

Resuscitation of the Asphyxiated Newborn Infant

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SUMMARY

The principles of resuscitation of the newborn infant are outlined and a method for the management of asphyxia neonatorum is described. Suitable equipment is listed as an appendix.

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The adaptation by the fetus to extra-uterine life is usually a smoothly executed process. Asphyxia neonatorum, which may be regarded as a severe form of failure of this adaptation, results in an acute cardiorespiratory failure, a situation requiring prompt diagnosis and efficient management. Resuscitation, the first phase of management, is aimed at the establishment of sustained respiration.

The purpose of this article is to outline the principles of resuscitation of the newborn baby, to suggest a form of procedure to be adopted and to list the necessary equipment.

PRINCIPLES

These may be described as:

- (i) the establishment and maintenance of a clear airway;
- (ii) the prevention of hypothermia;
- (iii) oxygenation, and maintenance of an effective circulation;
- (iv) initiation of respiration.

Sustained respiration requires an intact oxygenated respiratory centre which is dependent upon adequate ventilation and circulation. Successful adaptation to extra-uterine life therefore involves interaction between three systems, as depicted in Fig. 1.

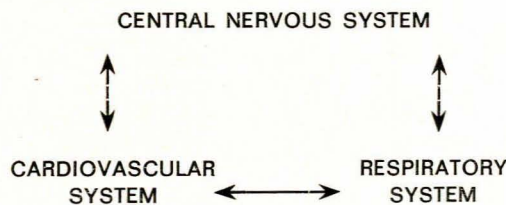


Fig. 1. Adaptation to extra-uterine life.

Most infants establish sustained respiration soon after birth. Some, however, have a period of initial apnoea which may be terminated by peripheral stimulation, e.g.

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nasopharyngeal suction, flicking the feet, a flow of oxygen over the nose and mouth, or abdomen. Head's paradoxical reflex,¹ by which positive airway pressure stimulates the baby's own respiratory efforts, may be included in this group. Other infants, apnoeic after birth, require positive pressure ventilation, with or without intravenous administration of alkali, before respiration is established. These two groups correspond roughly to the primary and secondary apnoea in experimental animals.²

Failure to establish sustained respiration after positive pressure ventilation leads one to consider the following possible causes: depression due to placental transfer of drugs administered to the mother; acidosis following exaggerated hypoxia; hypoglycaemia from severe or prolonged intra-uterine stress, or maternal diabetes mellitus; anaemia from intrapartum blood loss or haemolysis; hyaline membrane disease occasionally so severe as to present as asphyxia neonatorum; structural abnormalities of the airways, lungs or diaphragm.

PROCEDURE

The presence of a person experienced in intubation is desirable at the delivery of certain high-risk cases. These situations include: Caesarean section, breech and instrument deliveries; the delivery of an infant with low birth mass; where fetal distress has been detected antenatally, as well as complications of pregnancy (e.g. antepartum haemorrhage or hypertensive conditions) and maternal sedation. However, it must be remembered that no birth is exempt from the possibility of asphyxia neonatorum.

1. Check equipment, turn on heater and ensure that there is an incubator available.
2. With complete delivery of the infant, note the time.
3. Accept the infant and place it head down on the platform.
4. Clear upper airways by gentle suction. This should remove any mucus or blood present. The danger of causing arrhythmias, or even respiratory arrest, by raising vagal tone during rough suctioning,³ must be borne in mind. Meconium, because of its harmful effects on the lower respiratory tract,⁴ must be cleared under direct vision using a laryngoscope.
5. Apply peripheral stimulation, e.g. Head's paradoxical reflex, by giving 3-5 puffs with a mask ventilator at approximately 1 per second. This may also be achieved by administering oxygen via a nasal catheter and intermittently occluding the nose and mouth.
N.B. If, on initial assessment, the infant is shocked, with only a heartbeat, particularly if this is below 40 beats/minute, omit measures 4 and 5, and proceed to intubation and artificial ventilation.
6. If the mother has received morphine or pethidine within 4 hours and has not had Lethidrone prior to

delivery, give 0,5 mg Lethidrone to the infant by intramuscular or intravenous injection.

7. After Caesarean section two situations may arise where initial respiration is followed by apnoea. Firstly, in 'diffusion apnoea' the infant appears to be re-anaesthetised. This usually responds to intermittent mask ventilation. If this fails to induce respiratory effort, or if the condition persists for longer than approximately 6 minutes, intubation with positive pressure ventilation is recommended. In the other situation the airways become obstructed with 'foam'.⁶ If the fluid is not cleared by suctioning, it is best dispersed by endotracheal intubation and alternating suction via the tube and positive pressure respiration.
8. If the infant is still apnoeic after measures 4, 5 and 6 have been applied (usually 3-5 minutes after birth), positive pressure ventilation with oxygen is indicated. Although mask ventilation with the infant's neck extended may be successful, the most efficient method is to use endotracheal intubation,⁷ especially as this enables clearing of the airway under direct vision. Because a pressure greater than 30 cm water should not be used to inflate a newborn infant's lungs, a pressure safety valve is essential. It must be remembered that many of the resuscitators in use are capable of producing pressures far higher than 30 cm water. Humidification is not necessary since assisted ventilation is used for a short period only. Successful ventilation may be assessed by a sudden rise in heart rate, detected by auscultation or palpation of the base of the umbilicus. Once the infant is breathing spontaneously, the tube may be removed.
9. If, after 3-5 minutes of positive pressure ventilation, the infant has not established sustained respiration, infuse 4 ml of 8,4% sodium bicarbonate per kg, followed by 2 ml of 10% dextrose water per kg estimated weight, at a rate of not more than 3 ml/minute. The total volume of fluid administered should be limited to 12 or 15 ml, and the infusion may be given by peripheral or umbilical vein. The former is preferred, since a sepsis during an emergency cannot be guaranteed.
10. External cardiac massage is indicated if: (a) after endotracheal intubation and positive pressure ventilation, the heart rate does not rise above 100 beats/minute; this procedure may promote circulation to vital centres; (b) cardiac arrest occurs during resuscitation; (c) an infant is born without a heart-beat when the fetal heart was heard shortly prior to delivery. External cardiac massage may be achieved by placing one hand behind the infant's back, and with the index and middle fingers of the other hand, compressing the midsternum at a rate of approximately 100 times/minute.
11. If pallor persists after reversal of hypoxia and acidosis, a haemoglobin or haematocrit estimation should be carried out. If anaemia is present, an emergency transfusion of 10 ml/kg O-negative blood is indicated.

N.B. The Apgar score⁸ at 1 and 5 minutes, the time to sustained respiration,⁹ and a description of the method of resuscitation used, must be recorded.

After resuscitation, the infant should be transferred to a nursery for observation and special care. Aftercare is important, since complications such as respiratory distress, apnoea, convulsions, hypoglycaemia or hypothermia, which require prompt treatment, may occur.

CONCLUSIONS

Much can be done to prevent or lessen the damaging effects of asphyxia neonatorum. The fetus at risk must be recognised and preparations made for resuscitation should the infant be asphyxiated. Once the physiology involved is understood, relatively simple measures and equipment can be life-saving.

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APPENDIX

EQUIPMENT

Trolley fitted with:

- A platform sloping towards the resuscitator at a suitable height above the ground, upon which the infant is placed.
- An oxygen supply.
- A suction apparatus with a gauge, because the negative pressure used should not exceed 5 mmHg.
- A warming device, using either convection (by a flow of warm air from above) or radiation (by an overhead infra-red heater).
- A good source of light and timing device are recommended.
- Shelves on either side of the platform.

The trolley is best fitted with drawers containing the following:

- Stethoscope.
- Laryngoscope—Miller, premature model.
- Laryngoscope blades—Miller, size 0; —Seward, size 1.
- Spare bulbs and batteries.
- Endotracheal tubes—Warne, non-toxic, plastic neonatal.
- Endotracheal tubes—Samson (with introducer).
- Mask ventilator—Penlon, Cardiff or Blease Samson resuscitator.
- Drugs—nalorphine HCl—Lethidrone (1 mg/ml); —sodium bicarbonate 8,4% 20 ml ampoules; —dextrose 10% and 50% 20 ml ampoules; —vitamin K₁ (Konaktion).
- Disposable syringes (10 cc, 5 cc, 2 cc).
- Scalp vein sets and needles.
- Haemopoints, Dextrostix and swabs.

This equipment may only be available in a large hospital. Successful resuscitation may, however, be achieved with the following:

- Flat table.
- Stethoscope and laryngoscope.
- Mucus extractor.
- Blease Samson resuscitator with endotracheal tubes.
- Drugs, syringes and needles as listed above.