Immediate care of the newborn infant

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1 Introduction

The vast majority of newborn babies require little more than a clear airway and adequate warmth to support the first few minutes of adaptation to extra-uterine life. The success of human evolution and the exceptionally high survival rate of human infants attest to this. Unless specific problems need urgent attention, babies should be given to their mothers as soon after birth as the mother is ready.

2 Immediate care of the normal newborn infant

2.1 Welcoming the newborn infant

In his book *Birth without Violence*, Frederick Leboyer described a number of measures designed to minimize 'the shock of the newborn's first separation experiences': the use of a dark delivery room, delayed clamping of the umbilical cord, gentle massage, and a warm bath for the infant. Controlled trials of these specific measures have not shown any effects, either adverse or beneficial, on infant health, neurobehavioral status in the first few days of life, or subsequent development. The fact that no long-term advantages of the specific measures advocated by Leboyer have been demonstrated does not obviate the need for treating the newborn with the regard and respect due to any human being, including gentleness and avoidance of excessive noise in the environment.

2.2 Ensuring a clear airway

The practice of routine suctioning to remove secretions from the newborn infant’s oral and nasal passages has not been assessed in any clinical trials, and its value is uncertain. Possible benefits of the practice include improved air exchange, reduced likelihood of aspiration of secretions, and, perhaps, reduced acquisition of any pathogens present in the amniotic fluid or birth canal. Potential hazards include cardiac arrhythmias, laryngospasm, and pulmonary artery vasospasm.

Most healthy babies require no suction, they can usually clear their own airways. If nasal and pharyngeal suctioning is required, care should be taken to minimize pharyngeal stimulation. Suction bulbs, rather than catheters should be used, because suction bulbs are less likely to induce cardiac arrhythmias.

The practice of routine suctioning of the stomach was introduced following an untested suggestion that the respiratory distress of infants
of diabetic women often resulted from regurgitation and aspiration that might have been prevented by gastric suctioning. As the passage of the tube during the immediate neonatal period may produce bradycardia or laryngospasm and disruption of prefeeding behavior, there is no justification for routine gastric suctioning.

2.3 Maintaining body temperature

The recommendation that all babies be kept warm immediately after birth is based on a large body of evidence about thermal physiology of both newborn animals and humans. Newborns can maintain their body temperature in a cool environment only by greatly increased energy expenditure. Even vigorous newborns exposed to cold delivery rooms may experience marked drops in body temperature and develop metabolic acidosis during the first two hours of life.

Babies should be dried with prewarmed towels, giving particular attention to drying the head. They should be held by their mothers, preferably in skin-to-skin contact, and covered with a dry warm blanket. They may be held by the father or companion, or placed under a radiant warmer or in an incubator, if the mother is unable to hold her baby.

2.4 Initiation of breastfeeding

For several decades in developed countries the usual practice was to separate the mother from her baby soon after birth. After a brief visit with his or her mother, the baby was transferred to a nursery. Bottles of water or glucose water were routinely given for the first and subsequent early feeds.

These unhelpful routines were phased out when research identified the beneficial properties of colostrum. Further changes came with the growing belief that early contact between mother and infant would enhance the mother’s attachment to her baby. Results of the small controlled trials comparing early versus late contact, including timing of breastfeeding, are inconclusive. The implications of this are that mothers should have contact with their babies as soon after birth as they wish, and for as long as they wish.

Babies exhibit wide ranges in normal behavior. Some, but not all, are ready to feed immediately after birth. Interventions aimed at either delaying or speeding-up the time of the first feed should be avoided (see also Chapter 46).
2.5 Prophylactic administration of vitamin K to prevent hemorrhagic disease

The natural population incidence of hemorrhagic disease in early infancy due to vitamin K deficiency is not known, because infants at high risk have been given prophylactic intramuscular vitamin K at birth. Oral or no prophylaxis has been reserved for healthy term infants. In the 1950s, before prophylaxis was given, fully breastfed infants were said to have an incidence of about 4 per 1000 births, with most being classic hemorrhagic disease of the newborn occurring within the first 10 days of life. The incidence may have been high because of the relatively common occurrence of birth trauma and because the practice of delaying breastfeeding denied infants colostrum with its relatively high vitamin K content. Classic hemorrhagic disease, occurring predominantly from the umbilicus and gut or into the skin, can be totally prevented with a single dose of vitamin K given at birth.

The main concern now is adequate prophylaxis for late hemorrhagic disease, a rarer but more serious disorder, which is largely confined to infants who are fully breastfed. The concentration of vitamin K in cow’s milk or infant formula is considerably greater than in human milk. Late hemorrhagic disease usually presents at 2–12 weeks of age, and is often fatal or leaves serious morbidity due to intracranial hemorrhage. In 40–60% of cases, there is another underlying problem, such as malabsorption or liver disease, contributing to the vitamin K deficiency.

Recent data indicate that the rate of the late vitamin K deficiency bleeding is about 1 in 17 000 without prophylaxis, in the range of 1 in 25 000 to 1 in 70 000 in infants who have had a single oral dose of 1–2 milligrams at birth, and 1 in 400 000 after a single intramuscular injection at birth.

Although intramuscular vitamin K is the most reliable and effective prophylaxis, giving an intramuscular injection at birth is invasive and painful. There has been considerable debate as to whether it is associated with cancer or leukemia, and although not completely resolved, the weight of evidence favors no association. Very similar rates of protection against classical and late hemorrhagic disease can be achieved by giving repeated oral doses, either 1 milligram weekly or 25 micrograms daily. Undertaking this form of oral prophylaxis requires that parents accept responsibility for ensuring the course is completed.

2.6 Prophylactic measures to prevent eye infections

The Credé procedure of instilling silver nitrate routinely into the eyes of all newborn babies, introduced in 1881, was credited with the
control of gonococcal ophthalmia of the newborn in the last century. As a result, many countries have a legal requirement that one of a list of approved chemical agents be instilled routinely into the eyes of all newborn infants, with the aim of preventing infectious conjunctivitis. No controlled trials have been carried out to ascertain whether or not this is a more effective means of preventing blindness than careful observation of the newborn, followed by adequate treatment of any conjunctivitis that might appear. In circumstances where the incidence of bacterial ophthalmia is high, routine chemical prophylaxis may be useful.

In these circumstances, the next question concerns the choice of the most effective and least harmful agent. Silver nitrate results in more chemical conjunctivitis and provides no greater protection than tetracycline or erythromycin against gonococcal ophthalmia. It is ineffective against Chlamydia (which in many areas is the most common cause of neonatal ophthalmia). It should no longer be used. Both tetracycline and erythromycin provide protection against chlamydia, as well as gonococcal conjunctivitis.

Topical agents applied to the eyes of newborn infants may decrease eye openness and inhibit visual responses. This may disrupt the visual interaction between mother and baby during the first hour of life. If topical agents are necessary, their use should be delayed for an hour after birth. Mothers and babies should be able to enjoy the immediate closeness of the first hour or so after birth before chemical agents are applied.

3 Prophylactic measures in newborns considered to be at above-average risk

3.1 Suctioning of infants who have passed meconium before birth
For infants who have passed meconium before birth, suctioning the nostrils, mouth, and pharynx before delivery of the chest may prevent postnatal aspiration of meconium in the pharynx. This procedure is sufficiently safe to be recommended, even though its effectiveness in preventing severe meconium aspiration is unproven.

Four controlled trials, involving 2800 infants, have compared a policy of routine versus no (or selective) endotracheal intubation and aspiration in the immediate management of vigorous term meconium-stained babies at birth. Contrary to what was commonly believed,
routine endotracheal suctioning conferred no benefits and increased the risk of meconium aspiration syndrome. Based on current evidence, routine intubation of these infants should be abandoned, and reliance placed on nasal and pharyngeal suction.

3.2 Elective tracheal intubation for very-low-birthweight infants
Although some neonatologists advocate immediate intubation of all very-low-birthweight infants, whether or not signs of respiratory depression or respiratory distress are present, the available evidence does not warrant such a policy. Because of the potential hazards of intubation, routine delivery room intubation of infants below 1500 g with no signs of respiratory distress or respiratory depression is not justified on the basis of current evidence.

3.3 Prophylactic administration of surfactant to immature infants
A number of surfactant preparations, both synthetic and derived from animal sources, are available and in general use. There is clear evidence from large trials that prophylactic administration of surfactant to preterm newborns at high risk of developing respiratory distress syndrome (intubated infants less than 30 weeks gestation) is beneficial. Compared to therapeutic administration, prophylactic administration of surfactant improves respiratory function, and decreases the incidence of respiratory distress symptoms, pneumothorax, bronchopulmonary dysplasia, and death. No significant untoward effects of prophylactic surfactant administration have been noted.

4 Immediate care of ill newborn infants
The availability of professionals skilled in neonatal resuscitation has increased with the growth of neonatology as a specialty. This means that the birth of a very preterm asphyxiated or otherwise high-risk neonate is now more likely to be attended by someone who is experienced in giving care to such infants. A proportion of ill and high-risk infants will continue to present as unpredicted emergencies, however, and it will often fall to a midwife, nurse, general practitioner, or trainee obstetric specialist to initiate and continue neonatal resuscitation.

Whenever possible, a person skilled in resuscitation who can devote all of his or her attention to the infant should be in attendance at high-risk deliveries. Basic resuscitation equipment (a radiant warmer, resuscitation bags and masks, endotracheal tubes, laryngoscope,
stethoscope, oxygen source and tubing) should be readily available for every delivery room. Those attending births at home should ensure that there is a means of keeping the baby warm, and that they carry resuscitation bag and masks, a stethoscope, and possibly an oxygen source. Because the need for resuscitation is not recognized prior to the birth of approximately half of all infants requiring resuscitation, the presence and proper working order of this equipment should be verified before each delivery.

While anesthesia bags are likely to be required for the optimal resuscitation of severely asphyxiated infants, their hazards if used improperly (e.g. the application of dangerously high airway pressures) make them unsuitable for routine use by inexperienced caregivers. Likewise, the hazards of umbilical artery catheters and trochars for endotracheal tubes should preclude their use in delivery rooms, except by highly experienced resuscitators.

4.1 Resuscitation

Artificial ventilation should be initiated promptly for infants with a heart rate less than 100 beats/minute after birth, and oxygen should be administered to any infant with generalized cyanosis. Regardless of heart rate or colour, artificial ventilation should also be commenced for infants with inadequate chest excursion and poor breath sounds, especially small preterm infants likely to have surfactant deficiency.

Proper ventilation of the infant is the single most important aspect of neonatal resuscitation, and the heart rate is the most useful and easily measured criterion for its success. Caregivers who do not frequently intubate newborn infants should initiate resuscitation using a face mask, and consider intubation only when the heart rate does not increase with properly performed bag and mask ventilation.

Before intubation, attention should be given to the following points: proper positioning of the head (‘sniffing position’); ensuring that the upper airway is clear; using sufficient pressure to produce adequate chest excursions; and administering an adequate inspired oxygen concentration. Observing distension of the throat as the resuscitation bag is squeezed indicates that a proper head position and clear airway (allowing delivery of gas to the level of the glottis) has been established. The careful use of an anesthesia bag may be required to deliver more pressure or a greater oxygen concentration, than can be delivered by self-inflating bags. Applying excessive pressure to the infant’s head through the face mask may cause persistent bradycardia.
4.2 Oxygen  
Supplemental oxygen (100% concentration of the warm and humidified gas) is usually recommended for artificial ventilation of neonates who have not established effective spontaneous respiration by one minute of age. The need for 100% oxygen has been challenged, and some recent trials are investigating the benefits and risks of lower concentrations of oxygen. Outside a hospital setting, positive pressure ventilation with air may be more practical and is reported to be effective.

Some concern has been expressed that blowing oxygen across the face of a newborn infant might result in bradycardia, but most concern has been focused on whether the risk of severe retinopathy would be appreciably increased in immature infants who experience short periods of exposure to high blood-oxygen levels. There is no satisfactory evidence, however, to suggest that the risk is any greater than that associated with the relatively high blood-oxygen levels that occur at birth in all babies with the onset of air breathing.

4.3 Cardiac massage  
Cardiac massage through the intact chest wall of the newborn baby can be life-saving when used for infants born with an absent heart beat. The procedure is not without hazard; it may cause rib fractures and trauma to the liver or lung.

Little information of the kind needed to recommend precise indications and methods is available. Current recommendations are to perform cardiac massage either by using both thumbs with the hands encircling the chest, or by using the tips of the middle finger and either the index or ring finger of one hand positioned directly above the chest. The sternum should be depressed one-half to three-quarters of an inch (1.5 cm), 120 times per minute.

4.4 Naloxone  
Naloxone hydrochloride is a narcotic antagonist, believed to be virtually free of side-effects. It may be administered as an adjunctive measure after assisted ventilation has been established, if depression is thought to be the result of a narcotic drug given to the mother before birth. It is probably wise not to give naloxone to the newborn of a narcotic-dependent mother for fear of precipitating withdrawal illness in the baby.

Apart from concern about the potential importance of endogenous opioid substances in newborn infants, mothers have reported less
optimal ratings of infant behavior among naloxone-treated infants than among controls. Administration of naloxone should, therefore, be restricted to infants who have been exposed to narcotics during labour and who also require active resuscitation in the immediate neonatal period.

4.5 Sodium bicarbonate
Randomized trials have failed to detect any benefit from either rapid or slow administration of sodium bicarbonate to asphyxiated neonates. Potential hazards include a transient rise in PaCO2 and fall in PaO2; a sudden expansion of blood volume; a reduction in cerebral blood flow; and an increased incidence of intracranial hemorrhage.

In the absence of any demonstrated benefits of giving sodium bicarbonate in the immediate postnatal period, its use cannot be recommended.

4.6 Blood volume expanders
The only clear-cut indication for the use of blood volume expanders in the early neonatal period is the combination of unmistakable signs of shock with evidence of acute blood loss, including fetomaternal hemorrhage. In this circumstance, shock may be treated with repeated infusions of blood volume expanders (usually 5–10 ml) and the infant’s response assessed after each infusion. The volume expander may be Ringer’s lactate, saline, or in extreme emergency due to blood loss, heparinized placental blood. In the past, 5% albumin solutions have been used and are often still used for this purpose, but meta-analysis comparing colloid with electrolyte solutions for shock in adults clearly showed that mortality was higher with the use of albumin solutions, and this may be the case with newborns as well.

Volume expanders have also been used in the presence of hypotension unaccompanied by other signs of shock or blood loss. This practice is of far more dubious validity.

5 Indications for withholding or discontinuing resuscitation
The issue of when to withhold or discontinue resuscitation is the most difficult treatment decision to be made in the delivery room. Much of the information needed to define appropriate indications for using
intensive care is lacking. Better data are required on the effect of intensive care on mortality and the quality of life of survivors, and the cost of care for severely impaired or malformed infants.

Ultimately, decisions to withhold or withdraw aggressive care involve value judgements about what is considered an acceptable outcome and an acceptable cost. Although much has been written to express the views of health-care professionals, lawyers, and ethicists concerning aggressive care of extremely high-risk infants, little has been done to explore the views of the parents who, apart from the child, have most at stake in such decisions. The problem may be compounded in developing countries, where neonatal intensive care facilities are limited.

Given the limited amount of useful information for reaching decisions about instituting or withholding aggressive neonatal care, a liberal policy of resuscitation must be recommended whenever doubt exists. This allows the physician time to gather important information about the infant, and the distressed parents time and opportunity to participate more effectively in joint decisions about subsequent treatment.

6 Conclusions

The vast majority of infants need only a vigilant caregiver, warmth, a clear airway, and a gentle welcome. Mothers should have contact with their babies as soon as possible after birth, for as long as they wish. Initiation of breastfeeding should happen when the baby and mother are ready.

Many high-risk newborns can be successfully cared for by rather simple means.

Nasal and pharyngeal suction should be carried out on babies who have passed meconium _in utero_. Endotracheal intubation and suction should not be carried out routinely on vigorous, term babies who are meconium-stained at birth. There is no justification for routine suctioning of the stomach or for routine intubation of all very low-birthweight infants in the delivery room.

The great majority of babies who are depressed at birth require only appropriate ventilation without the need of drugs, volume expanders, or other adjuncts. The most common serious error in neonatal resuscitation is the failure to recognize and correct hypoventilation, a problem that is preventable with sufficient training and experience. Each hospital must establish appropriate methods to facilitate the most
effective care for asphyxiated or depressed neonates. Whenever feasible, the birth of high-risk infants should be attended by a caregiver experienced in neonatal resuscitation.

In the absence of further evidence, breastfed babies should receive supplemental vitamin K routinely to prevent hemorrhagic disease of the newborn. Although the evidence is not conclusive, it is probably best to administer vitamin K to formula-fed babies as well.

Where not required by law, observation for, and prompt treatment of, ophthalmia may be as effective as routine prophylaxis and save many babies from unnecessary medication. If eye prophylaxis is required, erythromycin causes less chemical conjunctivitis than silver nitrate and is more effective against chlamydia infection. Silver nitrate should not be used. There is no evidence to suggest that topical ophthalmic preparations must be given immediately after birth.

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