

RESUSCITATION OF THE NEWBORN BABY

This module is designed for education of nursing personnel in resuscitation of newborns in the delivery room. The same principles apply for resuscitation of sick newborns and infants up to age of three months in the wards and nursery.

LEARNING OBJECTIVES

At the end of this session, participants will be able to:

- **Assess a newborn baby at birth**
- **Perform resuscitation of a newborn baby using standard equipment if needed**
- **Provide aftercare if a baby requires help with its breathing at the time of birth**

MODULE CONTENTS

The module includes following elements:

- **Text material:** Easy to read format for quick reproduction and essential reference material for the participants. Key messages are highlighted in the boxes.
- **Demonstration:** Observing steps of resuscitation on the mannequin.
- **Webinar:** You will learn through a virtual classroom lecture.
- **Self-evaluation:** At the end of you will be evaluated by MCQ examination.
- **Video film:** Steps of basic resuscitation upto bag & mask ventilation will be shown.

1. INTRODUCTION

Spontaneous breathing after birth is not a problem for most babies. However, one in twenty babies might require help with breathing at birth. It is not always possible to know in advance which babies will need this help since up to half of them (who require resuscitation) have no identifiable risk factors before birth. Hence, resuscitation must be anticipated at each birth.

2. IMPORTANCE OF RESUSCITATION

Oxygen is important for every part of the human body. Without it, the cells that make up organs - brain and other body parts- will die. Before birth, the fetus receives oxygen from the placenta. After birth, the umbilical cord is clamped and cut which stops the delivery of oxygen from the placenta. If the baby does not start breathing immediately after birth, s(he) may even die due to lack of oxygen. A proper resuscitation helps the baby to attain normal breathing. Therefore, all health care providers should develop basic resuscitation skills.

An increased risk of breathing problems may occur in babies who are:

- preterm
- born after long traumatic labor
- born to mothers who received sedation during the late stages of labor

However, it should be kept in mind that any baby may have breathing difficulty at birth. Therefore, it is important to be prepared for resuscitation in all deliveries.

Any baby can have breathing difficulty at birth. It is important to anticipate and be prepared for this eventuality in all deliveries

3. KEY TO SUCCESSFUL RESUSCITATION

All health professionals who attend the mother at birth must be skilled at resuscitation and know how to recognise babies at risk. They must:

- anticipate
- be prepared
- know what to do (be gentle & fast)
- in what order
- be able to work quickly in coordination
- document/record
- maintain hygiene
- focus on mother needs

4. PREPARATION IN THE DELIVERY ROOM

When a baby has asphyxia, resuscitation must be started right away. If supplies are not prepared, much time can be lost before starting resuscitation. With this lost time a baby can become worse.

Preparations should include having warm, corner to do the resuscitation, equipment and supplies. These are summarized in the box below:

PREPARING FOR BIRTH

Essential

1. A draught free, warm room with temperature >25°C
2. A clean, dry and warm delivery surface
3. A radiant heater
4. Two clean, warm towels/clothes, with cord clamps or threads/tie
5. A folded piece of cloth (Shoulder roll) (1/2 to 1 inch thickness) to position the baby
6. Neonatal resuscitation bag (250-500 ml) with oxygen reservoir
7. Face masks, term (1) and pre-term (0) sizes
8. Suction devices & catheters, No. 12FG, 14 FG (oral suction), or a mucous extractor (Single use)
9. A Feeding tube with the 20 ml syringe in case prolonged ventilation is needed
10. Oxygen with flow meter and tubing (if available)
11. Oxygen air blender (if available)
12. Pulse oximeter (if available)
13. A clock with seconds hand
14. Stethoscope for evaluation
15. Medications: Epinephrine, normal saline
16. Identification band

Important points about the equipment used for resuscitation

- Equipment must be cleaned and checked after each delivery and checked again before the next delivery to ensure it is ready for use.
- Broken equipment is dangerous and should be replaced.
- Equipment must be of the appropriate size. Pediatric and adult bag and masks cannot be used on newborn babies who have small and fragile lungs.
- The volume of the bag should not be more than 240-500 mL; it should be able to generate a pressure of at least 35 cm of water.
- If a mucus extractor is used the trap should be big enough (20 mL) to prevent aspirated fluid

going into the resuscitator's mouth.

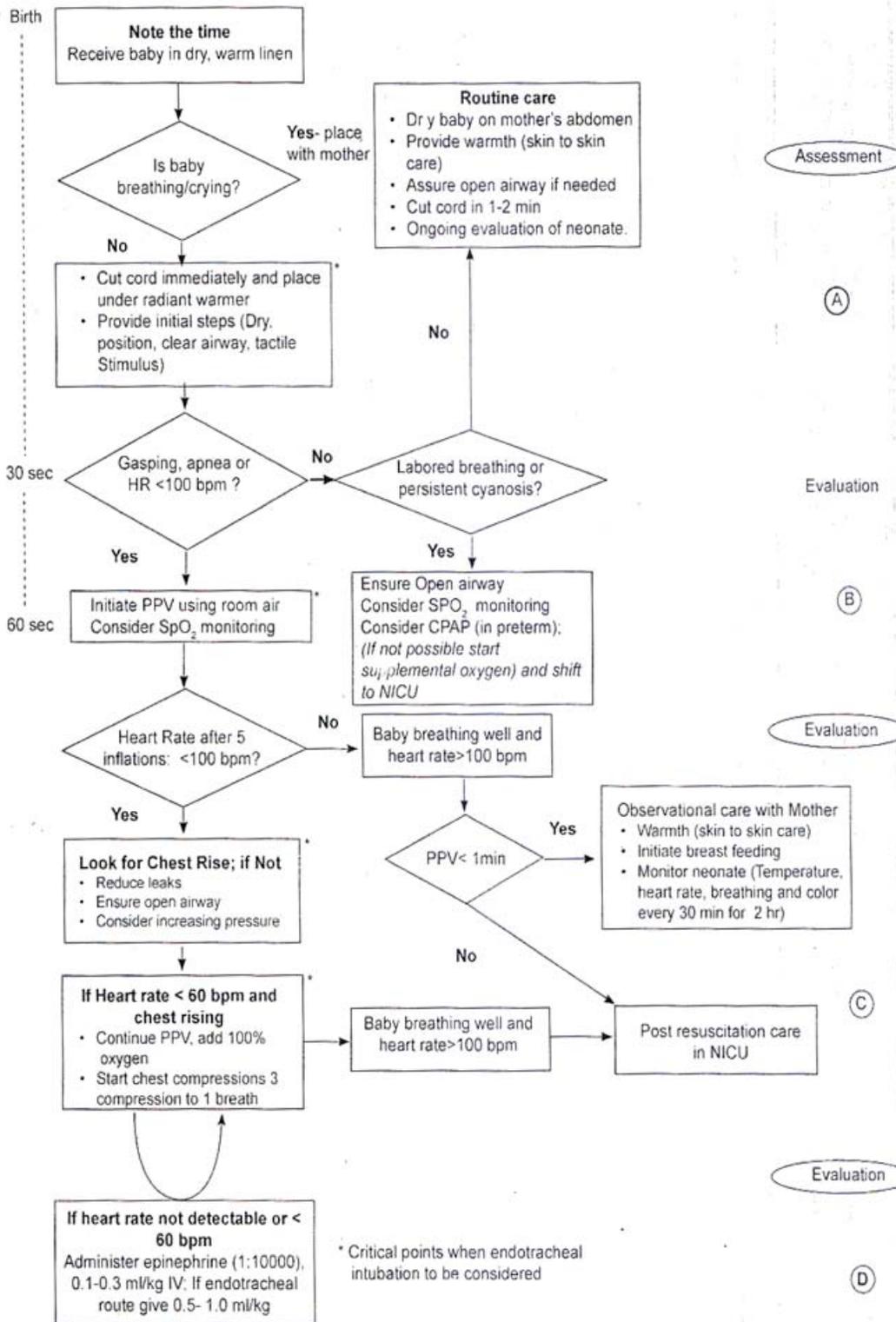
- A reusable mucus extractor with a bulb is NOT recommended because they are difficult to clean and might act as a source of cross infection if reused.
- Suction should not exceed a negative pressure of 100 mm Hg or 130 cm water.
- Resuscitation can be done without having piped oxygen available.
- Start the resuscitation with the room air. The oxygen can be used if required
- In preterm babies it is desirable to use air oxygen blender to deliver starting FiO_2 between 30 to 90 percent. This can be later titrated depending on saturation.



GROUP DISCUSSION

Preparation in the delivery room: raise a discussion about what the participants practice at the time of birth

Resuscitation Flow Diagram (NRP-India)



5. ASSESSING THE NEED OF RESUSCITATION AT BIRTH

The steps to be taken at the time of birth are given below:

- Note the time of birth
- Receive baby in dry warm linen

Is baby breathing (The chest should move equally on both sides with no difficulty between 30 to 60 times in a minute) or crying?

- If yes provide routine care.
- If NO the baby will require Resuscitation starting with initial steps

Hence, the first question to be asked at birth is " Does the baby need help with its breathing?"



This baby is crying, so does not need help for breathing?

IF BABY IS BREATHING

6. 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

6.1 Dry the baby on mother's abdomen

A new born baby should be dried on his mother's abdomen or chest with a warm towel. After drying, the wet towels or clothes should be replaced and the baby loosely wrapped in clean, dry and warm towels.

Drying the baby and wiping its eyes will take about 30 seconds; discarding the wet cloth and replacing it with a warm cloth will take about 10 seconds.

6.2 Provide warmth by skin to skin contact

Keeping a baby warm at birth is a priority. Provide warmth to the baby by direct skin to skin contact with mother

Breathing and warmth go together and breathing should be assessed whilst drying the baby. Drying itself often provides sufficient stimulation for breathing to start in mildly depressed newborn babies.

6.3 Cut cord in 1-2 minutes

Clamp and cut the cord in 1-2 minutes. There is research evidence to prove that delayed cord clamping results in healthier blood and iron levels in babies, and this benefit outweighs the slightly higher risk of developing jaundice.

6.4 Ongoing evaluation of neonate

Evaluate respiration and heart rate of the baby.

IF BABY IS NOT BREATHING/CRYING

Begin initial steps of resuscitation. Provide initial care (refer to algorithm) cut cord immediately and place under radiant warmer and provide initial steps (dry, position, clear airway and tactile stimulus)

7. INITIAL STEPS

1. Cut the cord immediately and place the baby under radiant warmer
2. Provide initial steps
 - a. Dry
 - b. Position
 - c. Clear airway as necessary (it may involve suctioning the trachea to remove meconium)
 - d. Tactile stimulus to stimulate the baby to breathe, reposition the head to maintain an open airway.
 - e. Evaluate respiration and heart rate of the baby after 30 seconds of initial steps.

The initial steps of resuscitation are discussed below:

7.1 Dry

Dry the baby thoroughly under the radiant warmer and remove wet linen.

7.2 Position

Place the baby on its back

Position the head so that it is slightly extended (to open the airway)

Place a folded piece of cloth under the baby's shoulders to help maintain this position (the folded cloth should not be too thick or thin-this may cause over extension or flexion which will close the airway)

7.3 Clear airway as necessary (it may involve suctioning the trachea to remove meconium)

- Suction first the mouth and then the nose (Remember 'M' comes before 'N')
- Do this by gently introducing a suction tube 5 cms into the baby's mouth until the '5 cms' mark is at the baby's lips
- Use suction while withdrawing the tube
- Next introduce the suction tube upto 3 cms into each nostril
- Use suction while withdrawing the tube
- Repeat suction if there is lot of mucus, amniotic fluid or meconium but not more than two times or for a duration exceeding 20 seconds

In case of meconium and baby if non vigorous (any of the following if abnormal, i.e. heart rate > 100, good breathing, good tone)

- After inserting a laryngoscope, use a 12 FG or 14 FG suction catheter to clear the mouth and posterior pharynx so that glottis can be visualized
- Insert an endotracheal tube into the trachea and attach a suction source to the endotracheal tube through a special aspirator device.
- Apply suction for several seconds when the tube is in trachea and continue suction while withdrawing
- In case bradycardia is encountered the resuscitation should take priority over suction of trachea

7.4 Tactile stimulus to stimulate the baby to breathe, reposition the head to maintain an open airway.

The safe and appropriate methods of providing tactile stimulation are:

- Gently flicking or slapping the soles
- 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.

7.5 Evaluate respiration and heart rate of the baby after 30 seconds of initial steps

Evaluate the newborn during the above mentioned first interventions and this should not take more than 30 seconds to complete.

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.

1 min:	60-65%
2 min:	65-70%
3 min:	70-75%
4 min:	75-80%
5 min:	80-85%
10min:	85-90%

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 providing supplemental oxygen.

Saturation targets for a normal baby are given above.

8. IF THE BABY IS NOT BREATHING: PROVIDE POSITIVE PRESSURE VENTILATION

PPV is initiated if:

- The infant is apneic or gasping, or
- the heart rate is less than 100 bpm even with breathing, and/or

8.1. Equipments available for PPV in newborns

It is important equipment to be used is a self inflating bag . You should become completely familiar with this equipment.

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.

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 when oxygen is 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 can not 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%.

Most resuscitation bags used in neonatal resuscitation have 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 are generally set to release at 30 to 40 cm H₂O. If pressures greater than this are generated, 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.

Resuscitation masks

Masks come in a variety of shapes, sizes and materials. Resuscitation masks should have cushioned rim to prevent injury to the face. The rim conforms more easily to the shape of the infant's face, making it easier to form a seal. There is less chance of damaging the infant's eyes if the mask is correctly positioned. Masks come in several sizes. Masks suitable for both small, premature infants as well as for larger term infants should be available for use. An appropriate size mask will cover the tip of chin, mouth, and the nose but not the eyes.

8.2 ASSEMBLING EQUIPMENT

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

8.3 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. 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 well? If not check

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?

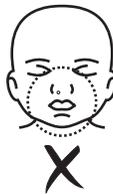
8.4 HOW TO VENTILATE THE BABY:

1. Re-check the baby's position.
2. Reposition the baby so that the neck is slightly extended.
3. Put the folded piece of cloth under the baby's shoulders at this time.
4. Place the correct sized mask on the baby's face so that it covers the baby's chin, mouth and the nose.



Size 1 for a normal weight baby and size 0 for a small baby

A mask that is too large covers the eyes, and extends over the tip of the chin:



A mask that is too small does not cover the nose and does not cover the mouth effectively:



5. Make a seal between the mask and the baby's face.
6. Hold the mask in place gently but firmly. Keep the head in position.
7. Squeeze the bag attached to the mask with the thumb and two fingers so as to cause adequate chest rise.
8. Squeeze and release the bag two or three times.
9. Watch the baby's chest as the bag is squeezed. Does it rise as the bag is squeezed?



10. If the baby's chest is rising, the ventilation pressure is probably adequate.
11. If the baby's chest is NOT rising, there can be one of the problems given below, do the following steps:

Problem		Remedial Steps
M	Inadequate seal	M ask adjusted to ensure airtight seal
R	Inappropriate position	R eposition the head in sniffing position
SO	Blocked airway	S uction the airway O pen bay's mouth and ventilate
P	Inadequate pressure	Increase P ressure by squeezing the bag with more pressure till a chest rise is Visible
T	No improvement with above steps	Consider endo T racheal intubation

12. Use oxygen if available (preferably through air oxygen blender), if not use room air.
13. Ventilate at a rate of 40 breaths per minute. Squeeze the bag(ventilate) at 40 times a minute until the baby starts crying or breathing.

Provide uninterrupted effective ventilation for 30 seconds and assess for spontaneous breathing and heart rate. If spontaneous breathing 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.

Count out loud. **An easy way to count is to:**

SQUEEZE-count a loud' one hundred and one, SQUEEZE one hundred and two, SQUEEZE one hundred and three, SQUEEZE.....'and continue until you reach 'One hundred and twenty'(i.e. For 30 seconds).

14. After 30 seconds of bag and mask ventilation, reassess respiratory efforts, heart rate every 30 seconds (oxygen saturation may be monitored continuously if available) and look for the following signs of improvement:
 - i. Is the baby crying?-If yes, STOP ventilation
 - ii. Is the baby breathing regularly at >30 breaths per minute?- If yes, STOP ventilation
 - iii. Does the baby have 'in-drawing' of the chest wall(skin between the ribs' sucked' inwards making the ribs very prominent)?- If NO, then STOP ventilation (chest in-drawing indicates that the baby is still having difficulty in breathing and hence need support for breathing), can continue with CPAP or free flow of oxygen.

The other signs of improvement are improving color and muscle tone.

When to stop ventilation?

1. **Baby is breathing or crying**
2. **Baby is breathing more than 30 times in a minute**
3. **NO chest in-drawing during breathing**

15. What is to be done if there is no improvement after 30 seconds?
 - i. If **NO** facilities/manpower are available: **continue to do bag and mask ventilation;** reassess after every 30 seconds until the baby is breathing spontaneously. In the mean time, shout for help and also arrange for referral to a higher centre.
 - ii. If PPV is prolonged over several minutes place an oro-gastric tube to prevent distention of stomach with air which may interfere with ventilation
 - iii. During transport, ensure that the baby's temperature is maintained and breathing is supported by bag and mask ventilation (with or without oxygen).
 - iv. The procedure of bag and mask ventilation should be continued until the baby establishes spontaneous breathing; however, if there are no signs of life(breathing/heart rate) even after 20 minutes of birth, ventilation may be stopped.
 - v. If facilities and/or man-power are available: **continue to do bag and mask ventilation and assess the need for chest compressions.** The need for chest compressions is decided on the basis of the baby's heart rate as shown below:

Problem	Remedial Steps
Above 100	STOP ventilation if spontaneous respirations are present; If gasping or not breathing, continue ventilation
60 to 100	Continue bag and mask ventilation
Below 60	Begin chest compressions; Continue to ventilate

Remember: Ventilation is more important during resuscitation than any other step - hence it SHOULD BE continued even while administering chest compressions. This might require at least two persons with the necessary Demonstration skills.

9. CHEST COMPRESSIONS

The heart circulates blood through out the body delivering oxygen to vital organs. When an infant becomes hypoxic, the heart rate slows and myocardial contractility decreases. As a result, there is a diminished flow of blood and oxygen to the vital organs. The decreased supply of oxygen can lead to irreversible damage to the brain, heart, kidneys and bowel. Chest compressions are used to temporarily increase circulation and oxygen delivery.

Chest compressions must always be accompanied by ventilation. Ventilation must be performed to ensure that the blood being circulated during chest compressions gets oxygenated.

After 30-45 seconds of chest compressions, the baby's heart rate should be re-assessed. If heart rate is still less than 60 per minute, chest compressions should be continue (after administering Inj. adrenaline); if heart rate is >60/min, stop chest compressions.

Coordinating ventilation and chest compression

Chest compression is accompanied by PPV. For every 3 compressions 1 breath is delivered (in a minute 90 compressions and 30 breaths are given)

Frequency

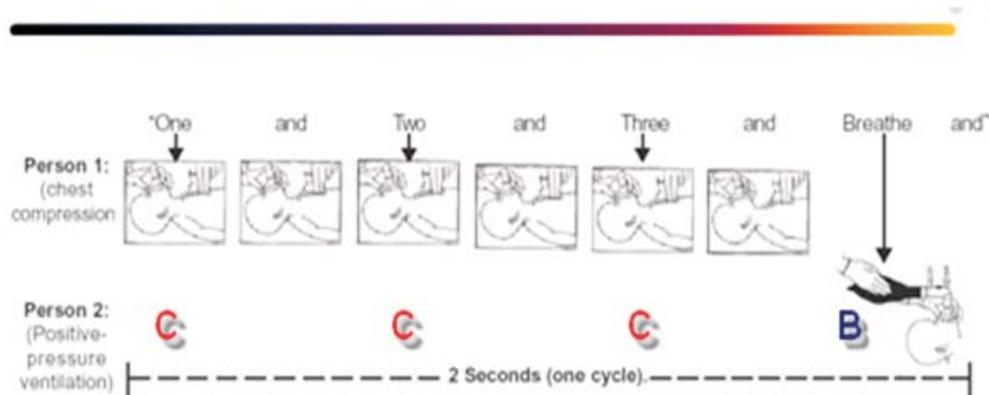


Figure 8.2: Coordinating ventilation and chest compression

10. MEDICATIONS

Medications like adrenaline and volume expanders (saline, ringer lactate) should be administered during resuscitation when in spite of adequate ventilation and cardiac compression, together for more than 45 seconds to 1 minute, the heart rate remains < 60/min and is not improving or if there is initial asystole after 30 sec of BMV.

Establishing intravenous access in newborn during resuscitation

Umbilical vein is the quickest venous access for neonatal resuscitation.

What to do in case no improvement?

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

Babies requiring chest compressions, intubation and medications often need presence of a skilled health care provider (Doctor).

11. FOLLOW ON CARE AFTER SUCCESSFUL RESUSCITATION

Follow up care after successful resuscitation can be observational care or post resuscitation care.

11.1 Observational care at mother's bedside

Newborns that have required PPV for less than 1 minute should be provided Observational care includes:

- Provide warmth
- Initiate breast feeding
- Monitor newborn (temperature, heart rate, breathing, and color every 30 minutes for 2 hours).

11.2 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 special care newborn unit.

12. RECORD THE EVENTS OF BABY BEFORE DISCHARGE

Record what has happened as soon as possible after the baby is stable. Keeping records of events which occur at the time of delivery and in the immediate period afterwards can be vital. The information is important if a baby needs to be referred or becomes sick in the next few days.

13. EXAMINE THE BABY BEFORE DISCHARGE

The baby should be thoroughly examined before (he) is discharged from the delivery room. Tell parents that although the possibility of complications is low, there is still a small probability that the baby may have problems such as feeding difficulty or convulsions in the first few days.

Instruct them to take the baby to the nearest hospital if these problems occur. Encourage the mother to maintain skin-to-skin contact as much as possible in the next few days.

RECOMMENDED READING

- Basic Newborn Resuscitation: A practical guide. WHO/RHT/ MSM/98.1
- WHO essential newborn care course based on pregnancy, postpartum and newborn case guide for essential practice www.who.int/making_pregnancy_safer/publications/en.
- Neonatal resuscitation: India. Text Book .1st Edition. www.nnfi.org.

