

REVIEW ARTICLES

DELIVERY ROOM MANAGEMENT OF NEWBORN - A REVIEW

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Summary :

Five million neonatal deaths happen each year worldwide. Birth asphyxia alone shares 19% of these deaths. It is estimated that neonatal outcome might be improved for more than 1 million infants by implementing simple resuscitative techniques. In this article the pathophysiology of birth asphyxia has been revised briefly. The current views and techniques of neonatal resuscitation have been reviewed here. These include rapid assessment and basic steps of initial stabilization of the neonate

Introduction :

Every birth should be taken as a medical emergency. Perinatal hypoxia is the leading cause of infant mortality and neurological handicaps both in term and preterm infants. The purpose of delivery room management is to support the newborn's respiratory and circulatory system in order to prevent the consequences of perinatal hypoxia. The health professionals working in this area should have adequate knowledge and ability to work as a team. A discussion of delivery room management integrates the basic elements of resuscitation as well as some more advanced procedures.

Physiology

Effective regular respiration should be initiated within 30 to 45 seconds of delivery. The change in PaO₂ and PaCO₂ resulting from clamping the umbilical cord affects chemoreceptors and aid in the reflexive initiation of respiration. Immediately after birth the hostile physical environment comprising light, cold, air current provides respiratory drive by operating through different sensory receptors. The initial breath may generate from 20 to 70 cm of H₂O of negative intrathoracic pressure to expand the collapsed alveoli¹. A rapid decrease in pulmonary vascular resistance and increase in pulmonary blood flow occur after initial lung expansion². Higher colloidal osmotic pressure and lower postnatal hydrostatic pressure of blood within the pulmonary circuit assist in absorbing alveolar fluid after delivery. Fetal right-to-left shunts through the ductus arteriosus

immediately after delivery, the initiation of artificial ventilation using bag-mask and bag-tube and maintenance of circulation including techniques of chest compression. Management of meconium - stained baby has been briefly reviewed. Finally administration of medications and fluids and glucose homeostasis have also been summarized for better understanding in delivery room management of newly born baby.

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and foramen ovale gradually close during this process and by 24 hours of age it becomes functionally insignificant.

Asphyxia and apnea

Asphyxia is defined as inadequate tissue perfusion, which fails to meet the metabolic demand of the tissues for oxygenation and waste removal. Hypoxic tissues begin anaerobic metabolism, producing metabolic acids that are initially buffered by bicarbonate. When bicarbonate fails, acidosis occurs. Asphyxia may occur in utero or postnatal. In either circumstances, there follows a well defined series of events. After a brief period of rapid breathing, respiratory movement ceases and a period of apnea designated as primary apnea follows. At the same time, heart rate falls and neuromotor tone diminishes. If the asphyxic insult continues, the heart rate falls further, blood pressure falls and a series of spontaneous deep gasps occurs. After the last gasp

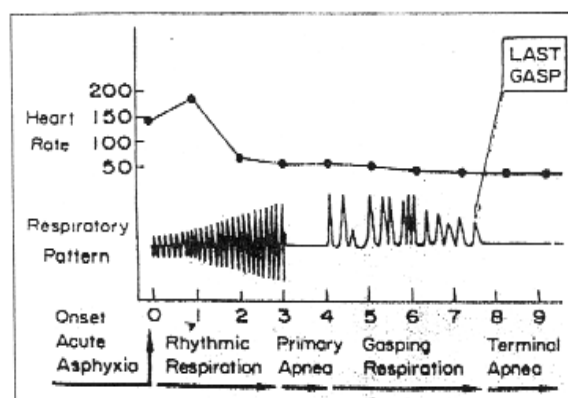
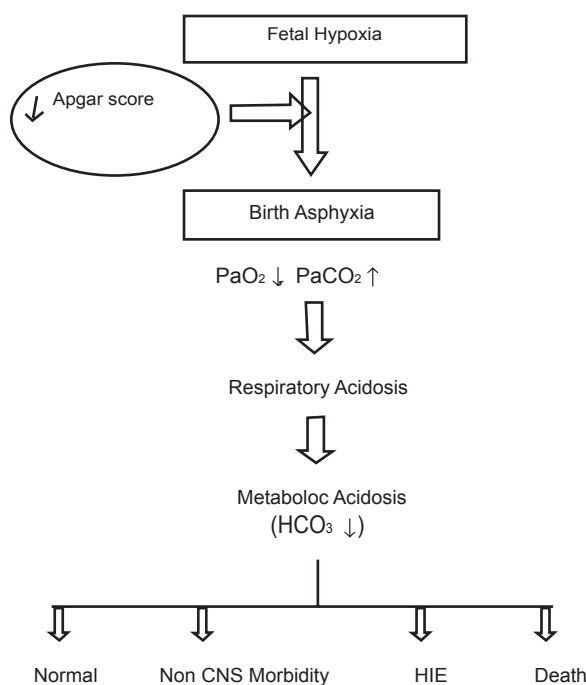


Fig.-1 : Schematic representation of sequence of events of respiratory failure in experimental animals⁵

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occurs, there begins a period of apnea known as secondary apnea³. If an infant is in primary apnea, exposure to oxygen and stimulation will usually induce respiration. If delivery occurs during secondary apnea, the infant will not respond to stimulation. Spontaneous respiration will not resume until resuscitation is initiated with oxygen, assisted ventilation is rarely required. Birth asphyxia should be diagnosed when "baby has gasping and inadequate breathing or no breathing at 1-min". Severe asphyxia corresponds to 1-min Apgar score of 3 or less. Premature infants of less than 37 weeks gestation may develop apnea without any identifiable cause known as Apnea of Prematurity (AOP). This is characterized by cessation of breathing associated with bradycardia and/or cyanosis and attributable to immaturity of respiratory system and CNS⁴.



PaO₂, partial pressure of arterial O₂
 PaCO₂, partial pressure of arterial CO₂
 HIE, hypoxic - ischemic encephalopathy

Fig.-2 : Sequence of events following birth asphyxia⁶

Conditions That May Require Immediate Resuscitation at Delivery

Intrapartum Problems

- Fetal distress
- Persistent late decelerations
- Severe variable decelerations without baseline variability

- Scalp pH < 7.25
- Meconium- stained amniotic fluid
- Cord prolapse
- Premature rupture of membrane (>12 hrs)
- Prolonged or difficult labor (>24 hrs)
- Prolonged 2nd stage of labor (>2hrs)

Medical / Obstetric / Genetic Problems

- Diabetes mellitus
- Suspected or confirmed maternal infection
- Third trimester bleeding
- Pregnancy induced hypertension
- Prolonged rupture of membrane
- Low- birth- weight infant
- Prematurity
- Isoimmunization
- Fetal congenital abnormalities
- Drug therapy- Mg⁺⁺, β-blocker

Neonatal Resuscitation

The steps of neonatal resuscitation follow the standard ABCDs for resuscitation:

- A- Airway
- B- Breathing
- C- Circulation
- D- Drugs

With the ABCDs as an overall frame work for neonatal resuscitation, the components of the procedure can be explained sequentially:

- A. Establishment of an airway
 - Positioning
 - Suction of mouth, nose, and trachea (in some cases)
- B- Initial breathing
 - Tactile stimulation
 - Positive pressure ventilation
- C- Maintenance of circulation
 - Chest compression
- D- Drugs or Medications

Apgar score

The Apgar score, developed by Dr. Virginia Apgar in 1952, provides a comprehensive and objective measure of the infant's condition in the first minute after birth. Though Apgar score has limitations; Apgar score should be assigned at 1 and 5 minutes and every 5 minutes thereafter until the score is 7. Apgar score between 4 to 7 needs active resuscitation, but less than 4 demands endotracheal intubation, positive-pressure ventilation and supportive medications.

	Sign	Score		
		0	1	2
1.	Appearance (color)	Blue, pale	Baby pink Extremities blue	Completely pink
2.	Heart rate	Absent	<1 00 beat / min	>1 00 beat / min
3.	Grimace (reflex irritability to suctioning)	No response	Grimace	Cough or sneezing
4.	Activity (muscle tone)	Limp	Some flexion	Well flexed
5.	Respiration (breathing efforts)	Absent	Weak, irregular	Strong cry

Practical epigram of Apgar score

Initial Steps of Resuscitation

- a. Prevention of heat loss
- b. Clearing the airway (positioning and suctioning) - if needed
- c. Initiation of breathing by tactile stimulation or bag-mask ventilation, and
- d. Evaluation of the infant.

a. Prevention of heat loss

The majority of the heat loss is due to evaporation of amniotic fluid from the baby's skin surface. Hypothermia frequently results in hypotonia, bradycardia, respiratory depression and acidosis. To prevent the heat loss

- Place the infant under a radiant heat source or over a heated water mattress
- Dry the infant thoroughly and remove the wet linens

b. Clear the airway

- Position the infant supine flat with the neck slightly extended. A rolled blanket or towel may be used under the shoulder.
- Suction the mouth, and then nose to clear the airway. Suction pressure should not exceed negative pressure of 100 mm Hg and suction should not be continued longer than 10s at a time.
- Turn the head to the side to allow secretions to pool in the cheek.
- Deep pharyngeal suction should not be performed during the first few minutes after birth to avoid vagal depression and resultant bradycardia.

c. Initiation of breathing

- Provide tactile stimulation by rubbing the back or gently slapping the feet.
- If the infant remains apneic even after stimulating once or twice and heart rate less than 100 beat / min begin bag-mask ventilation immediately.
- Continue gentle rubbing of trunk, extremities or head to support early respiratory efforts in a depressed infant.
- If the neonate remains apneic or has gasping respiration intubate and continue positive pressure ventilation. Other indications of endotracheal intubations are,
 - = ineffective bag-mask ventilation
 - meconium aspiration
 - Apgar score less than 4
 - suspected diaphragmatic hernia.

d. Evaluation of the infant

At each step of the resuscitation procedure the neonate is to be evaluated based on respiration, heart rate, and colour.

Maintenance of circulation

If heart rate is < 100 beats / min, positive pressure ventilation has to be begun even though the infant may have spontaneous respirations. If after 15 to 30 seconds of positive-pressure ventilation with 100 % oxygen the heart rate is < 60 / min, intubation is to be considered and emergency drugs should be prepared. 100 % oxygen

at 5 l / min provides 80 % to 100 % oxygen to the infant when delivered via a mask or tubing held ½ inch from the nares and surrounded by a cupped hand.

Chest compression

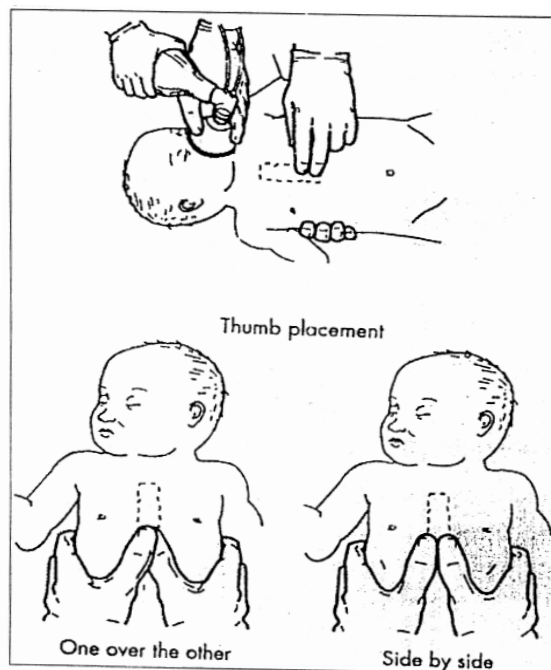
Indications for chest compression include a heart rate of < 60 beats / min, and a heart rate between 60 and 80 beats / min and not increasing despite ventilation for 15 to 30 seconds with 100% oxygen. Following steps should be performed:

- Position the infant supine with the neck slightly extended.
- Provide firm support for the back.
- Perform compression by two-finger or thumb method (Figure 3)
 - Position: lower- third of sternum
 - Rate : 90 times / min
 - Depth : 1/2 to 3/4 inch
 - Support: encircling fingers or hand under the back.
- Provide 90 compression / min and interpose 30 breaths / min with a 3:1 ratio of compression to breath (intubated).
- Continue compression until the heart rate is >80 beat / min.

Medications

The indications for drugs during resuscitation include the followings: Epinephrine: heart rate <80 beats / min despite at least 30 seconds of adequate ventilation with 100 % oxygen and chest compression; heart rate is zero.

Two finger method : Use the tips of two fingers of one hand to compress the sternum, and use your hand or a very firm surface to support the infants back.



Sodium bi-carbonate: documented or suspected metabolic acidosis in the presence of adequate ventilation.

Naloxne hydrochloride: severe respiratory depression and narcotic administration to mother in the last 4 hours.

Volume expander: signs of hypovolemia and poor response to other resuscitative measures.

Table-I

<i>Medications for Neonatal Resuscitation</i>			
Medication	Concentration	Dosage / Route	Remarks
Adrenaline	1: 10,000	0.1- 0.3 ml / kg i.v,ET(in absence of IV line)	Dilute with normal saline to 1-2 ml for ET administration ^{8,9}
Sodium bi-carbonate	4.2 % solution	2 mEq / kg i.v.	Slowly over 2 min
Naloxone	0.5 mEq / ml 0.4 mg / ml 1.0 mg / ml	0.1 mg /kg i.v,ET,i.m,s.c.	i.v, ET preferable i.m, s.c. acceptable
Volume expander	5% Albumin Normal saline Ringer's lactate	10 mg / kg i.v.	Over 5-10 min
Glucose	D ₁₀ W	2 ml / kg i.v. 2-8 mg/kg/min	Slowly
	D ₅ W	30-60 ml	Orally

ET, Endotracheal tube

Steps of Resuscitation with Meconium-Stained Amniotic Fluid.

Acute fetal hypoxia or "fetal distress" may be associated with passage of meconium into the amniotic fluid¹⁰. Severe fetal acidosis can result in fetal gasping, leading to in utero meconium aspiration¹¹. Suctioning of mouth and hypopharynx at delivery of head should be done to prevent aspiration of meconium with first-breath¹². If the infant is depressed or the meconium is thick and particulate, suctioning of trachea under direct visualization using an endotracheal tube should be undertaken immediately. Clearing of residual meconium from the stomach also to be done in order to prevent the postnatal regurgitation and aspiration.

Glucose Homeostasis

Fetal glucose concentration varies directly with maternal concentration and is usually 70% of the maternal value. The most common clinical situation in which hyperinsulinemia occurs is the diabetes mellitus. In utero, the fetus becomes hyperglycemic because of the increased transfer of glucose across the placenta from the hyperglycemic mother. The fetal pancreatic beta cells are stimulated by the increased fetal glucose concentration to produce increased quantities of insulin¹³. After delivery, however, the source of glucose is abruptly removed while the hyperinsulinemia persists, producing hypoglycemia. Neonates with hypoglycaemia tend to develop seizures and should be treated immediately with intravenous glucose infusion to avoid worst neurological sequelae. Hypoglycemic neonates may also suffer from various neurological deficits including lower IQ scores at 5 to 7 years of age¹⁴.

Maternal Risk Factors for Neonatal Hypoglycemia

- Diabetes or abnormal glucose tolerance test
- Pregnancy induced or essential hypertension
- Substance abuse
- Antepartum administration of IV glucose

Hypoglycemia was defined previously as a whole blood glucose concentration of less than 35 mg / dl in term infant or less than 25 mg / dl in the preterm infant. The incidence of hypoglycemia is increased in preterm infants, with estimates ranging from 1.5 % to 5.5%

Conclusion

The survival and outcome of distressed newborns depend on timely and effective intervention in the first few minutes after birth. When an infant fails to respond to intensive resuscitative measures in the delivery room, the decision must be made when to stop support. If the Apgar score remains less than 4 at 20 minutes, the probability of cerebral palsy in surviving infant is more than 50 %. If no heart beat has been obtained by 10 minutes or the heart rate remains less than 100 after 20 minutes of maximum resuscitative efforts, consideration should be made to discontinue supportive measures. Parents should have the opportunity to take part in making the decision.

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