</td>
</tr>
<tr>
<td>Wash hands before removing the oxygen mask or tube</td>
<td>Reduces transmission of micro-organisms</td>
</tr>
<tr>
<td>Inspect the patient for relief of symptoms associated with hypoxia</td>
<td>Indicating that hypoxia is reduced/treated</td>
</tr>
<tr>
<td>Record procedure in the nurse’s notes</td>
<td>Documents correct use of oxygen therapy and the patient’s response</td>
</tr>
</tbody>
</table>
6.2.6 After Care of the Newborn

- Stay with the baby till he/she is at ease
- Keep the baby warm and comfortable
- Evaluate baby’s progress by observing the vital signs and symptoms
- Watch the baby for any deteriorating symptom after the removal of oxygen.

6.3 METHODS OF ADMINISTERING OXYGEN

6.3.1 Head Box/Oxygen Hood (Fig 6.1a and b)

Procedure:

- Place a head box over the baby’s head.
- Ensure that the baby’s head stays within the head box even when the baby moves.
- Use shoulder roll if necessary. Do not seal space between infants neck and hood.
- Attach the oxygen tube to the nozzle located on the head end side of the box.
- Raise the concentration of oxygen in the head box till cyanosis disappears and arterial oxygen saturation of the baby is kept between 90-95%.
- Adjust the flow of oxygen to achieve the desired flow and concentration.
  - Low - 3 L per minute
  - Moderate - 3 to 5 L per minute
  - High - more than 5 L per minute
- Adjust oxygen flow to desired level so as to obtain desired O₂ concentration.
- Check every hour that oxygen delivery system is intact.
- Monitor baby for respiratory rate, distress and colour.
- Remove hood in case of accidental disruption of oxygen supply.
- As oxygen is toxic, it should be used in the lowest concentration to relieve cyanosis or maintain normal arterial oxygen saturation.
- Discontinue oxygen when it is no longer required.

Fig. 6.1a: Head Box
6.3.2 **Nasal Catheter**

- Use a 6-8 Fr size catheter.
- Determine the distance, for which the tube should be passed by measuring the distance from the nostril to the inner margin of the eye brow.
- Gently insert the catheter into nostril. If a gastric tube is already in place in one nostril, insert the catheter into the same nostril that the gastric tube is in, if possible.
- Ensure that catheter is correctly positioned
  - Look into the baby’s mouth
  - The catheter should not be visible at the back of the mouth
  - If the catheter is visible at the back of the mouth, pull the catheter out slowly until it is no longer visible
- Adjust the flow of oxygen to achieve the desired concentration
  - Low = 0.5 L per minute
  - Moderate = 0.5 to 1 L per minute
  - High = More than 1 L per minute
- Change nasal catheter twice daily.
- Keep the nostril free of any crust.
- Give oxygen using a face mask while cleaning and disinfecting the catheter if necessary.

6.3.3 **Nasal Prongs (Fig 6.2)**

**Procedure**

- Use 1 mm twin holed nasal prongs for a small baby (less than 2.5 kg at birth or born before 37 weeks gestation) and use 2 mm prongs for a term baby.
- Place the prongs just within the baby’s nostrils.
- Secure the prongs in place and attach catheter using elastic or a piece of adhesive tape.
- Adjust the flow of oxygen to achieve the desired concentration
  - Low - 0.5 L per minute
  - Moderate - 0.5 to 1 L per minute
  - High - 1-2 L per minute
- Change the nasal prongs twice daily. Give oxygen using face mask while cleaning and disinfecting the prongs if necessary.
6.3.4 Face Mask

Procedure

- Give oxygen using face mask while cleaning and disinfecting the prongs.
- Place the mask over the baby’s mouth and nose.
- Secure the mask in place using elastic or a piece of adhesive tape.
- Adjust the flow of oxygen to achieve the desired concentration and flow
  Low = 1 L per minute
  Moderate = 1 to 2 L per minute
  High = More than 2 L per minute

6.4 PULSE OXIMETRY AND OXYGEN SATURATION

- The infant who presents with any kind of respiratory distress should have a baseline recording of arterial saturation of oxygen (SaO\textsubscript{2}) measured with a pulse oximeter. In a healthy newborn/infant the percentage saturation of oxygen should be 95-98%.
- Pulse oximeter is non-invasive, painless and reliable technique for management of SaO\textsubscript{2}. When used properly it will detect hypoxaemia before clinical signs become evident.
- A sensor or a probe is placed around the fleshy part of the body for e.g. A fingertip in the older child, around the nail bed of the toe in the newborn/infant.
- The sensor emits red and infrared light and has a photo detector which detects the amount of light absorbed by the tissues.
- The different colors of oxygenated and deoxygenated blood absorb different amount of infrared light. This information in then converted into an average value which is displayed as percentage saturation. Pulse oximeter measurements have been shown to correlate to arterial blood gas value.

6.5 NEBULISATION THERAPY

Nebulizers produce aerosol particles of uniform size by the arrangement of baffle mechanism. It is the device to deliver the drug to the newborn’s lung using compressed air (Fig 6.3).
6.5.1 Purposes
To provide inhaled medication to newborn and infant when delivering the upper or lower airways as desired.

6.5.2 Equipments
- Nebulizer
- Oxygen tubings with hood or mask
- Resuscitation bag with mask (for a infant on mechanical ventilation)
- Compressed air supply
- Appropriate medication and saline solution

Fig. 6.3: Nebulizer

6.5.3 Steps of Procedure
1) Monitor the heart rate before and after the treatment of baby using bronchodilator drugs.
2) Explain the procedure to the parents.
3) Place the baby in mother’s lap with head supported.
4) Add the prescribed amount of medication and saline to the nebulizer at the ratio of 1:3 (3 part of saline and 1 part of bronchodilator).
5) Connect the tubing to the compressor and set the flow at 6 to 8 L/minute.
6) Observe expansion of chest.
7) Monitor vital signs and breath sounds before and after treatment.
8) Let all the medication get nebulized. Drug should be nebulized over a period of 8-10 minutes. If the procedure takes more than 10 minutes, the chamber is either malfunctioning or supply of compressed air is defective.
9) See that a good mist is formed. It indicates that the nebulization procedure is satisfactory.
10) Record medication used and description of secretion.

11) Disassemble and clean nebulizer after each use with light detergent followed by plain water. 1% vinegar solution can be used for overnight immersion to disinfect the nebulizer and tubings.

12) Before next use, the nebulizer should be run dry for a few minutes.

6.5.4 Advantages of Nebuliser
- Generates particles of uniform size
- Useful for all ages
- Convenient for high dose nebulisation
- Heart lung coordination is not required

6.6 ACTIVITIES AND GUIDELINES

Activity 1
Identify newborn in your work place (nursery) who requires oxygen therapy and provide care to the baby
- Observe the oxygen hood, mask and nasal catheter/nasal prongs for oxygen administration
- Monitor concentration of oxygen being administered by oxygen analyser. Monitor by transcutaneous blood gas monitor

Guideline for Oxygen Therapy
Follow the given guidelines for Oxygen Therapy:

Identification Data:
Date of Oxygen Therapy: .................................................................
Name: ......................... Ward No: .............................................
Age: ......................... Bed No: .............................................
Sex: .........................
Hospital Record Number: .............................................
Date of Admission: .................................................................
Diagnosis: .................................................................

Methods of delivery of \( \text{O}_2 \) therapy

- Head box
- Nasal catheter
- Nasal prongs
- Face mask

Rate of flow/min ................
Concentration of oxygen ................

Care provided during oxygen therapy
- Check vital signs and symptoms
Techniques in Newborn and Infant Care

- Explain to parents
- Check equipment every eight hours
- Keep the humidification jar filled at all times
- Check O₂ flow rate
- Observe for complication
- Record the procedure

Remarks: ............................................................................................................

Activity 2

- Identify newborn who needs nebulization therapy
- Monitor heart rate before and after treatment
- Preparation of medication used in nebulizer
- Record of administration of medication

Guidelines for Nebulization Therapy

Identification data

Name: …………………………. Ward No: ………………………………………
Age: ………………………… Bed No: ………………………………………
Sex: ……………………………
Date: ……………………………
Time of Nebulization …………………………….
Pre-procedure vital signs ……………………………
Preparation of medication for nebulization
Observations made during procedure
Care provided during procedure
- Monitor heart rate before and after treatment
- Explain the procedure
- Position of the baby (propped up position)
- Preparation of medication
- Record medication

6.7 LET US SUM UP

In this practical we have discussed about administering oxygen and nebulization. We have focused on general guidelines, indications and different methods of administering oxygen therapy in newborn and infant. We have also discussed nebuliser therapy, its importance and steps.
PRACTICAL 7  MONITORING OF SICK NEONATE

Structure

7.0 Objectives
7.1 Sick Neonate and the Need for Monitoring the Sick Neonate
7.2 Temperature
  7.2.1 Purposes
  7.2.2 Indications
  7.2.3 Contraindications
  7.2.4 Equipments
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7.3 Pulse
  7.3.1 Purposes
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7.5 Blood Pressure
  7.5.1 Purposes
  7.5.2 Indications
  7.5.3 Procedure
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  7.6.1 Purposes
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7.7 Oxygen Saturation Monitoring
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  7.7.4 Procedure
7.8 Capillary Blood Sampling
  7.8.1 Purposes
  7.8.2 Indications
  7.8.3 Equipments
  7.8.4 Procedure
7.9 Activities and Guidelines
7.10 Let Us Sum Up
7.0 OBJECTIVES

After studying this practical, you should be able to:

- Explain who is sick neonate and the significance of monitoring sick neonate;
- Define the vital parameters like temperature, pulse and respiration etc.;
- Identify normal range of vital signs in neonate;
- Assess temperature, pulse and respiration, blood pressure, blood sugar, oxygen saturation and capillary blood sampling;
- Identify normal and abnormal variations; and
- Assess the condition and progress made by the infant.

7.1 SICK NEONATE AND THE NEED FOR MONITORING THE SICK NEONATE

Sick neonate is the one who has the following characteristics:

- Weight less than 1500 gm
- Temperature less than 36ºC despite warming for 1 hour
- Cried after 5 minutes of birth
- Difficulty or absence of sucking
- Respiratory rate is more than 60/minute with chest retraction.
- Apnea or Gasping respiration
- Central cyanosis
- Jaundice
- Convulsion
- Bleeding
- Major malformation
- Presence of diarrhoea/vomiting or abdominal distension
- Pus in the umbilicus
- Fever and skin pustules

Sick neonates are looked after at the district hospitals where the special newborn care unit is available or in the small health facilities. At the smaller health facilities, only immediate care such as warmth, stabilization etc. is given. Once the neonate is stabilized, the baby is referred to higher health facility for the necessary monitoring and management. It is essential that the sick neonate is monitored every hour. Measurement of vital signs determines the neonate’s level of health and response to stress (physical, physiological) as well as medical, surgical and nursing therapy. Any alteration is indicative of deviation of health from normal. Measurement of vital signs is also routine part of complete physical examination.

As a nurse you should be able to measure vital signs correctly, understand and interpret the values and record them appropriately. In this unit we shall discuss about the assessment of temperature, pulse and respiration in relation to purposes, indications and contraindications, equipments and steps of procedure.
Temperature is defined as the degree of heat maintained in the body. It is the balance between heat produced and heat lost from the body. Normal temperature in newborn is 36.5-37.5°C.

7.2.1 Purposes
- To assess the condition of the infant on admission
- To determine the baseline values for comparison
- To detect any deviations
- To evaluate therapeutic measures

7.2.2 Indications
- On admission
- Routine assessment
- Any change in health status
- Pyrexia
- Pre and postoperatively
- Post procedures
- Emergencies

7.2.3 Contraindications
These are listed as per routes of taking temperature:

**Axillary Temperature** should not be taken immediately after bath/sponge

**Rectal Temperature** - rectal surgery, diarrhoea, rectal anomaly, after enema

7.2.4 Equipments
- Thermometer (oral/rectal) – Low reading thermometer
- Bowl of cotton swabs
- Spirit
- Kidney tray
- Paper bag
- Electronic Temperature Monitor
- Tympanic membrane thermometer (**Fig. 7.1**)
- Wrist Watch

**Fig 7.1: Tympanic Membrane Thermometer**
7.2.5 Procedure

**Tactile Assessment:**
- Wash Hands
- Rub them to dry
- Rub together and warm them
- Touch babies’ soles and palms with the dorsum of your hands
- Now touch the babies’ chest with the dorsum of your hands
- If both are warm – baby is normothermic. If periphery is cold but chest is warm – cold stress. If both are cold – baby is hypothermic.

**Axillary Temperature**
- Explain the procedure to mother or care taker
- Shake thermometer to lowest level
- Ensure dry arm pit
- Abduct arm at shoulder, place the bulb of the thermometer in the apex of the axilla
- Hold arm in abduction in shoulder and flexion at the elbow for 3 minutes
- Remove the thermometer
- Read the mercury reading at eye level and record the reading
- Clean and replace the thermometer.

Refer to **Table 7.1** for different routes of taking temperature.

**Table 7.1: Advantages, Disadvantages and Contraindication for Taking Temperature by Various Routes**

<table>
<thead>
<tr>
<th>Site</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Contraindication</th>
</tr>
</thead>
</table>
| Axilla | • Safest method  
• Non-invasive  
• No bad taste of disinfection  
• No fear of biting thermometer  
• Most reliable | • Less accurate  
• Needs more time for recording | • Cannot be used in children who have skin infection or surgery done in axillary region |
| Rectal | • False reading if rectum is loaded with fecal matter  
• In newborns and infants, insertion results in ulceration and perforation  
• Not recommended by WHO as it causes damage and infection to rectal mucus membrane | | • Infant with rectal surgery and rectal conditions |

Remember: Rectal temperature is not recommended
7.2.6 Conversion of Temperature Readings

If you have to express the Fahrenheit temperature in Celsius or Celsius into Fahrenheit you can use the following formula for conversion.

**Formula to Convert Fahrenheit Scale into Celsius Scale**

\[ C = \frac{(F-32) \times 5}{9} \]

- **C** = Temperature in centigrade
- **F** = Temperature in Fahrenheit

*Example: to convert 102°F to Celsius*

\[ C = \frac{(102 -32) \times 5}{9} = 70 \times \frac{5}{9} = 38.8°C \]

So 102°F equals to 38.8°C

**Formula to Convert Celsius Scale into Fahrenheit Scale**

\[ F = \frac{(C \times 9)}{5} + 32 \]

*Example: to convert 38.5°C to Fahrenheit*

\[ F = \frac{(38.5 \times 9)}{5} + 32 = \frac{346.5}{5} + 32 = 69.3 + 32 = 101.3°F \]

So 38.5°C equals to 101.3°F

Temperature monitoring can be intermittent or continuous. Based on the instrument used it also varies.

**Intermittent monitoring**

- Clinical thermometer
- Digital electronic thermometer
- Infrared thermometer

**Continuous monitoring**

- Monitor with thermocouple or thermistor probe.

7.3 PULSE

Pulse is the palpable bounding of the blood flow noted at various points on the body where the artery is near the surface and passes over a bone, when blood is pumped into the arteries by the contraction of left ventricle (normal range is 140±20/minute). In newborn most accurate method to check pulse is to take the apical pulse for one full minute.
7.3.1 Purposes
- To assess the heart rate of an infant on admission
- To determine baseline value for comparison
- To detect any deviations
- To evaluate the therapeutic measures given

7.3.2 Equipments
- Wristwatch or stopwatch
- Stethoscope

7.3.3 Procedure
- Explain the procedure to the mother/caretaker.
- Make the infant comfortable.
- Place stethoscope between infant’s left nipple and sternum.
- Count apical pulse for full one minute with stethoscope.
- Note the time in stopwatch/wristwatch.
- Record the findings.

7.4 RESPIRATION
It is the act of breathing. It involves two processes i.e. inspiration and expiration followed by pause. Normal range in newborn is 40-60/minute.

7.4.1 Purposes
- To assess asphyxia in newborn
- To assess the respiratory rate of an infant on admission
- To determine baseline value for comparison
- To detect any deviations
- To evaluate the treatment given

7.4.2 Equipments
- Wristwatch or stopwatch

7.4.2 Procedure
- Explain the procedure to the mother /caretaker.
- Quiten the newborn.
- Expose the chest of the newborn.
- Count the respiration before checking pulse and temperature.
- Note the time in stop watch or wrist watch.
• Count for full one minute.
• Check complete cycle of respiration i.e. inspiration and expiration.
• Note rise and fall of chest and abdomen.
• Note for chest in-drawing (indicates respiratory distress).
• Listen for abnormal sounds in breathing/grunting.
• Note cyanosis, nasal flaring, dyspnoea etc.

7.5 BLOOD PRESSURE

Blood pressure can be termed as a product of peripheral vascular resistance and cardiac output.

7.5.1 Purposes

• Assess neonates who are at risk of hypotension or hypertension
• Early detector of hemodynamically unstable babies

7.5.2 Indications

• At risk and unstable babies
• During management of serious illnesses like sepsis, birth asphyxia, or hypothermia
• Babies on drugs like steroids (change the blood pressure)
• Babies on isotopes of dopamine, dobutamine, epinephrine

![Fig. 7.2: Application of BP cuff](image)

7.5.3 Procedure

• Blood pressure can be measured by non invasive and invasive methods.
• In non invasive method, cuff size should cover 2/3 of the length of the arm (from shoulder to elbow).
• Cuff bladder should fully encircle the arm or if it encircles part of the circumference, then the bladder should lie over the artery.
• The cuff of 2.5 cm width for preterm and 4 cm width for term babies is used.
• The infant to be placed in supine position with limb fully extended in level with the heart.
• The cuff should be applied firmly and not loosely over the arm.
• Inflate the cuff rapidly to a pressure of a 15 mm Hg above the point at which the distal pulse disappears. Refer Fig.7.2 for application of BP cuff in neonates.
• Deflate the cuff slowly, document and report the findings.

**In invasive method:** A catheter is placed in the arterial blood vessel, associated system consisting of pressure transducer, tubing and an electronic processor. It is used for infant on aggressive ventilator support, unstable infants prone to severe hypotension.

### 7.6 BLOOD SUGAR MONITORING

LBW and sick neonates are prone to develop low blood sugar which increases mortality and morbidity. It is important to monitor, diagnose and treat early for a favorable outcome. Hypoglycemia is defined as blood sugar level of less than 45 mg/dl in all newborns.

#### 7.6.1 Purposes

• To monitor blood sugar to detect hypoglycemia (blood sugar level less than 45 mg/dl with or without symptoms).

#### 7.6.2 Indications

• Premature and L.B.W. neonates especially those weighing less than 2 kg.
• Infants of diabetic mother.
• Sick neonates (asphyxia, hypothermia, poor and/or delayed feeding, sepsis, shock, respiratory distress).

#### 7.6.3 Equipments

- Glucometer / test strips
- Alcohol for skin preparation
- 26 gauze needle or lancets
- Soap to wash hands

#### 7.6.4 Procedure

• Heel is most common site used for this procedure.
• Wash hands and make sure the heel is not cold. Make warm by rubbing if required.
• Prepare the site with 70% isopropyl alcohol/spirit, using a swab and scrubbing skin in circular motion.
• Do not use povidine/betadine as specimen contamination may allurate some results.
• Allow spirit to dry, failure to allow spirit to dry may contaminate the specimen and give fallacious results.
• Make a needle stick puncture on the posterio-lateral aspect of the heel. Avoid the middle portion of the heel and avoid making deep punctures.
• Follow the instructions on the dextrostix or glucometer for obtaining blood for analysis.
7.7 OXYGEN SATURATION MONITORING

Pulse oximetry is a method to determine the saturation of haemoglobin with oxygen (SpO₂).

7.7.1 Purposes
- Non-invasive arterial O₂ saturation monitoring
- Pulse rate monitoring and to guide oxygen therapy

7.7.2 Indications
- Useful adjunct in the assessment of response to the resuscitation
- Important measurement to aid in titration of oxygen therapy in newborn
- Acts like an apnea monitor
- Valuable companion during transport of newborn

7.7.3 Equipments
- Oxygen saturation monitor
- Sensor probe (Refer Fig. 7.3 for application of sensor probe)
- Tape to hold the probe

Fig. 7.3: Application of sensor probe
7.7.4 Procedure

- Assemble all necessary equipment.
- If saturation monitor probe is reusable, clean probe with spirit and dry it.
- Turn monitor on.
- Apply probe to a site that is well perfused.
- Ensure both sides of probes are directly opposite each other.
- Secure probe in place. Avoid edematous bruised sites and excessive pressure.
- Set high and low alarm limits for saturation and HR (2% above and below desired limits).
- Set pulse and alarm volumes.
- Check for correlation of depicted HR on monitor and the actual HR by auscultation.
- Record HR, RR, colour, oxygen saturation and FiO₂ hourly.
- Observe and change site at least once per shift.

7.8 CAPILLARY BLOOD SAMPLING

7.8.1 Purposes

- To draw a capillary blood sample by heel prick

7.8.2 Indications

Used for assessing
- Blood sugar
- Blood gas
- Hematocrit
- Sepsis screen
- Bilirubin estimation
- Blood chemistry

7.8.3 Equipments

- Pair of gloves
- Cleansing solution as per the institutional policy
- Collection tube for individual tests
- Dry gauze
- Lancet
7.8.4 Procedure (Fig. 7.4)

- Explain the mother/relative about the procedure.
- Choose the site for skin puncture.
- Warm the skin puncture site with warm face cloth.
- Gloves must be worn throughout procedure.
- Cleanse the site, select lancet appropriate for infants size, puncture in the most medial or most lateral portion of the planter surface.
- Following puncture, the first drop of blood should be wiped away with a gauze as it contains tissue fluids which may contaminate the specimen.
- Blood flow from the site will be increased if the puncture site is held downward and a gentle continuous pressure applied to the surrounding tissues.
- Strong repetitive pressure (milking) should be avoided as it may cause hemolysis and increase amount of tissue fluid in the specimen.
- Collect blood in the appropriate container.
- Apply firm pressure using dry sterile swab.

7.9 ACTIVITIES AND GUIDELINES

Activity 1
Assessment and recording of TPR, BP, Blood sugar O₂ saturation and capillary blood sampling.

- Select four newborns in the nursery/postnatal ward.
- Assess the vital signs.
- Record the TPR in recording form and
- Monitor blood sugar, O₂ saturation and assist in capillary blood sampling.
- Determine any deviations from normal.

Guidelines

- Observe proper hand washing techniques.
- Maintain adequate temperature and humidity of the room[28±2°C, and (50 - 60%) respectively].
- Ensure appropriate physical and lighting facilities.
Techniques in Newborn and Infant Care

- First take respiration, then pulse and at last the temperature of the baby and check BP.
- Check blood sugar and O₂ saturation and assist in capillary blood sampling.
- Maintain accurate recording and reporting.
- Fill up the TPR sheet (temperature, pulse and respiration record sheet neatly and accurately)

Follow the given guidelines to record your assessment findings:

Place of examination: .................................................................

Identification data:
Name............................. Age ..................... Sex .................

Date of birth..............Time of birth.............Birth weight........

Gestational age .................................................................

Time of examination from .........to ........................................

Category according to birth weight and gestational age ..............

Temperature .................................................................

Pulse ..............................................................................

Respiration .......................Blood Pressure .....................

Blood Sugar/capillary blood sampling ........................................

7.10 LET US SUM UP

In this practical we have learnt that for managing sick neonate’s vital parameters TPR, BP, Blood Sugar, capillary blood sampling is very important.

We have also learnt how to assess these vital parameters. Hope you will develop knowledge and necessary skills from this unit when monitoring essential parameters in the assessment of sick neonate.
PRACTICAL 8 NEONATAL PROCEDURES

Structure

8.0 Objectives
8.1 Introduction
8.2 Role of Nurse in Neonatal Procedures
  8.2.1 Inserting IV Cannula
  8.2.2 Umbilical Vein Catheterization
  8.2.3 Sampling
  8.2.4 Dextrose Monitoring
  8.2.5 Blood Transfusion
  8.2.6 Exchange Transfusion
  8.2.7 Retinopathy of Prematurity (ROP) Screening
8.3 Activities and Guidelines
8.4 Let Us Sum Up

8.0 OBJECTIVES

After going through this practical, you should be able to:

- Identify indications and contraindications for carrying out any neonatal procedure;
- Place the newborn and infant in appropriate position according to type of procedure;
- Assist the physician in various specialized procedures;
- Identify any adverse reaction in a newborn and infant during the procedures; and
- Monitor the vital signs and promote nursing care as per needs of the newborn and infant.

8.1 INTRODUCTION

One of the important components of care of sick newborn and infant is to diagnose/identify the exact problem of newborn and infant based on observation and certain diagnostic procedures which will help you as nursing professionals to plan and implement the care needed by the newborn and infant.

This practical will help you to develop and/or improve your skills in positioning the newborn and infant properly. You will also improve your skills in assisting and providing skilled nursing care to children during various procedures such as cannulation, umbilical vein catheterization and exchange transfusion etc.

8.2 ROLE OF NURSE IN NEONATAL PROCEDURES

A neonatal nurse plays very important role in NICU. She has to have adequate skills in performing and/or assisting in specialized procedures. In this section, we will learn about various procedures as discussed below:
8.2.1 Inserting IV Cannula

Inserting IV cannula is a very common procedure in NICU. All sick neonates require IV cannulation for intravenous therapy one or the other time during their stay in NICU.

Purposes

Purposes of IV cannulation are to:
1) collect blood sample
2) administer fluid therapy
3) stabilize sick neonate
4) administer IV medication
5) infuse blood products

Articles

- Sterile spirit swabs
- Sterile betadine swabs
- Neoflon (24 G cannula)
- 2ml or 1 ml syringe
- Specimen collection bottle
- Specimen form and label
- Sterile gloves

Procedure

1) Select the vein (dorsum of hand/foot) (Refer Fig.8.1 for site of vein puncture in neonates & infants)
2) Wash hands and dry.
3) Wear gloves.
4) Prepare skin with betadine, spirit and let it dry between applications.
5) Hold the limb proximally to make the vein prominent.
6) Pierce skin distal to the intended site of puncture.
7) Insert needle into the vein (feeling of give way ).
8) Ensure free flow; thread the needle further up.
9) Secure the cannula /scalp vein needle by adhesive tape.
10) Secure splint.
11) Inject fluid/medications.
12) Check distal limb for adequacy of circulation.
13) Document timing of intravenous access and medications given.
8.2.2 Umbilical Vein Catheterization

**Purposes**

Umbilical vein is considered to be the most appropriate route for administration of IV fluids and medication during neonatal resuscitation (Fig. 8.2). Purposes of umbilical vein catheterization are to:

1. administer fluid therapy
2. stabilize sick neonate
3. administer IV medication
4. infuse blood products
5. promote exchange transfusion

**Articles**

- A pair of sterile gloves
- Sterile umbilical catheter (3.5 F for babies less than 1.5 kg, 5 F for babies more than 1.5 kg)
- Sterile infusion set with I/V fluids
- Sterile 5 or 10 ml syringe
- Sterile spirit swabs
- Sterile betadine swabs
**Procedure**

1) Wash hands & dry.
2) Wear gloves.
3) Connect syringe to the catheter, flush the catheter with saline & keep ready.
4) Clean the cord with antiseptic lotion (betadine and spirit).
5) Place a loose tie of umbilical tape around the base of the cord.
6) Cut the umbilical cord transversely. Clean with a sterile blade.
7) Identify 2 arteries & 1 vein – the umbilical vein is a thin walled patulous with large opening in contrast to the arteries which are thick walled and much smaller in caliber. (In the normal position the umbilical vein is at 11-12° Clock position).
8) Insert the saline filled catheter gently into the vein (back flow of blood can be appreciated in a live baby by pulling at the plunger).
9) In actual situation the length of the catheter to be inserted is usually 1-2 cm below the skin till there is a free flow of blood.
10) Inject the required volume of drug as ordered.
11) Pinch the catheter & remove.
12) Press the cord to prevent bleeding.

![Fig. 8.2: Umbilical vein catheterization](image)

**Points to remember**

- Never force the catheter if resistance is encountered.
- Ensure that the air is not in the catheter and that a closed syringe is attached to the end of the catheter.

**Remember the procedure is performed by Neonatologist/ Pediatrician and you have to assist and monitor the baby**

**8.2.3 Sampling**

One of the important components of care of sick newborn and infant is to diagnose and identify the exact problem of newborn and infant based on observation and certain diagnostic procedures which help you as nursing professionals to plan and implement the care needed by newborn and infant. In this section we will learn about collection of blood and body fluids.
8.2.3.1 Blood Sampling

Blood Sampling is used for blood sugar monitoring, blood gas analysis, estimation of serum bilirubin, sepsis screening, hematocrit and blood chemistry in neonates. Blood sample can be a venous or a capillary sample. Capillary blood sampling is the most common procedure being practiced for blood collection.

**Purposes**

Purposes of capillary blood sampling are to

1) monitor blood sugar levels in sick, preterm and large for date babies.
2) monitor serum bilirubin levels in case of neonatal jaundice.

**Articles**

- Sterile pair of gloves
- Sterile spirit swabs
- Sterile betadine swabs
- Dry cotton swabs
- 24 Gauge needle
- Capillary tube

**Procedure**

1) Wash hands.
2) Collect all the articles.
3) Warm heel by rubbing, if required.
4) Prepare the skin of the heel using sterile spirit swab.
5) Squeeze the heel firmly enough to make it red.
6) Make the puncture on the postero-lateral aspect of heel (Fig. 8.3).
7) Avoid squeezing the heel and rubbing the heel as this can cause bruising and dilution of blood with tissue fluid.
8) Collect the blood in the tube taking enough blood to perform all necessary laboratory investigations.
9) Record the volume of blood taken.

![Fig. 8.3: Site for capillary blood sampling](image)
Special points to remember

• Avoid middle portion of heel and avoid making deep punctures.
• Remove betadine completely with spirit swab after preparing the site.
• Allow spirit to evaporate as contamination will give fallacious results.

8.2.3.2 Collection of Urine

Articles

• Plastic sheet
• Disposable urine bag or collector
• Cleansing agent
• Cotton swabs
• Specimen container
• Gloves (clean)

Procedure (Fig. 8.4)

1) Wash vulva/ perineum before collection of specimen.
2) In male baby wipe tip of penis in circular motion down towards the scrotum, retract foreskin if present.
3) Apply collecting bag firmly so that opening is expressed to receive urine.
4) In female baby stretch perineum during application, attach bag to perineum first, then proceed up to symphis pubis.
5) Apply diaper and comfort baby, give additional fluids.
6) Elevate the head of bed.
7) Check frequently (30-45 minutes) to see if she/he has voided, remove bag gently.
8) Cleanse the area and reapply diaper to the infant. If the infant has not voided within 45 minutes then procedure must be repeated.
9) Pour specimen into proper collecting container and send specimen to the laboratory with in 30 minutes or refrigerate.
10) When sterile specimen is needed, child must be catheterized using plain or foley’s catheter.
11) Chart the following on records

- Time when the specimen collection was started and ended
- Amount of urine collected
- Colour of urine (cloudy, turbid, any sediment)
- Type of test to be done
- Condition of skin of perineal area
- Weight of diaper (1gm = 1ml)
8.2.3.3 Collection of Stool

**Articles**
- Container
- Spatula
- Gloves
- Tissue paper
- Plastic sheet with disposable lining
- Diaper

**Procedure**
1) Provide privacy.
2) Diaper the baby with clean diaper.
3) Wash spatula well before collection.
4) Scrap the stool from diaper whichever is used and transfer to container.
5) If patient has loose stool, line the diaper with a piece of plastic lining.
6) Wear clean gloves.
7) Check the infant frequently if stool has been passed.
8) Remove soiled diaper, clean perineal area, apply diaper and make the infant comfortable.
9) Remove small amount of stool from diaper with the spatula and place it in the specimen container.
10) Send labeled specimen to the laboratory promptly.
11) Accurately describe and record the following
   a) Time of specimen collection
   b) Color, amount and consistency of stool
   c) Type of specimen collected
   d) Nature of test to be done
   e) Condition of perineal skin
8.2.3.4 Collection of Cerebro-Spinal Fluid (CSF)

Examination of CSF is one of the most useful laboratory procedure in neurological diagnosis. The CSF can be collected by lumbar (the commonest), ventricular, cisternal or subdural puncture. All the procedures need strict surgical asepsis. The purposes of all these procedures are the same.

The purposes of CSF collection are diagnostic, therapeutic and prognostic.

**Indications**

**Diagnostic**
- Meningitis
- Hemorrhage
- Acute polyneuritis
- Poliomyelitis
- Hydrocephalus
- Spinal compression
- Radiographic studies e.g. myelography

**Therapeutic/prognostic**
- To reduce intracranial pressure e.g. in hydrocephalus and encephalitis
- To inject drugs in subarachnoid space
- For spinal anesthesia (through lumbar puncture)
- To study the effect of treatment given

**Articles**
- Antiseptic solutions
- Lumbar puncture tray
- Disposable lumbar puncture needle
- Drapes
- Sterile swabs
- Sterile container to preserve the specimen
- Cotton swabs
- Glass slides with cover slips
- Sterile gloves
- Local anesthetic agent
- Tincture benzoin swabs for sealing

**Nursing Responsibilities**
- Explain the procedure to the parent/relative of the baby.
- Obtain consent.
- Position the child (Fig. 8.5 gives position & site for doing lumbar puncture)
- Assist for the procedure.
Observe vital signs during and following the procedure.
Observe area for leakage of CSF/Bleeding.
Send specimen for laboratory investigations.

Complications of the procedure are:
- Bleeding
- Infections
- Trauma
- Headache (irritability)

8.2.4 Dextrose Monitoring

Purposes
Purposes of dextrose monitoring are to
1) monitor blood glucose level in sick neonate
2) detect hypoglycemia in high risk baby

Articles
Same as described in capillary blood sampling (7.8.3 Pg.120), dextrostix bottle and glucometer

Procedure
1) Procedure of blood collection is same as described in capillary blood sampling (7.8.4 Pg. 121).
2) Allow a drop of blood to form and fall on the strip.
3) Do not rub the strip against the skin.
4) Follow the instructions on the dextrostix or glucometer.
5) If blood sugar value is less than 45 mg/dl, inform physician; the baby may require bolus of dextrose and/ or I/V dextrose solution.

8.2.5 Blood Transfusion

Blood transfusion is the process of infusing blood products into newborn’s circulation intravenously. It is a critical part of everyday nursing procedures and saves lives of critically ill babies, not having adequate circulatory volume.
**Indication of packed RBC transfusion**

1) Hematocrit less than 40%, if baby has hypotension, is on mechanical ventilation.

2) Hematocrit less than 30% if baby is sick but hemodynamically stable, has unexplained recurrent apnea or tachycardia (>160/min) for > 48 hrs or wt gain < 10 g/kg/d.

3) Hematocrit less than 20% if asymptomatic.

**Articles**

- Small sterile tray having a 2cc/5 cc syringe
- IV cannula (22G, neoflon) depending upon the size of the vein
- Spirit swabs
- Sterile gloves
- Blood transfusion sterile set with a line filter
- Leukoplast/adhesive tape/micropore
- Received blood bag
- Mackintosh
- Normal saline
- Kidney-tray
- Splint and bandages
- Torch light
- Infusion pump

**Procedure**

1) Check the neonatologist’s instructions related to type of blood products, any premedication or medication to be administered mid transfusion.

2) Obtain informed consent/inform the parents as per the policy of the hospital.

3) Assess the veni-puncture site for any signs of infection, infiltration and pain etc.

4) Determine the patency and functioning of the IV cannula.

5) Obtain the blood product from the bank.

6) Check the blood compatibility and see for the information attached to the bag and form attached with it including the expiry date.

7) Inspect the bag for signs of blood clots, contamination, gas bubbles, colour and consistency etc.

8) Begin the transfusion slowly at 2ml per minute for first 15 minutes.

9) Check vital signs and compare it with the baseline measurement.

10) Document the type and amount of blood product, blood bag number, time of starting and the time of completion.

**The maximum transfusion should be 10-15 ml/kg. Volumes larger than 15 ml/kg are to be divided. The transfusion should be given over a period of 3-4 hrs.**
Exchange transfusion with packed RBC is preferred when there is severe anemia and large volume is required to correct anemia. This would help to prevent CHF due to circulatory overload.


**Precautions for blood transfusion**

1) In case of shock due to acute blood loss, compatible whole blood 10-20 ml/kg should be transfused. In emergency situations, where baby’s blood group is not known, O-negative blood may be used.

2) Before transfusion check the following:
   a) The blood Bag No.
   b) Date of donation.
   c) The name and Medical Record / Registration No. of the patient.
   d) Blood group of baby and donor.

3) Do not transfuse chilled blood. Warm it till room temperature before transfusion, allow it to gradually come to room temperature in natural environment. Don’t immerse in hot water for rewarming.

4) Routine administration of furosemide with all transfusions is not recommended. Furosemide 0.5 mg/kg IV can be given during transfusion in patients with impending heart failure.

5) Baby’s vitals should be monitored carefully before, during and after blood transfusion (atleast for 2 hrs).

6) Check PCV of the baby 4 hrs after blood transfusion.

7) If untoward transfusion reaction like hemodynamic instability such as tachycardia, desaturation, rash, shock is observed, then immediately stop the transfusion and keep IV line on and send bag with blood set, post transfusion sample and duly filled reaction form to the blood bank.

**8.2.6 Exchange Transfusion**

**Assisting in Exchange Transfusion**

Exchange transfusion in which the infant’s blood is removed in small amounts (usually 5 to 10 ml at a time) and replaced with compatible blood, is a mode of therapy for treatment for severe hyperbilirubinemia that is unresponsive to phototherapy (Fig. 8.6).

**Indications**

1) At birth Cord hemoglobin of less than 10 g per 100 ml or bilirubin of more than 5 mg per 100 ml with history of severe Rh-isoimmunization in previous babies.

2) Indirect serum bilirubin level of 20 mg per 100 ml or more; or salicylate saturation index of more than 7 or HBABA binding capacity of less than 50 percent or bilirubin protein ratio of more than 3.5 during neonatal period. Preterm infants should be exchanged at a relatively lower serum bilirubin
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level (10 to 18 mg per 100 ml) particularly when it is associated with perinatal asphyxia, acidosis, hypothermia, hypoglycemia and respiratory distress.

3) Partial exchange transfusion for chronic anemia due to any causes.
4) Exchange transfusion with fresh heparinized blood for disseminated intravascular coagulation.
5) Life threatening metabolic disorders such as hyperglycemias.
6) Poisoning due to accidental injection of local anesthetic into fetal scalp during paracervical block, transplacental passage of chlorpropamide and magnesium sulfate to the fetus etc.
7) Acute renal and hepatic failure.
8) Septicemia with sclerema.

Fig. 8.6: Exchange transfusion

Collection of Specimens

Exchange transfusion provides an opportunity for large quantity of blood being available for various investigations. The following investigations need to be done:

- **Donor blood**: Hemoglobin, hematocrit, potassium and pH
- **Baby’s blood at the beginning of procedure**: Hemoglobin, hematocrit, bilirubin, glucose, potassium, pH and various investigations for the cause of jaundice
- **Post Exchange**: hematocrit, hemoglobin, bilirubin, glucose, calcium, potassium and pH
- **Bacteriological specimen**: umbilical swab at the beginning of procedure and blood for culture at the end. At the time of removal of catheter, its tip is sent for culture.

Equipments

Radiant warmer, cross board, blood with identification, syringe, umbilical catheter, life saving drugs, articles for preparation of the site.

Choice of blood

- In emergency situation O Rh negative blood can be used without cross matching.
- It is important that an Rh negative neonate with hemolytic disease of newborn due to Rh isoimmunization must be given Rh negative blood.
• In hemolytic disease of newborn due to ABO incompatibility, O Rh specific cells with a low titre of antiA and anti-B antibodies should be preferred.

• Fresh citrate phosphate dextrose (CPD) blood not more than 3 days old or heparinised blood can be used for the procedure. CPD blood is relatively safe and free from side effects.

• An effective exchange is achieved by performing the procedure with double the blood volume of the baby i.e. 2X 80 cc/kg body weight.

Procedure

1) Explain the procedure to the parents and give support.

2) Keep the baby adequately warm during the procedure with the help of a servo controlled overhead heat source.

3) Decompress the abdomen by passing orogastric/nasogastric tube.

4) Place the baby fastened on to a well padded cross board.

5) Keep ready an exchange transfusion chart which incorporates the following information.
   — Input output volume
   — Heart rate
   — Respiratory rate
   — Oxygen saturation
   — Colour of the baby
   — Temperature
   — Drugs administered
   — Any problem encountered

6) Assist in cleaning the area. Assist in cannulation of catheter in umbilical vein with full aseptic precautions.

7) Attach the catheter to two three way so that its leads are connected to the umbilical catheter, syringe, donor blood and a sterile container for waste.

8) Withdraw the blood with gentle suction from the baby.

9) Inject donor’s blood slowly in amount of 10-15 ml depending upon the size of the baby.

10) Rinse the jammed syringes and blocked three way connections with heparinised saline (10 units of heparin per ml).

11) Record the blood flowing in and out.

12) Assess the condition of baby.

13) Observe for heart rate, temperature, respiration, colour etc. during the procedure.

14) Restart the procedure according to doctor’s advice when the condition of newborn improves.

15) Inject 1 ml calcium gluconate slowly after every 50 ml of exchange of blood being transfused.
16) Rinse the catheter before with heparinised saline.
17) Inject calcium gluconate to avoid clotting of blood.
18) Observe heart rate for any bradycardia while injecting calcium gluconate.
19) Stop injection of calcium. Start oral calcium gluconate after the procedure if heart rate falls below 100 beats per minute.
20) Fill the catheter with heparinised normal saline, after the procedure.
21) Spray umbilical stump with antibiotic powder and cover with a light dressing

During the procedure donor blood bag should be gently agitated from time to time to keep the cells and plasma mixed

Stop the procedure if there are untoward signs like restlessness, grunting, distressed respiration, heart rate above 160 or below 100 per minute, fall in O₂ saturation and deterioration in the colour of the baby or umbilical blood

Care during procedure
• Explain procedure to the parents.
• Assist in pre and post exchange investigations.
• Assist the procedure under aseptic conditions.
• Monitor and record vital signs.
• Record the time, volume withdrawn and infused, parameters, medications, administration and special observation.
• Watch for complications.

Complications of Exchange Transfusion
• Infection of umbilical cord and infection related to blood transfusion like malaria, CMV, AIDS, and hepatitis B.
• Overloading of circulation with cardiac failure or shock following excessive deficit or rapidly performed exchange transfusion.
• Inadequate heating arrangement may give rise to hypothermia.
• Hypocalcemia, hyperkalemia, acidosis and sudden cardiac arrest or arrhythmia may occur during exchange transfusion.
• Hypoglycemia and bleeding manifestations may occur following exchange transfusion with heparinised blood.
• O₂ toxicity may occur at a relatively lower arterial oxygen tension because adult hemoglobin (transfused blood) readily releases oxygen to the tissues by virtue of its poor affinity to the oxygen.

8.2.7 Retinopathy of Prematurity (ROP) Screening
Retinopathy of prematurity (ROP) is a disorder of the developing retina of low birth weight preterm infants that potentially leads to blindness in a small but significant percentage of these infants. In term infants, the retina is fully developed, and ROP cannot occur; however, in preterm infants, the development of the
retina, which proceeds from the optic nerve head anteriorly during the course of gestation, is incomplete, with the extent of the immaturity of the retina depending mainly on the degree of prematurity at birth.

**Indications**

1) Infants with a birth weight of less than 1500 g or gestational age of 32 weeks or less

2) Selected infants with a birth weight between 1500 and 2000 g or gestational age of more than 32 weeks with an unstable clinical course.

3) Selected infants requiring cardio-respiratory support.

**Procedure**

- Pupillary dilation is done using cyclopentolate 0.5% and phenylephrine 2.5% eye drops at least 30 minutes before the procedure.
- Retinal screening examination is performed by the neonatologist using binocular indirect ophthalmoscopy to detect ROP.

**Note:**

One examination is sufficient only if it unequivocally shows the retina to be fully vascularized in each eye. Effort should be made to minimize the discomfort and systemic effect of this examination by pretreatment of the eyes with a topical anesthetic agent such as proparacaine; consideration also may be given to the use of pacifiers, oral sucrose, etc.

The initiation of acute-phase ROP screening should be based on the infant’s age. The onset of serious ROP correlates better with postmenstrual age (gestational age at birth plus chronologic age) than with postnatal age. Follow-up examinations should be recommended by the examining ophthalmologist on the basis of retinal findings classified according to the international classification. The following schedule is suggested:

1-week or less follow-up
- stage 1 or 2 ROP: zone I
- stage 3 ROP: zone II

1- to 2-week follow-up
- immature vascularization: zone I—no ROP
- stage 2 ROP: zone II
- regressing ROP: zone I

2-week follow-up
- stage 1 ROP: zone II
- regressing ROP: zone II

2- to 3-week follow-up
- immature vascularization: zone II—no ROP
- stage 1 or 2 ROP: zone III
- regressing ROP: zone III
Care during procedure
Nurse’s role is to assist the neonatologist in retinal screening examination. Clearly communicate with parents of the newborn about the course of disease, therapy and frequency of follow-up.

8.3 ACTIVITIES AND GUIDELINES

Activity 1
Identify a newborn requiring I/V cannula insertion
• Perform I/V cannulation

Activity 2
Identify a newborn requiring umbilical vein catheterization
• List indications
• Prepare articles required for umbilical vein catheterization
• Provide care during umbilical vein catheterization

Activity 3
Identify a newborn requiring sample collection. Collect the following samples:
• Capillary Blood for blood sugar monitoring
• Blood
• Urine
• CSF

Activity 4
Identify a newborn requiring blood transfusion
• List indications
• Prepare articles required for blood transfusion
• Provide care during blood transfusion

Activity 5
Identify a newborn receiving phototherapy
• List indications
• Prepare phototherapy unit
• Provide care during phototherapy

Activity 6
Visit a newborn nursery of your workplace. Identify newborn which is planned to receive exchange transfusion. Identify the problem for which exchange transfusion is indicated. Set unit and assist in the exchange transfusion.

Activity 7
Identify a preterm sick neonate requiring retinopathy of prematurity (ROP) screening and monitor the progress made by the baby.

8.4 LET US SUM UP

This practical on neonatal procedures dealt with the role of a nurse in neonatal procedures like inserting I/V cannula, umbilical vein catheterization, sampling, dextrose monitoring, blood transfusion, exchange transfusion and retinopathy of prematurity screening. Hope this practical helped you to learn the skills required for performing and assisting in various neonatal procedures.
PRACTICAL 9 NEONATAL EQUIPMENTS

Structure

9.0 Objectives
9.1 Introduction
9.2 Equipments of Thermal Control/ Thermogenesis
  9.2.1 Radiant Warmer
  9.2.2 Incubator
  9.2.3 Transport Incubator
9.3 Other Monitoring/Caring Equipments in the Care of Neonates
  9.3.1 Pulse Oximeter
  9.3.2 Oxygen Analyzer
  9.3.3 Transcutaneous Bilirubinometer
  9.3.4 Infusion Pump
  9.3.5 Photo Therapy
  9.3.6 Weighing Scale
  9.3.7 Suction Machine
9.4 Activities and Guidelines
9.5 Let Us Sum Up

9.0 OBJECTIVES

After completing this practical, you should be able to:

- List indications and purposes of various monitoring equipments;
- Operate equipments for monitoring neonates efficiently; and
- Take precautions for efficient maintenance of monitoring devices.

9.1 INTRODUCTION

Modern neonatal intensive care demands the use of equipments for optimum care of sick neonates. Equipments alone, however do not necessarily improve the care of high risk neonate. Maintenance of the existing equipment is more important than acquiring new gadgets. Therefore, it is essential that we as nursing personnel should be aware of neonatal equipments in terms of its operation and maintenance as well as care of newborn being nursed.

In this practical you will acquire skills related to operation of neonatal equipments for monitoring sick neonates. We shall discuss about the indications, purposes, parts, working, precautions, trouble shooting, disinfection and care of babies under these equipments.

9.2 EQUIPMENTS OF THERMAL CONTROL/ THERMOGENESIS

Following equipments are used for thermoregulation of newborn and infant:
9.2.1 Radiant Warmer

The radiant warmer is also called open care system which provides an intense source of radiation (heat energy) and reduces the conductive loss by providing a warm micro-environment around the baby (Fig. 9.1).

Parts

Parts of the open care system and their working/functions are given below:

- **Bassinet**: Bassinet is flat surface containing mattress, where the baby is placed
- **Quartz rod**: The overhead quartz rod produces heat. This is reflected by the parabolic reflector on to the baby placed on the bassinet.
- **Skin probe**: The skin temperature of the baby is sensed by the skin probe and displayed on the temperature display panel. The thermocouple probe is a very small bead made up of the junction of two dissimilar metals. The bead generates a very small voltage proportional to temperature. The voltage generated by the bead is measured by the monitor and converted to thermal units.
- **Air probe**: Air probe measures the temperature of the circulating air.
- **Control panel**: The information of desired skin temperature selected by temperature selection knob is processed by the microprocessor inside the control panel and matched against the actual temperature of the baby.
- **Heater output**: The quantity of heat produced is displayed on the heater output panel.
- **Alarm**: Whenever the baby’s temperature rises by more than 0.5°C of the set temperature a visual/auditory alarm is activated. Alarms are emitted due to air sensor failure, power failure or if skin probe is displaced.

Steps for operation

1) Connect the unit to mains and switch it on.
2) For pre-warming, select manual mode and keep heater output to maximum.
3) Place baby under the radiant warmer.
4) Connect probe and select servo mode.
5) Attach skin probe on baby’s abdomen (midway between umbilicus and xiphisternum). Select the desired temperature of the baby at 36.5°C.
6) Read temperature on display.

In case of severe hypothermia (temperature < 32°C)

1) Select manual mode.
2) Adjust heater output
   a) If below 36°C- High.
   b) If between 36-36.5°C-Medium.
   c) If between 36.5-37.5°C-Low.
   d) If >37.5°C - Remove baby/Switch off warmer.
3) Measure baby’s axillary temperature 1/2 hourly X 2 hours & then 2 hourly.

Fig 9.1: Radiant warmer

Cleaning and disinfection

- Use gluteraldehyde 2% for terminal disinfection and soap/detergent and water once daily, when in use.

Monitoring baby under radiant warmer

- Baby nursed under radiant warmer requires monitoring. There are certain do’s and don’ts to be observed:

Dos and don’ts:

- Check temperature of the baby every ½ hourly for 2 hours, then 2 hourly.
- Ensure warm feet of the baby.
- Ensure probe is connected on the abdomen. In case of prone position, probe is applied on the groin.
- Do not leave baby unattended.
- Ensure side walls are fastened up to prevent fall.
- Ensure adequate clothing of baby in case of electricity failure.
- Identify reason for the alarm and take corrective action while silencing the alarm.

Trouble shooting

- In case of any trouble shooting, check fuse, plug and cords of the equipment.

Side effects & dangers

The side effects and dangers associated with the use of radiant warmer are:

- Increased insensible water loss
- Fluid intake must be tailored to meet demands
- Hypothermia
- Hyperthermia

Maintenance

- Radiant warmer requires regular maintenance which includes calibration and annual maintenance contract (AMC).
9.2.2 Incubator

The incubator is a closed system with a heating element underneath and a transparent hood or canopy around the baby. Air or an air oxygen mixture is sucked through micro-filter, streamed over the heating element and circulated through the hood to attain a uniform temperature within (Fig. 9.2).

**Recommended incubator temperature for air mode**

Recommended incubator temperature for air mode is given in Table 9.1.

**Table 9.1: Recommended incubator temperature for air mode**

<table>
<thead>
<tr>
<th>Weight of the baby</th>
<th>Incubator temperature by age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>35°C</td>
</tr>
<tr>
<td>Less than 1.5 Kg</td>
<td>1-10 days old</td>
</tr>
<tr>
<td>1.5- 2kg</td>
<td>-</td>
</tr>
<tr>
<td>2.1-2.5 kg</td>
<td>-</td>
</tr>
<tr>
<td>&gt;2.5 kg</td>
<td>-</td>
</tr>
</tbody>
</table>

**Parts of the incubator**

- Bassinet with the mattress
- Acrylic/plexiglass/fiberglass
- Air inlet, oxygen inlet
- Filter fan
- Humidity tray
- Inlet for tubing
- Skin probe
- Air probe
• Control panel
• Heater output

**Indications of using incubator**
• Neonates born < 35 weeks and/or birth weight < 1800gm.
• Humidification for extremely LBW neonates < 1Kg.
• Isolating infected baby to achieve barrier nursing.
• For transporting baby using transport incubator.
• For providing stimulation to an apneic baby, if incubator has rocking bed attachment.

**Steps for operation**
1) Connect incubator to mains.
2) Determine the appropriate temperature for the incubator based on the baby’s weight and age (Table 9.1).
3) Place the baby inside the incubator.
4) Connect the probe to the baby. Site for probe attachment is same as in case of radiant warmer.
5) Work in air mode if baby is unstable and skin/servo mode if baby is stable. In servo mode the set temperature should be between 36ºC to 37ºC.
6) Check the temperature of the incubator every hour for first eight hours and then every three hours.

**Cleaning and disinfection**
• Use glutaraldehyde 2 %, every seventh day, after shifting the baby to another clean incubator. Clean the incubator with soap/detergent and water once daily.

**Monitoring baby in incubator:**

**Dos and don’ts:**
• Check temperature ½ hourly for first 2 hours and then 2 hourly
• Ensure that the baby’s head is covered and is clothed unless it is necessary for the baby to be naked.
• Ensure probe is connected.
• Do not leave baby unattended.
• Identify reason for the alarm and take corrective action while silencing the alarm.

**Trouble shooting**
• In case of any trouble shooting, check fuse, plug and cords of the equipment.

**Side effects and dangers**
The side effects and dangers associated with the use of incubator are:
• Fluid intake must be tailored to meet demands.
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- Hyperthermia
- Hypothermia

Maintenance

- Incubator requires regular maintenance which includes calibration and annual maintenance contract (AMC). Date of change of air filters is done every 3 months, temperature calibration of the incubator is done every 3 months, and preventive check every 6 months.

9.2.3 Transport Incubator

A transport incubator is an equipment, which provides a safe and hospitable environment to the sick and fragile newborn during transport to and fro from one neonatal centre to another. The working, care, and maintenance are similar to the incubator.

9.3 OTHER MONITORING/CARING EQUIPMENTS IN THE CARE OF NEONATES

9.3.1 Pulse Oximeter

Pulse Oximeter is a device used to determine the percent saturation of hemoglobin with oxygen. It provides a simple noninvasive, portable and inexpensive method to continuously monitor oxygen saturation and heart rate with accuracy. In the newborns pulse oximeter provides the fifth vital parameter besides temperature, pulse, respiration and blood pressure (Fig. 9.3).

Fig.9.3: Pulse Oximeter

Indications

To measure oxygenation in infants suffering from hypoxia, apnoea, cardio-respiratory disease, bronchopulmonary dysplasia (BPD)

Purposes

- To monitor response to therapy during resuscitation
- To monitor saturation during suctioning and intubation
- To regulate FiO2 during neonatal anesthesia
**Parts:**

Parts of the pulse oximeter are:

- Numeric display (LED)
- Graphic display (LED)
- SpO2 alarm limits, high / low setting button
- Pulse rate alarm limits, high / low setting button
- Display contrast adjust slide
- Power / Stand by button
- Carrying handle
- Sensor Connector
- Pulse Beep volume button
- Alarm volume button
- Alarm silence button

**Principle of Working**

A sensor device consisting of two light sources (red and infrared) and a photo detector is placed over a pulsating arteriolar bed (e.g. on the finger, toe, ear) opposite to each other. Light moves through the tissue and is absorbed by the pulsatile arteriolar bed of the intervening tissue bed. The light passing through the tissue bed after absorption is measured by the photo detector and displayed as the plethysmograph as well as a numeric value in percent. This value is a ratio of the oxygenated to deoxygenated hemoglobin. The pulse oximetry reading reflects the amount of hemoglobin SATURATED with oxygen at the time of measurement.

**Steps of operation**

1) Connect pulse oximeter to Mains.
2) Use the mode switches in the oximeter rear panel to set the language, averaging mode, patient mode, patient’s pulsatile value display and EMI line frequency.
3) If you change the switch settings while the oximeter is on, the new settings do not take effect until you power OFF then ON again.
4) Attach probe to the finger, toe or ear.
5) Within few seconds, monitor starts displaying the readings.

**Cleaning and disinfection**

Cleaning and disinfection of pulse oximeter especially the probe is to be done every time before using it on a new baby.

- Display panel is cleaned using cotton swab moistened with 70% isopropyl alcohol and is to be gently wiped.
- Use a soft cloth dampened with a mild soap and water solution or one of the following solutions such as 70% isopropyl OR ethyl alcohol, quaternary ammonia, 3 % hydrogen peroxide in water, 100 : 1 bleach solution or cidex plus activator.
Do’s and don’t’s:
- When cleaning the display area do not use abrasive cleaning compounds OR other materials that could damage the screen.
- Do not autoclave, pressure sterilize OR gas sterilize.
- Do not soak or immerse the monitor in liquid.
- Do not use petroleum based solutions, acetone solutions OR other harsh solvents to clean the oximeter.

Trouble shooting
- In case of any trouble shooting, check fuse, plug, battery and cords of the equipment, also check for sensor failure.

Side effects and dangers
The side effects and dangers associated with the use of incubator are:
- Failure of operation.
- Explosion hazard in presence of any flammable anesthetic mixture.
- Electrical shock hazard.
- Reddening, blistering, skin discolouration etc, because of the sensor placement.

Maintenance
- Pulse oximeter requires regular maintenance which includes cleaning the oximeter as necessary, recharging the battery as necessary and replacing the fuses in power module as necessary.

Drawbacks
- Unreliable readings in hypothermia, hypotension, vasoconstriction and motion artifacts.
- Abnormal hemoglobin are not accounted for, like CO poisoning and methemoglobinemia which is rarely seen in infants.
- Does not work well in bright ambient light.

Precautions
- Don’t apply the probe tightly.
- Rotate the site of probe applications as delicate neonatal skin tends to get compressed and there could be perfusion problem.
- Clean the probe with only clean cotton swab with distilled water (ideally one probe is for one baby only).

9.3.2 Oxygen Analyzer
The equipment measures the concentration of oxygen in the inspired air. It is portable small and light weight equipment which enables setting of high and low alarm limits (Fig. 9.4).

Parts
- Digital display
Neonatal Equipments

- % sign flashes during the calibration
- Low battery indicator
- On/off key
- Lock/unlock key
- Calibration key (up and Down key for calibration)
- Sensor
- Connecting cable

Fig.9.4: Oxygen Analyzer

Steps of operation
1) Check the life time of battery of the equipment periodically.
2) Set the alarm limits within 5% of desired oxygen concentration.
3) Place the oxygen sensor in gas mixture whose concentration is to be measured.
4) Read the displayed value, that is the concentration of oxygen in the gas measured.

Cleaning and Disinfection
- Use a damp cloth to clean the equipment using soap and water.

Do’s and Don’ts
- Perform calibration before measurement.
- Don’t leave oxygen monitor stored with power switch on.
- Do not pull or bend the sensor connecting cable.
- Avoid storing oxygen analyzer at very high or low temperature.

Trouble Shooting
- Check display panel of the equipment.
- Check alarm and safety features.

Side Effects and Dangers
- Analyzers must be removed from O₂ source after each reading as the humidity damages the sensor and makes it less accurate.
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- Slower response and erroneous reading may be obtained in the environment of high humidity.

Maintenance

- Life time of the battery is less and needs to be changed regularly.

9.3.3 Transcutaneous Bilirubinometer

Neonatal jaundice is a very common condition. For appropriate management of hyperbilirubinemia, estimation of serum bilirubin is required. Transcutaneous bilirubinometer is a non-invasive reliable technique for estimation of total serum bilirubin (TSB) in a jaundiced baby (Fig. 9.5).

Indications

- Prediction of serum bilirubin in jaundiced neonate

Steps of operation

1) Clean the site with alcohol where the sensor is to be placed.
2) Apply double sided adhesive ring to the sensor.
3) Apply one drop of contact solution at the skin site.
4) Peel protective backing from adhesive ring, place sensor on the skin over the contact solution and press the sensor to the skin.
5) Place sensor on lateral abdomen, anterior or lateral chest, inner upper arm, inner thigh or posterior chest.
6) Choose site devoid of hair, avoid bony prominence and areas with large surface blood vessels. Secure the sensor cable to prevent tugging of the electrode when the cable is manipulated.
7) Turn the site/sensor temperature control to 44°C. Allow 15-20 minutes for site equilibration before taking readings.
8) Note the time at which the sensor was placed on the skin, so that the site can be changed after 4 hours period.
9) When changing the sensor site:
   - Use an alcohol pad to help loosen the adhesive and peel gently from the skin.
o Inspect the skin site for sensitivity to heat or to the adhesive.
o Peel adhesive ring off the sensor.
o Flush the membrane surface with de-ionized water.
o Gently blot excess water and dry the sensor.
o Observe the site for local erythema and burns.

Cleaning and Disinfection
• Clean the body of the bilirubinometer using damp cloth and clean the probe with spirit swab.

Do’s and Don’ts
• Gently press the optic head of the meter against the neonates skin usually forehead or upper part of sternum.
• Ensure optic head makes full contact with the skin and there should be no gaps between the head and the skin.
• Avoid measurement against bruises, birthmarks and sub-cutaneous hematomas.
• Record reading in mg/dl.

Side Effects and Dangers
• At higher level of bilirubin, transcutaneous bilirubinometer underestimates the TSB. Therefore, blood sample should be sent to the lab for estimation of bilirubin.

Maintenance
• Perform two point gas calibrations using the device specific apparatus, as per manufacturer’s instructions.
• Do regularly check battery for proper functioning of the instrument.

9.3.4 Infusion Pump
As in practical 5 you have learnt about intravenous therapy and you are aware that regulation of rate of flow is an important nurse’s responsibility. Accurate fluid infusion and drug administration is crucial for the optimum management of a critically ill neonate. The use of infusion pump has been advocated over manual flow control system on the basis of assuring precise and accurate delivery of prescribed fluid volume over a specified time (Fig. 9.6).

Indications/ purposes
Use of infusion pump is indicated in case of:
• Continuous and controlled intravenous delivery of fluids and common medications, such as antibiotics, dopamine, phenobarbitone, aminophylline and glucose etc.
• Small babies or those with compromised renal, cardiac or pulmonary function, have limited fluid tolerance so as to prevent inadvertent volume overload.
Fig. 9.6: Infusion Pump

**Parts of infusion pump**

Parts of infusion pump are:

- Syringe barrel clamp
- Pusher and Push guard
- Handle and Assembly bolt
- Main connection, fixing button
- Swing lock clamp
- ON / OFF switch
- Screen
- Menu
- Alarm Warning (visual and auditory)
- Silence Alarm
- Bolus OR Prime
- Value Selection
- Stop – Infusion stop

**Steps of operation**

1) Connect infusion pump to Mains.
2) Press on key to turn the pump on.
3) Install syringe loaded with desired amount of fluid with pressure line attached and primed.
4) Press OK to confirm syringe.
5) Select the flow rate.
6) Connect it to the baby.
7) Start the infusion.
8) Check IV site regularly to avoid inadvertent extravasations.
9) To give a BOLUS, press the bolus key and continue pressing till the desired amount has been infused.
10) Press STOP to stop the infusion.
Cleaning and Disinfection:
- Use a cloth soaked in DETERGENT – DISINFECTANT, previously diluted with water if required to destroy micro organisms.

Do’s and don’t’s:
- Do not place in autoclave or immerse the device.
- Disconnect battery before opening device.
- Avoid short circuits and excessive temperatures.

Trouble shooting
- Check continuous display, indicator lights, alarm and safety features.

Side effects and dangers
- Short circuits & excessive temperatures.

Maintenance
- Preventive maintenance is recommended every 3 years, which includes battery replacement.

9.3.5 Photo Therapy
Phototherapy involves the exposure of the skin of the jaundiced baby to blue or cool white light of wavelength of 400-520 nm. It reduces the serum concentration of bilirubin and the risk of bilirubin toxicity (Refer Fig. 9.7 for phototherapy unit).

Fig. 9.7: Phototherapy Unit

Parts
- Tubes - Number -6 (Color -Blue/White)
- Watt -20
- Irradiance -4-8 uw/cm²/nm (minimum)
- Wavelength -420-460 nm
Steps of operation

1) Connect to mains.
2) Switch on the unit & check that all tube lights are working.
3) Place baby naked only with the napkin on.
4) Cover the eyes.
5) Change position frequently.
6) Increase fluid intake.
   a) Breast feed frequently
   b) Spoon/Gavage – Increase by 20 ml/kg/day
7) Provide continuous phototherapy.

Cleaning

Use damp duster soaked in soap/detergent for cleaning the unit and dry it.

Dos and don’ts

• Cover eyes of the baby.
• Check temperature of the baby 2 hourly- prevent hypo/hyperthermia.
• Check weight of the baby daily.
• Frequent breast feeding is to be provided to the baby.
• Reassess the baby frequently.

Trouble shooting

• Check fuse, plug, cord of the equipment. Change tube, if it is flickering or ends of the tube are blackened.

Ineffective phototherapy

Phototherapy can be ineffective if

• Baby is covered
• Some tubes are not working
• Flickering light
• Tube ends have black circles

Side effects and dangers

• Hyperthermia/Hypothermia
• Increased insensible water loss
• Tailor fluid intake to meet demands

Maintenance

• Change tubes - if ends black or - every three minutes.
• Check flux (if possible).
• Have annual maintenance contract for the equipment.
9.3.6 Weighing Scale

Accurate weighing scale is a fundamental need for all special care neonatal units and delivery room. Weight recording is essential to monitor the adequacy of nutrition as well as fluid balance (Refer Fig. 9.8)

![Fig. 9.8: Weighing Machine](image)

**Parts**
- Pan or baby tray
- Weight scale dial

**Steps of operation**
1) Wipe/clean the weighing pan.
2) Place sheet on the pan.
3) Check for and adjust zero error.
4) Place baby on the surface, note weight.
5) In case, if zeroing cannot be done with sheet placed on the weighing scale
   - Weigh the sheet above (a)
   - Place baby on the surface and note weight (b)
   - Subtract a from b (b-a)
6) Record weight of the baby.

**Cleaning and disinfection**
- Clean with damp cloth using soap and water and
- Wipe with spirit swab between patient use.

**Dos and don’ts:**
- Always look for and adjust zero error.
- Always calibrate using a known weight.
- Weigh baby naked with just a nappy.
- Remove excessive clothing.
- Do not stack up linen or other objects on the weighing pan when not in use.
- Record weight only when needle is stationary & not oscillating.
**Troubleshooting**
- Place weighing scale on a flat firm surface.
- Calibrate weighing scale before each use.
- Record zero error if it cannot be corrected and account for it.

**Maintenance**
- Calibrate weighing scale daily.
- Have annual maintenance contract.

### 9.3.7 Suction Machine
Suction machine is an essential equipment both in labour room and neonatal ICU. Suctioning is used to remove secretions from the oral and naso-pharyngeal area of the neonate using catheter (*Fig. 9.9*).

**Parts**
- Suction Catheter
- Suction tubing
- Suction bottles

**Types**
- De Lee’s suction trap
- Foot operated
- Electric (if available)

**Steps of operation**
1) Connect suction machine to mains.
2) Switch on the unit and occlude distal end to check the pressure. Ensure it does not exceed 100 mm of Hg.

3) Use disposable suction catheters.

4) Connect to suction tubing.

5) Perform suction gently.

6) Switch off the suction machine.

**Cleaning and disinfection**
- Wash suction bottle with soap & water.
- Change bottle solution (1% hypochlorite solution) every day.

**Dos and don’ts**
- Suction gently.
- Do not do vigorous & deep suction.
- Use only disposable suction catheters.
- Check adequacy of suction pressure.

**Troubleshooting**
- Check fuse, cord, earthing and leakages in the bottle/tubing.

**Side effects & dangers**
- Local trauma
- Bradycardia
- Apnea
- Infection

**Maintenance**
- Check for adequacy of suction pressure.
- Change tubing if leaky or broken.
- Have annual maintenance Contract for proper upkeep of the device.

### 9.4 Activities and Guidelines

**Activity 1**
Select a neonate nursed in incubator/radiant warmer. Set the thermoregulatory equipment and monitor the equipment

**Activity 2**
Select a preterm baby being admitted in neonatal ICU for management. Monitor saturation of the baby

**Activity 3**
Select a baby with physiological jaundice with serum bilirubin more than 20 mg/dl. Monitor serum bilirubin level, and initiate phototherapy for the baby.
Activity 4
Select a newborn baby and start I/V infusion using infusion pump.

Activity 5
Select a baby and weigh to find out the change in body weight and also weigh the used nappy of the baby to find out the urine output.

Activity 6
Select a baby being mechanically ventilated and perform endotracheal, oral and naso-pharyngeal suctioning.

9.5 LET US SUM UP

This practical section on neonatal equipments dealt with neonatal equipments used for caring and monitoring sick neonates. Parts of the equipments, their working, precautions, troubleshooting, disinfection and monitoring babies under these equipments were also covered.

This practical unit will help you to learn the skills required for handling the equipments and using the equipments for care and monitoring the sick neonate.
PRACTICAL 10  DISINFECTION AND HOUSE KEEPING

Structure
10.0  Objectives
10.1  Introduction
10.2  Sources of Infection
10.3  Principles of Prevention of Infection
10.4  Procedure for Entering into the Nursery
10.5  Types of Disinfectants/Germicides used in Newborn Unit
10.6  General Instructions for using Disinfectants in Newborn Unit
10.7  Cleaning and Disinfection of Newborn Care Unit
   10.7.1  Cleaning and Disinfection of Newborn Care Area
   10.7.2  Cleaning and Disinfection of Newborn Care Equipments
10.8  Bio-Medical Waste Management
10.9  Activities and Guidelines
10.10  Let Us Sum Up

10.0  OBJECTIVES

At the end of this unit you should be able to:

• List the sources of infection;
• Understand the principles of infection prevention;
• Perform the procedure for entering into the nursery;
• Identify the various types of disinfectants/germicides used in nursery;
• Follow the instructions for using disinfectants; and
• Disinfect patient care area and patient care equipment.

10.1  INTRODUCTION

An infection is an invasion of the body by pathogens or micro-organisms capable of producing diseases. Newborn in hospitals and health care settings can easily acquire infection because they are in high risk group. Such infections are transmitted by health care practices/approaches.

Hence, it is important to prevent the transmission of infection by following various disinfection procedures.

Disinfectant is an agent usually chemical that kills any types of pathogenic micro-organisms but not necessarily the more resistant forms such as spores. In this unit we will discuss regarding disinfection and housekeeping for infection control.
10.2 SOURCES OF INFECTION

The sources of infection in newborn unit could be:

- Personnel working in the unit
- Infected newborns
- Fomites – equipments
- Environment
- Invasive procedures

10.3 PRINCIPLES OF PREVENTION OF INFECTION

By practicing the following principles of infection prevention we can protect the baby, mother and care provider from infection:

- Provide routine care to the newborn baby
- Consider every person (including the baby and staff) as potentially infectious
- Wash hands or use an alcohol based hand rub
- Wear protective clothing and gloves
- Use antiseptic techniques
- Handle sharp instruments carefully and clean, sterilize or disinfect instruments and equipment as required.
- Routinely clean the newborn special care unit and dispose off waste
- Isolate babies with infection to prevent spread of nosocomial infection.

10.4 PROCEDURE FOR ENTERING INTO THE NURSERY

- Keep strict restriction for entry into the nursery. Allow only heath care providers and parents. Do not allow visitors to enter into the nursery.
- Remove shoes, socks and woollens (wear nursery slippers) before entering the newborn unit.
- Please note that change of shoes though does not help in controlling infection but it does prevent the unwanted entry of infectious agents.
- Remove watch and rings upon entering nursery and wash hands and arms thoroughly by following the tips mentioned below:
  - Use plain or antimicrobial soap for hand washing (bar, liquid or powder).
  - Wash hands and arms up to the elbow for at least 2 minutes according to six steps of hand washing as per the following sequence (Fig 10.1).
    a) Palms and fingers and web spaces
    b) Back of hand
    c) Fingers and knuckles
d) Thumbs
e) Fingertips
f) Wrists and forearm up to the elbow

- Wash hands for at least 30 seconds before touching the next baby after you have handled an infected neonate.
- If the baby is uninfected, use alcohol based hand rub (sterillum or 70% alcohol) for hand washing before touching another newborn.
- Note that rinsing hands with alcohol or sterillium is not a substitute for proper hand washing.
- Make use of single use autoclaved sterile towel or disposable paper towel for drying the hand.
- Trim the nails and avoid nail polish
- Use mask and sterile gown for all invasive procedures e.g. lumbar puncture
- Wear sterile gown after hand washing and prior to entry into the main unit.
- Always use sterile gloves for all invasive procedures.
- Wash gloved hands to remove blood stains and secretions from the gloves and then discard them in a container of polar bleach. Wash hands again.

Fig.10.1: Six Steps of hand washing

10.5 TYPES OF DISINFECTANTS/ GERMICIDES USED IN NEWBORN UNIT

Various disinfectants/germicides used in newborn unit is summarized in Table 10.1.
### Table 10.1 Disinfectants and Germicides used in newborn care unit

<table>
<thead>
<tr>
<th>Name</th>
<th>Indication for use</th>
<th>Directions for use and special considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacillocid spray (2%)</td>
<td>• Walls of nursery</td>
<td>• Prepare solution as per instruction of manufacturer</td>
</tr>
<tr>
<td></td>
<td>• Incubators and warmers (when not in use)</td>
<td>• Put off air conditioners at the time of spray</td>
</tr>
<tr>
<td></td>
<td>• Surface of weighing machine</td>
<td></td>
</tr>
<tr>
<td>Cidex (2%) (Glutaraldehyde)</td>
<td>• Oxygen/suction tubings</td>
<td>• Before immersing into cidex, clean thoroughly with soap and water</td>
</tr>
<tr>
<td></td>
<td>• Face mask and Ambu bag</td>
<td>• Time of contact (once prepared, solution is active for 14 days)</td>
</tr>
<tr>
<td></td>
<td>• Reservoir</td>
<td>• For sterilization: 4-6 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• For disinfection: 15 mins</td>
</tr>
<tr>
<td>Ecoshield (H₂O₂ 11%w/v, Silver Nitrate 0.01% w/v)/ Formalin (40%)</td>
<td>Fumigation of nursery</td>
<td>Routine fumigation:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 200 ml in 800 ml of water per 1000 cubic feet area for 60 minutes for aerial fumigation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 30 ml formalin with 90 ml water per 1000 cubic feet area. Nursery is to be sealed properly. Switch off AC and seal AC duct. Take desired amount of formalin and water in the OT care. Switch on the machine for half an hour. Open and clean the nursery after 6 hrs.</td>
</tr>
<tr>
<td>Sodium hypocholorite (bleach 1%)</td>
<td>Sharps/needles and disposables</td>
<td>Keep the solution covered, change it every 24 hours</td>
</tr>
<tr>
<td>Spirit (70% alcohol)</td>
<td>Skin preparation, cleaning laryngoscopes/blades, tape measures, stethoscope</td>
<td>Do not use to clean incubators and warmers</td>
</tr>
<tr>
<td>Soap and water</td>
<td>Oxygen hood, feeding utensils, swab containers, injection tray, face mask, buckets</td>
<td>After washing in soap and water, boil the feeding utensils for 10 min</td>
</tr>
<tr>
<td>Phenyl</td>
<td>Cleaning floors</td>
<td>As per the instruction of manufacturer. Use daily in morning shift/ as required</td>
</tr>
<tr>
<td>Betadine (5%, w/v)</td>
<td>Skin preparation</td>
<td>Use undiluted</td>
</tr>
</tbody>
</table>

**Note:** Ecoshield is an eco-friendly, non-toxic and safer chemical agent for fumigation.

### 10.6 GENERAL INSTRUCTIONS FOR USING DISINFECTANTS IN NEWBORN UNIT

- Follow manufacturer’s instructions
- Check expiry date before using
- Use recommended dilution
- Label containers – date of issue and expiry
- Empty container after use
- Wash and disinfect container before reuse
- Do not refill container without disinfecting container between each use
- Topping up is not allowed
- Do not use the same container to store other solutions
- Do not leave disinfectant container open at any time
- Wash and clean articles before disinfecting

10.7 CLEANING AND DISINFECTION OF NEWBORN CARE UNIT

10.7.1 Cleaning and Disinfection of Newborn Care Area

- Ensure that the floor and walls are cleaned once in each shift by wet mopping with dettol/2% Bacillol/Phenyl solution and mop is changed for each room.
- Ensure that the windows, walls, storage shelves are scrubbed periodically with dettol/bacillol.
- Make sure that the sinks and wash basins are scrubbed daily with vim, surf and teepol.
- Make sure that the fans are cleaned with wet clean cloth once a week.
- See that the plastic bags are put in dustbin, also these bags should be sealed before they are removed. Dustbins should be cleaned and washed properly under running water. Ensure that it is not leaking. The bin must always be kept closed.
- See that the buckets are cleaned everyday in the morning shift with soap and water.
- Transfer the babies who remain in the nursery for an extended period to a clean and disinfected unit periodically. No baby should remain in the incubator longer than 7 days without cleaning.
- The nursery should be fumigated as per requirement. For room of 1000 sq ft size, take one liter formaldehyde and add 450 gms KMNO₄ in it.

<table>
<thead>
<tr>
<th>Name</th>
<th>Disinfection Method</th>
<th>Frequency &amp; other considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor</td>
<td>Wet mopping with phenyl</td>
<td>Once in each shift</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No dry sweeping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Do not use 2% gluteraldehyde (cidex)</td>
</tr>
<tr>
<td>Walls</td>
<td>2% Bacillolid</td>
<td>Once in each shift</td>
</tr>
<tr>
<td>Fans</td>
<td>Wipe with wet clean cloth</td>
<td>Once in a week</td>
</tr>
<tr>
<td>Window AC</td>
<td>Surface and filters to be washed with soap and water</td>
<td>Once a week</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>Defrost and clean with soap and water</td>
<td>Once in a week</td>
</tr>
<tr>
<td>Buckets</td>
<td>Soap and water</td>
<td>Daily in morning shift</td>
</tr>
<tr>
<td>Sinks</td>
<td>Vim/surf</td>
<td>Daily in morning shift or as required</td>
</tr>
</tbody>
</table>
These are general guidelines which may be adapted based on the availability of disinfectants and the infection control policy of the hospital. Refer Table 10.2 for housekeeping routines in newborn care area.

### 10.7.2 Cleaning and Disinfection of Newborn Care Equipments

1) Clean the **cots** everyday with savlon/detol/bacillol.

2) Clean **open care units, radiant warmer and incubator** everyday with soap water, if occupied. If not occupied, clean with 2% bacilloicid.

3) Clean the **stethoscope, measuring tape, BP cuffs, probes of radiant warmer/incubator, pulse oximeter** with spirit swab daily.

4) **Thermometers**
   - Wipe exterior with alcohol after each use
   - Store them dry in a bottle containing dry cotton
   - Keep separate thermometer for each baby

5) **Respiratory equipments**
   - **Laryngoscope** – disinfect with spirit swabs (thoroughly daily and after each use). Wrap in autoclaved cloth, put date on cover.
   - **Laryngoscope blades** – ensure that these are autoclaved and changed daily if ventilator is being used. Alternatively, cidex (10 minutes) may be used.
   - **Endotracheal tubes** – use disposable tubes. Non disposable tubes can be disinfected in 2% glutaraldehyde (cidex) for 10 minutes.
   - **Compressor** – clean filter everyday.
   - **Oxygen hood** – clean daily with soap and water. Do not use alcohol on plexiglass hoods. Dry with autoclaved linen
   - **Face mask** – clean daily and after each use with soap and water, immerse in cidex for 20 minutes, revise in distilled/running water, dry with autoclaved linen and wrap in autoclaved linen and put date.
   - **Resuscitation bag and reservoirs, oxygen tubings, bottle and tubings of suction machine:** clean with detergent/soap and water after dismantling. Immerse in cidex for 4 – 6 hours. Rinse in distilled water. Dry, wrap in autoclaved linen and put a date.
   - **Suction apparatus**
     - Change the tube connected with suction bottle daily.
     - Flush the tube under running water, dry and autoclave daily.
     - Change the suction bottles daily. Clean suction bottle with water and detergent and then autoclave daily.
     - See that the suction bottle contains hypochlorite solution.
     - Use disposable suction catheter.
6) **Feeding utensils**

- Wash the feeding cups with soap and water immediately after use. Then these should be boiled for 10 minutes.
- Use disposable feeding tubes. In-dwelling naso-gastric tube should be changed once in 24 hours.

7) **Mackintoshes**

- Decontaminate by immersing in a tub of 0.5% chlorine/sodium hypochlorite/chlorhexidine solutions.
- Spread the mackintosh on a flat surface and wet it by pouring water on it.
- Use a piece of clean cloth or a plastic scrubber to apply soap and wash away the soap using water.
- Repeat the above process on the other surface.
- Dry it in shade on a dry horizontal surface.
- When dry, powder it lightly with dusting powder and roll it with a paper lining on it.

8) **Rubber tubes and catheters**

- Hold the tube upside down under running water to let the stream of water run through it.
- Use swab stick to remove any organic matter blocking the tip of the tube, and eye of the catheter, if needed. Ensure patency of each by seeing free flow of water through the eye of the catheter and tip of the tube.
- Using soap and water clean the dirt and grease on the surface of the catheter or tube.
- Hang the tubes and catheters to dry in a cool/shaded place.
- After drying, separate same sized catheters and tubes.
- Powder the outer surface using dusting powder; coil the tube by securing the tip into the broader end.
- Wrap individual tube and catheter using a piece of thin cloth and boil for five minutes or autoclave.

9) **Gloves**

- Gloves are considered to be contaminated with body secretions which may be highly infective. Therefore, it is essential that the wearer decontaminates the gloves on hands before removal by dipping them either in the disinfectant solution, 0.5% chlorine solution or just washes hands under the running water even if they are disposable gloves.
- Remove gloves and discard in a decontamination bucket.
- Disposable gloves should be sent for autoclaving and shredding.
- For re-usable gloves (red rubber gloves used for housekeeping): wash the gloves using soap and water first from the outside surface and then the inside surface by reversing them.
10) **Rubber Articles**

- **Autoclaving**: this is the best method of sterilization of rubber good. It is done at a lower temperature of 250 – 254°F or 121-123°C and pressure of 15-17 pounds per square inch, for 15 minutes.

- **Boiling**: wrap the rubber item to be boiled in soft, thick cloth and boil for 15-20 minutes. Hard rubber goods should not be boiled for more than five minutes and cooled fast to retain their shape.

- **Chemicals**: chemical sterilization can also be done using the following chemicals:
  
  - Savlon 100% 30 minutes
  - Glutaraldehyde 2% 10-20 minutes for chemical disinfection and 10 Hours for chemical sterilization
  - Alcohol 50-70% 20-30 minutes

11) **Glass Items**

- Disinfect the item by immersing in 0.5% chlorine/sodium hypochlorite/ chlorhexidine solution minimum for five minutes in a plastic container covered with lid. This will lessen the number of micro-organisms on the surface of the item.

- Clean glasswares using mild liquid soap because strong soaps and detergents can damage the smooth surface of glass.

- Use plastic brushes of an appropriate size to cleanse the tubes, brushing dislodges sticky substances and organic matter from corners and grooves.

- Rinse the glass items under cold running water to wash off the organic material.

- Dry the item on a rack or appropriate stand by placing the item in an inverted position to drain water from the items.

12) **Enamelwares**

- Empty the contents of used enamelware e.g. in case of bowls, basins, kidney trays to avoid contamination and bad odours.

- Immerse the item in a chlorine solution of 0.5%.

- To disinfect, wash the item with cold water and then hot soapy water and rinse, using water jet/stream. Remove residual fluid remaining in the item after cleaning.

- Dry the item by keeping in an inverted position. Store separately, keep in an inverted position in the appropriate cupboard/shelf to deodorize and to prevent growth of bacteria.
• If needed, boil the item in a big water-filled container. Ensure that the item is fully dipped in the water and cover the container. There is no need to wrap the item. Boil for ten minutes to destroy pathogens.

• As required send for autoclaving wrapped in a piece of cloth or paper, put label on the wrapper, one can also use chemicals for sterilizing the item.

13) **Stainless Steel Items**

• All stainless steel items are heat-resistant, anticorrosive and long lasting but expensive, hence they should be handled well.

• Do not boil stainless steel items repeatedly as they get dull.

• They can be easily sterilized using chemicals and by autoclaving.

• Always use gloves while cleaning and washing soiled/contaminated instruments.

a) **Instruments**

• Always immerse the used instruments in 0.5% of chlorine solution for five minutes to disinfect.

• Wash the instrument in cold running water, paying special attention to the tips, toothed end, and grooves of forceps to clean the instrument effectively.

• Separate sharp instruments from other blunt and fine-tip instruments to maintain inventory, to have easy access and to prevent damage.

• Put a hard rubber cap on fine-tip instruments. Sort out instruments of the same size and type together to protect the tip from damage.

• Dry them thoroughly. Wrap and make different packs e.g. bowl, forceps etc. and prepare for autoclaving to prevent growth of microorganisms.

b) **Needles**

• Decontaminate all types of needles attached to syringe and flush with 0.5% chlorine solution/chlorhexidine/sodium hypochlorite immediately after use.

• Discard the disposable injection needle with syringe either in a puncture resistant container or destroy the needle still attached to the syringe in needle destroyer to segregate the items as per the Centers for Disease Control (CDC) classification to prevent misuse.

• Send the puncture-proof container for incineration to prevent the misuse/reuse.

• Send the stainless steel needles for autoclaving packed with syringes in mizor to destroy all types of pathogens.
c) **Sharp Instruments**

- Immerse the sharp instruments in a 0.5% chlorine solution or in 2% glutaraldehyde for 20 to 30 minutes. Add antirust agent e.g. Sodium Nitrate, 0.1% if available, to disinfect/sterilize the instruments.
- Remove from the disinfectant solution, rinse in sterile water to remove chemicals and avoid rusting. Steam and wipe dry using a dry piece of sterile cloth.
- Store in an appropriate container for ready re-use.

14) **Cleaning other articles**

- Clean in cold water then in warm, soapy water and rinse to remove any dirt.
- Empty and rinse items like kidney trays, I/V sets, syringes (barrel and plunger separated) of their contents in drain and immerse in a 0.5% chlorine solution.
- Discard I/V sets, drainage tubes, catheters, cannulas, syringes, I/V fluid bottles into a blue bag. Send for incineration to dispose off properly and prevent recycling.

15) **Linen, Blanket and Blanket Cover**

- Ensure each delivery of clean linen contains sufficient linen for at least one 8 hour shift.
- Remember that no new garment or linen is used for neonates without prior laundering.
- Make sure that linen and cotton used in the intensive care, intermediate care and admission areas is clean and autoclaved.
- Soak the contaminated linen in big plastic drums with chlorine 5% solution minimum for 10 minutes to decontaminate the linen.
- Rinse in cold water to prepare for autoclaving.
- Dry in the sun.
- Send for autoclaving to make it safe for use.
- Use sterile autoclaved draw sheets.
- See that the frocks for infants are in soft cloth and used only after washing and autoclaving.

16) Disinfect the **cotton gauze** by autoclaving as and when required.

17) Wash **everyday the swab container, injection and medicine tray** with soap and water/autoclave. Use separate swab containers for each baby.

18) Autoclave **sets for procedures** after each use (every 72 hours if not used).

19) Autoclave **cheattle forceps** daily. Put in sterile autoclaved bottle containing dry sterile cotton.

20) Autoclave **steel drums** after use and every 48 hours.
21) Cleaning and disinfection of furniture

- Wipe the dust on furniture using a piece of dry, clean, soft cloth daily, followed by damp dusting.
- Wipe any water or chemical from the polished surface of furniture to avoid stains and damage to the polished surface.
- Disinfect iron, steel, plastic furniture and incubators using 2% Glutaraldehyde, 2% Savlon every day.
- Trolleys, lockers, I/V stands, examination tables should be disinfected daily.

10.8 BIO-MEDICAL WASTE MANAGEMENT

Bio-medical waste management is an integral part of infection control. Proper disposal of hospital waste is important to keep the environment clean. The waste should be disposed off in a proper way. All health professionals should be well conversant with their local hospital policies for waste disposal which may vary from place to place.

The following are different colour drums with different colour polythene for different type of waste, to be disposed off in different ways.

a) Black Drum/Bag
   Left over food, fruits, feeds, vegetables, waste paper, packing material, empty box, bags etc. This waste is disposed off by routine municipal council committee machinery.

b) Yellow/Red Drum/Bag
   Infected non-plastic waste e.g. human anatomical waste, blood, body fluids, placenta etc., and this type of waste requires incineration.

c) Blue Drum/Bag
   Infected plastic waste such as used disposable syringes, needles (first destroy the needle in the needle destroyer).

   Used sharps, blads and broken glass should be discarded in puncture proof containers before discarding.

   I/V sets, blood transfusion set, endo-tracheal tube, catheter, urine bag etc. should be cut into pieces and disposed in blue bag. This waste will be autoclaved to make it non-infectious. This is then shredded and disposed off.

10.9 ACTIVITIES AND GUIDELINES

Activity 1

- Observe the aseptic technique during your placement in nursery.
- Practice hand washing technique
- Practice use of mask, gown and gloves
- Use various disinfection procedures for various equipments during care of baby.
10.10 LET US SUM UP

This practical section on infection prevention dealt with the sources of infection, principles of infection prevention, procedure for entering nursery, types of various disinfectants used in nursery, instructions for using disinfectants, cleaning and disinfection of patient care area and equipment.

This practical will help you to learn the skills required for cleaning and disinfecting patient care area and equipment.
## List of Self activities

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the activity</th>
<th>No. of Cases</th>
<th>Hours</th>
<th>Place/Area for demonstration/practice</th>
<th>Weight age of marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Resuscitation of Newborn</td>
<td>4</td>
<td>8</td>
<td>Manikin/Labor Room / Nursery / Laboratory</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>Care of the Neonate</td>
<td>2</td>
<td>3</td>
<td>Nursery</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Assessment of the Neonate</td>
<td>2</td>
<td>6</td>
<td>Nursery</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>Breast feeding and expressing breast milk</td>
<td>2</td>
<td>4</td>
<td>Nursery/Labor Room</td>
<td>5</td>
</tr>
<tr>
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## List of Supervised activities

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