APPENDIX

# I

# Resuscitation of the baby at birth

## I.1 OBJECTIVES

This will teach you:

- the important physiological differences in the newly born baby
- the equipment used for resuscitation at birth
- how to assess the baby at birth
- how to resuscitate the baby at birth
- additional measures for special situations

## I.2 INTRODUCTION

The resuscitation of babies at birth is different from the resuscitation of all other age groups, and knowledge of the relevant physiology and pathophysiology is essential. However, the majority of babies will establish normal respiration and circulation at delivery without help. Ideally, someone trained in newborn resuscitation should be present at all deliveries. All those who attend deliveries should attend courses such as the Newborn Life Support Course, organised by the Resuscitation Council (UK) or the Neonatal Resuscitation Programme, organised by the American Academy of Pediatrics. However, some babies are born in unexpected places such as A&E departments. For these situations it is important that clinicians have an understanding of the differences in resuscitating a baby at birth.

## I.3 NORMAL PHYSIOLOGY

At birth the baby must change, within a matter of moments, from an organism with fluid-filled lungs whose respiratory function is carried out by the placenta to a separate being whose air-filled lungs can successfully take over this function. Preparation for this begins during labour, when the fluid-producing cells within the lung cease secretion and begin re-absorption of that fluid. Delivery by caesarean section before the onset of labour may slow the clearance of pulmonary fluid from the lungs.

During vaginal delivery some lung fluid, perhaps 35 ml in a term baby, is expelled by passage through the birth canal. In a healthy baby the first spontaneous breaths may generate a negative pressure of between – 40 cm $H_2O$ and –100 cm $H_2O$ (–3·9 and – 9·8 kPa), which aerates the lungs for the first time. This pressure difference is 10–15 times greater than that needed for later breathing but appears to be necessary to overcome the viscosity of the fluid filling the airways, the surface tension of the fluid-filled lungs and the elastic recoil and resistance of the chest wall, lungs and airways. These powerful chest movements cause fluid to be displaced from the airways into the lymphatics and circulation.

After delivery, a healthy term baby usually takes its first breath within 60–90 seconds of clamping or obstructing the umbilical cord. Separation of the placenta or clamping of the cord leads to the onset of hypoxia with hypercarbia, which is initially a major stimulant to start respiration. Physical stimuli such as cold air or physical discomfort may also provoke respiratory efforts.

In a 3-kg baby up to 100 ml of fluid is cleared from the airways following the initial breaths, a process aided by full inflation and prolonged high pressure on expiration, i.e. crying. The effect of the first few breaths is to produce the baby's functional residual capacity. Neonatal circulatory adaptation commences with the detachment of the placenta, but lung inflation and alveolar distension release mediators, which affect the pulmonary vasculature as well as increase oxygenation.

## Pathophysiology

Our knowledge of the pathophysiology of fetal asphyxia is based on pioneering animal work in the early 1960s. The results of these experiments, which followed the physiology of newborn animals during acute, total, prolonged asphyxia and subsequent resuscitation are summarised in Figure I.1.

When the placental oxygen supply is interrupted, the fetus attempts to breathe. Should these attempts fail to inflate the lung with air – as they will inevitably fail to do in utero – the baby will lose consciousness. If hypoxia continues, the respiratory centre becomes unable, through lack of sufficient oxygen, to continue initiating breathing and the breathing stops, usually within 2–3 minutes (primary apnoea, Figure I.1).

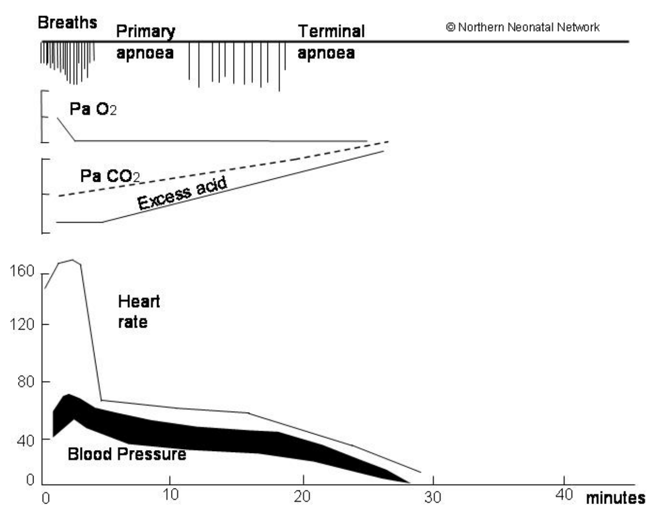



**Figure I.1** Response of a mammalian fetus to total, sustained asphyxia started at time 0.

Fetal bradycardia ensues but blood pressure is maintained, primarily by peripheral vasoconstriction and diversion of blood away from non-vital organs, and also by an increased stroke volume. After a latent period of apnoea (primary), primitive spinal centres, no longer suppressed by neural signals from the respiratory centre, will initiate primitive gasping breaths. These deep spontaneous gasps are easily distinguishable from normal breaths as they only occur 6–12 times per minute and involve all accessory muscles in a maximal inspiratory effort. After a while, if hypoxia continues, even this activity ceases (terminal apnoea). The time taken for such activity to cease is longer in the newly born baby than in later life, taking up to 20 minutes.

The circulation is almost always maintained until all respiratory activity ceases. This resilience is a feature of all newborn mammals at term, largely due to the reserves of glycogen in the heart. Resuscitation is therefore relatively easy if undertaken before all respiratory activity has stopped. Once the lungs are inflated, oxygenated blood will be carried to the heart and then to the brain provided the circulation is still functional (Figure I.2). Recovery will then be rapid. *Most* infants who have not progressed to terminal apnoea will resuscitate themselves if their airway is patent. Once gasping ceases, however, the circulation starts to fail and these infants are likely to need more extensive resuscitation (Figure I.3).

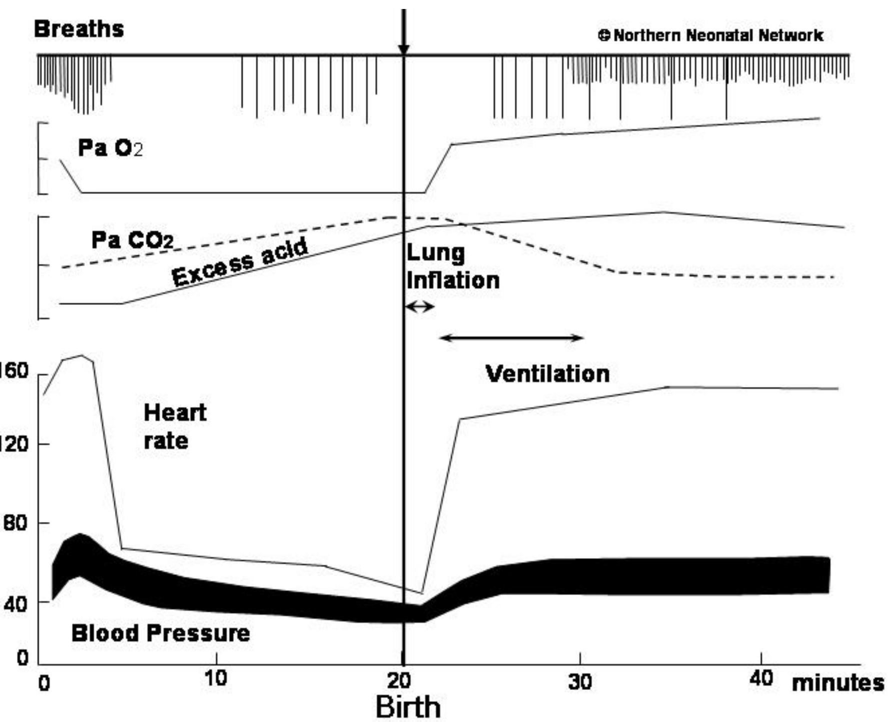



**Figure I.2.** Effects of lung inflation and a brief period of ventilation on a baby born in early terminal apnoea but before failure of the circulation (Reproduced with permission from the Northern Neonatal Network)

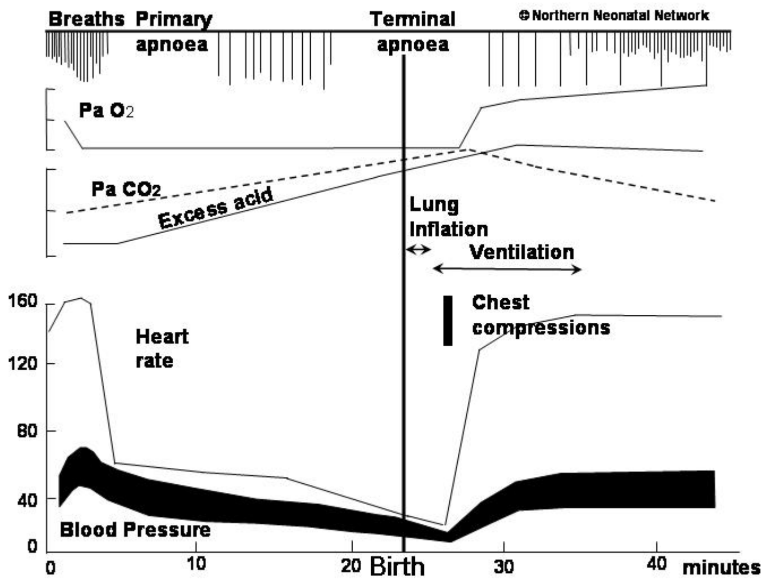



**Figure I.3.** Response of babies born in terminal apnoea. In this case lung inflation is not sufficient because the circulation is already failing. However, lung inflation delivers air to the lungs and then a brief period of chest compressions (CC) delivers oxygenated blood to the heart which then responds.(reproduced with permission from the Northern Neonatal Network)

## I.4 EQUIPMENT

For many newborn babies, especially those born outside the delivery room, the need for resuscitation cannot be predicted. It is therefore useful to plan for such an eventuality. Equipment, which may be required to resuscitate a newborn baby is listed in Table I.1. The list will vary between departments; however, most babies can be resuscitated with a flat surface, warmth, knowledge and a way to deliver air or oxygen at a controlled pressure.

**Table I.1.** Equipment for newborn resuscitation

| |
|---|
| • A flat surface |
| • Radiant heat source and dry towels (or suitable plastic bags for preterm infants) |
| • Suction with catheters at least 12 Fr |
| • Face masks |
| • Bag-valve-mask or T piece w pressure limiting device |
| • Source of air and/or oxygen |
| • Oropharyngeal (Guedel) airways |
| • Laryngoscopes with straight blades, 0 and 1 |
| • Nasogastric tubes |
| • Cord clamp |
| • Scissors |
| • Tracheal tubes sizes 2.5 to 4.0 mm |
| • Umbilical catheterization equipment |
| • Adhesive tape |
| • Disposable gloves |

## I.5 PRACTICAL ASPECTS OF NEONATAL RESUSCITATION

Most babies, even those born apnoeic, will resuscitate themselves given a clear airway. However, the basic approach to resuscitation is **A**irway, **B**reathing and **C**irculation, with the following initial actions:

- Get help
- Start the clock
- Dry, wrap and keep baby warm
- Assess baby

### Call for help

Ask for help if you expect or encounter any difficulty.

### Start clock

If available, or note the time.

### Keep the baby warm

Dry the baby off immediately and then wrap in a dry towel. A cold baby has increased oxygen consumption and cold babies are more likely to become hypoglycaemic and acidotic. They also have an increased mortality. If this is not addressed at the beginning of resuscitation it is often forgotten. Most of the heat loss is evaporative heat loss caused by the baby being wet and in a draught – hence the need to dry the baby and then to wrap the baby in a dry towel. Babies also have a large surface area to weight ratio; thus heat can be lost very quickly. Ideally, delivery should take place in a warm room, and an overhead heater should be switched on. However, drying effectively and wrapping the baby in a warm dry towel is the most important factor in avoiding hypothermia. A naked wet baby can still become hypothermic despite a warm room and a radiant heater, especially if there is a draught. (see “Pre-Term Babies”)

### Assessment of the newborn baby

The APGAR score was proposed as a tool for evaluating a baby’s condition at birth as a means of judging the quality of obstetric anaesthesia. Although the score, calculated at 1 and 5 minutes, may be of some use retrospectively, it is almost always recorded subjectively. It is not used to guide resuscitation.

Acute assessment is made by assessing:

| | | |
|---|---|---|
| • **Breathing** | (rate and quality) | **Airway and Breathing** |
| • Heart rate | (fast, slow, absent) | |
| • Colour | (pink, blue, pale) | **Circulation** |
| • Tone | (unconscious, apnoeic babies are floppy) | |

Unlike resuscitation at other ages, it is important to assess the situation fully so one can judge the success of interventions. This is especially true of heart rate.

## Respiration

Most babies will establish spontaneous regular breathing within 3 minutes of birth that is sufficient to maintain the heart rate above 100 beats/min and to improve the skin colour. If apnoea or gasping persists after drying, intervention is required.

## Heart rate

Listening with a stethoscope at the cardiac apex is the best method to assess the heart rate. Palpating peripheral pulses is not practical and cannot be recommended. Palpation of the umbilical pulse can only be relied upon if it is more than 100 beats/min. A rate less than this should be checked by auscultation if possible. An initial assessment of heart rate is vital because an increase in the heart rate will be the first sign of success during resuscitation. This initial assessment will categorise the baby into one of the three following groups:

1. *Regular breathing, fast heart rate (more than 100 beats/min) pink, good tone.*
   These are healthy babies and they should be kept warm and given to their mothers. The baby will remain warm through skin-to-skin contact with the mother under a cover and may be put to the breast at this stage.
2. *Irregular or inadequate breathing, slow heart rate (less than 100 beats/min), blue, normal or reduced tone.*
   If gentle stimulation (such as drying) does not induce effective breathing, the airway should be opened and cleared. If the baby responds then no further resuscitation is needed. If there is no response, progress to lung inflation.
3. *Not breathing, slow or absent heart rate (less than 100 beats/min), blue or pale, floppy.*

Whether an apnoeic baby is in primary or secondary apnoea (Figure I.1) the initial management is the same. Open the airway and then inflate the lungs. Reassessment of any heart rate response then directs further resuscitation. Reassess the heart rate and respiration at regular intervals throughout.

Apnoea, low or absent heart rate, pallor and floppiness together suggest terminal apnoea.

After assessment, resuscitation follows:

- Airway
- Breathing
- Circulation
- Use of drugs in a few selected cases

## Airway

The baby should be positioned with the head in the neutral position (see Figure I.4 and Chapter 4). The newborn baby's head has a large occiput, which is often exaggerated further by moulding. This tends to cause the neck to flex with consequent obstruction of the airway when the baby is supine on a flat surface. However, overextension may collapse the newborn baby's pharyngeal airway, also leading to obstruction. A towel folded to a thickness of about 2-3 cm and placed under the shoulders may help to maintain the airway in a neutral position.

If the baby is very floppy then jaw thrust may be needed to bring the tongue forward and open the airway (Figure I.5). Visible secretions may be removed by gentle suction with a paediatric Yankauer or 12–14-Fr suction catheter, although these rarely cause airway obstruction. Blind deep pharyngeal suction should be avoided as it may cause vagally induced bradycardia and laryngospasm. Suction, if it is used, should not exceed –-100 mmHg (9·8 kPa). The presence of thick meconium (see below) in a non-vigorous baby is the only indication for considering immediate suction.

*Meconium aspiration*

Meconium-stained liquor is relatively common and occurs in up to 10% of births. Happily, meconium aspiration is a rare event. Meconium aspiration usually happens in term infants and before delivery. A large randomised trial has shown no advantage to suctioning meconium from the mouth and nose whilst the head is on the perineum. This practice is, therefore, no longer recommended. Another randomised trial has shown that, *if the baby is vigorous*, then intubation followed by immediate suctioning of the trachea offers no advantage either and no specific action (other than drying and wrapping the baby) is needed.

However, if the baby is not vigorous – i.e. has absent or inadequate respirations, a heart rate <100 beats/min or hypotonia, then our current state of knowledge suggests that you should inspect the oropharynx with a laryngoscope and aspirate any particulate meconium seen using a wide-bore catheter.

If intubation is possible and the baby is still unresponsive, aspirate the trachea preferably using the tracheal tube as a suction catheter. However, if intubation cannot be achieved immediately, clear the oropharynx and start mask inflation. If, while attempting to clear the airway, the heart rate falls to less than 60 beats/min then stop airway clearance, give aeration breaths and start ventilating the baby.

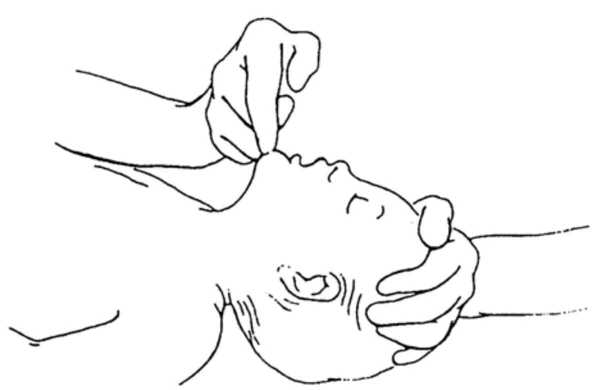


**Figure I.4.** Chin lift in infants

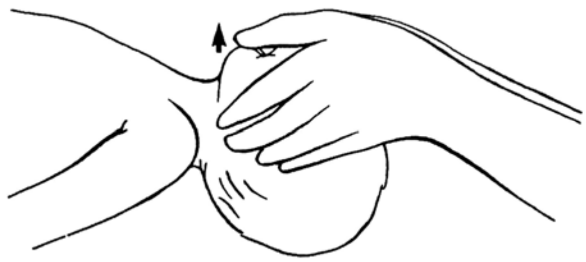


**Figure I.5.** Jaw thrust

## Breathing (aeration breaths and ventilation)

There is currently insufficient evidence to specify the concentration of oxygen to be used when starting resuscitation at birth. Most experts still use oxygen enriched air but the absence of oxygen should not delay the delivery of breaths in an apnoeic baby. The priority must be to aerate the lungs. Therefore, the first five breaths should be 'aeration' or 'inflation' breaths in order to replace lung fluid in the alveoli with air/oxygen. These breaths should have a sustained inflation time of 2–3-seconds and are most easily delivered using a continuous gas supply, a pressure-limiting device a T-piece and a mask. Use a transparent, circular mask with a big enough to cover the nose and mouth of the baby (Figure I.7). If no such system is available then a 500-ml self-inflating bag with a blow-off valve set at 30–40 $cmH_2O$ can be used. This is especially useful if compressed air or oxygen is not available.

The chest may not move during delivery of the first 1–3 breaths as fluid is displaced by air with little change in chest volume. Adequate ventilation is usually indicated by either a rapidly increasing heart rate or a heart rate that is maintained at more than 100 beats per minute. Therefore, reassess the heart rate after delivery of the first 5 breaths. It is safe to assume the lungs have been aerated successfully if the heart rate responds. If the heart rate has not responded, then check for chest movement rather than auscultation. In fluid-filled lungs, breath sounds may be heard even when the lung is not aerated.

Once the lung is aerated and the heart rate has increased or if the chest has been seen to move in response to passive inflation then ventilation should be continued at a rate of 30–40 per minute. Continue ventilatory support until regular breathing is established.

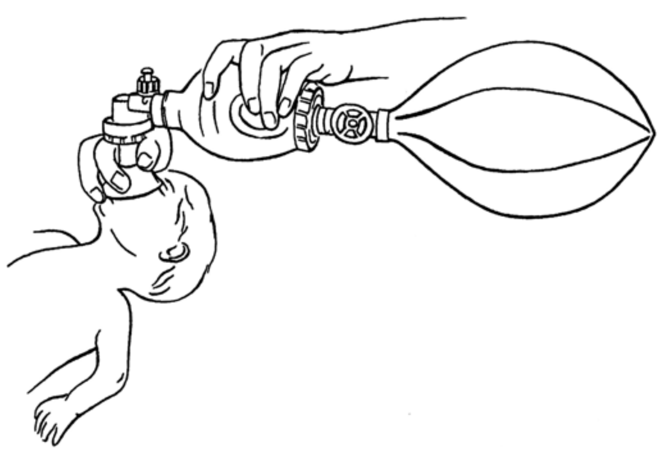


**Figure I.6.** Bag and mask ventilation

## Circulation

If the heart rate remains slow (less than 60 beats/min) even after the lungs have been aerated, chest compressions must be started. However, the most common reason for the heart rate to remain low is that lung inflation has not been successful – chest compressions are rarely needed. Cardiac compromise is always the result of respiratory failure and can only be effectively treated if effective ventilation is occurring.

The most efficient way of delivering chest compressions in the neonate is to encircle the chest with both hands, so that the fingers lie behind the baby and the thumbs are apposed on the sternum just below the inter-nipple line (Figure I.8). Compress the chest briskly, *by one third of its depth*. Current advice is to perform three compressions for each ventilation breath (3:1 ratio).

**Figure I.8.** Infant chest compression: hand-encircling technique

The purpose of chest compression is to move oxygenated blood or drugs to the coronary arteries in order to initiate cardiac recovery. Thus there is no point in starting chest compression before effective lung inflation has been established. Similarly, compressions are ineffective unless interposed by ventilation breaths of good quality. Therefore, the emphasis must be upon *good-quality breaths*, followed by effective compressions. Simultaneous delivery of compressions and breaths should be avoided, as the former will reduce the effectiveness of the breaths. Once the heart rate is above 60 beats/min and rising, chest compression can be discontinued.

## Drugs

If after adequate lung inflation and chest compressions the heart rate has not responded, drug therapy should be considered. However, the most common reason for failure of the heart rate to respond is failure to achieve lung inflation, and there is *no point* in giving drugs unless the airway is open and the lungs have been inflated. Airway and breathing must be reassessed as adequate before proceeding to drug therapy. Venous access will be required via an umbilical venous line, because ideally drugs should be given centrally. The outcome is poor if drugs are required for resuscitation.

### *Adrenaline (epinephrine)*

The alpha-adrenergic effect of adrenaline (epinephrine) increases coronary artery perfusion during resuscitation, enhancing oxygen delivery to the heart. In the presence of profound unresponsive bradycardia or circulatory standstill, 10 micrograms/kg (0·1 ml/kg 1:10000) adrenaline (epinephrine) may be given intravenously. Further doses of 10–30 micrograms/kg (0·1–0·3 ml 1:10000) may be tried at 3–5-minute intervals if there is no response. The tracheal route cannot be recommended, as there is insufficient data. However, if it is used tracheally animal evidence suggests that doses of 30 microgram/kg will be ineffective.

### *Bicarbonate*

Any baby who is in terminal apnoea will have a significant metabolic acidosis. Acidosis depresses cardiac function. Bicarbonate 1-2 mmol/kg (2 ml/kg of 4·2% solution) may be used to raise the pH and enhance the effects of oxygen and epinephrine.

Bicarbonate use remains controversial and it should only be used in the absence of discernible cardiac output despite all resuscitative efforts or in profound and unresponsive bradycardia.

### *Dextrose*

Hypoglycaemia is a potential problem for all stressed or asphyxiated babies. It is treated using a slow bolus of 5 ml/kg of 10% dextrose intravenously, and then providing a secure intravenous dextrose infusion at a rate of 100 ml/kg/day of 10% dextrose. BM stix are not reliable in neonates when reading less than 5 mmol/l.

### *Fluid*

Very occasionally hypovolaemia may be present because of known or suspected blood loss (feto-maternal haemorrhage, antepartum haemorrhage, placenta or vasa praevia, cord haemorrhage) or it may be secondary to loss of vascular tone following asphyxia. Volume expansion, initially with 10 ml/kg, may be appropriate. Normal saline can be used; alternatively Gelofusine has been used safely and if blood loss is acute and severe, non-cross-matched O-negative blood should be given immediately. Albumin is no longer recommended. However, most newborn or neonatal resuscitations do not require fluid unless there has been known blood loss or septicaemic shock.

### *Naloxone*

Strictly speaking this is not a drug of resuscitation – it should only be used once it is clear that a baby *who has been effectively resuscitated* – is pink, with a heart rate of over 100 beats/min – but is not breathing spontaneously or adequately because of the possible effects of maternal opiates. If respiratory depressant effects are suspected the baby should be given naloxone intramuscularly (200 micrograms in a full term baby). Smaller doses of 10 micrograms/kg will also reverse the sedation but the effect will only last a short time (perhaps 20 minutes IV or a few hours IM). Intravenous naloxone has a half-life shorter than opiates, and there is no evidence to support intra-tracheal administration.

### *Atropine and calcium gluconate*

Atropine and calcium gluconate have no place in newborn resuscitation. Atropine may, rarely, be useful in the neonatal unit, when vagal stimulation has produced resistant bradycardia or asystole (see bradycardia protocol).

## I.5 RESPONSE TO RESUSCITATION

The first indication of success will be an increase in heart rate. Recovery of respiratory drive may be delayed. Babies in terminal apnoea will tend to gasp first as they recover before starting normal respirations (Figure I.3). Those who were in primary apnoea are likely to start with normal breaths, which may commence at any stage of resuscitation.

### Tracheal intubation

Most babies can be resuscitated using mask inflation. Swedish data suggests that if this is applied adequately, only 1:500 babies appear to need intubation. However, tracheal intubation remains the gold standard in airway management. It is especially useful in prolonged resuscitations, pre-term babies and meconium aspiration. It should be considered if mask ventilation has failed, although the most common reason for failure with mask inflation is poor positioning of the head or failure to use jaw thrust with consequent failure to open the airway.

The technique of intubation is the same as for infants and is described in Chapter 20. A normal full-term newborn usually needs a 3·5 mm tracheal tube, but 4·0, 3·0 and 2·5 mm tubes should also be available.

Tracheal tube placement must be assessed visually during intubation and in most cases will be confirmed by a rapid response in heart rate on ventilating via the tracheal tube. If in doubt exhaled CO2 detection will correctly identify most correctly sited tubes in the presence of any cardiac output.

## I.6 SPECIAL CASES

### Pre-term babies

Pre-term babies are more likely to get cold (higher surface area to mass ratio, little insulating fat), and more likely to become hypoglycaemic (fewer glycogen stores). There are now several trials, which support the practice of placing small preterm babies in plastic bags (with the face exposed) under radiant heat *without drying*, in order to prevent evaporative heat loss. This technique might also be useful when dealing with the unexpected pre-term birth outside a delivery unit but it must be remembered that it does <u>nothing</u> to prevent conductive or radiant heat losses. Large, food-grade microwaveable roasting bags are suitable. (see below)

**GUIDELINES FOR USE OF PLASTIC BAGS FOR PRE-TERM BABIES (<29 WEEKS) AT BIRTH**

1. Pre-term babies born below 29 completed weeks' gestation may be placed in plastic bags, under radiant heat, to maintain their temperature during resuscitation. They should remain in the bag until they are on the NICU and the humidity within their incubator is at the desired level. This prevents evaporative heat loss but it does not prevent conductive or radiant heat loss. It should not replace all efforts to maintain a high ambient temperature around babies born outside delivery suites.
2. At birth the baby should not be dried, but should be slipped straight into the prepared plastic bag and placed under the radiant heater. This prevents evaporative heat loss. There is no need to wrap in a towel so long as this is done immediately after birth.
3. Suitable plastic bags are food-grade bags designed for microwaving and roasting. They should be large.

The bag is prepared with a V cut in the closed end.

4. The bag should be slipped from the head up to the legs, covering in full, and let the head be completely accessible from the V-cut. This is most easily performed if the hand is placed through the V, the head placed in the hand, and the bag drawn back down over the baby.
5. The head will stick out of the V-cut and will be dried as usual and resuscitation commenced as per standard guidelines. A hat should be placed on the head to further reduce heat loss.
6. The standard resuscitation would be carried out without any limitations of access, but if the umbilicus is required for any access then a small hole can be made above the area and the desired intervention done.
7. Chest compression can be performed without removing the bag,
8. After the baby is transferred to a neonatal unit, the temperature should be recorded after securing ventilation. The bag is only removed when the incubator humidity is satisfactory, and further care provided as per nursing protocols.

The more pre-term a baby the less likely it is to be able to establish adequate respirations. Preterm babies (<32 weeks) are likely to be deficient in surfactant especially after unexpected or precipitate delivery. The surfactant, secreted by pneumocytes in the alveolar epithelium, reduces alveolar surface tension and prevents alveolar collapse on expiration. Small amounts of surfactant can be demonstrated from about 20 weeks' gestation, but a surge in production occurs at 30–34 weeks. Surfactant is released at birth due to aeration and distension of the alveoli. The half-life of the surfactant is approximately 12 hours. Production is reduced by hypothermia (<35°C), hypoxia and acidosis (pH <7·25). In babies born before 32 weeks, one must anticipate a lack of surfactant. The effort of respiration will be increased, although the musculature will be less developed. They may require help to establish prompt aeration and ventilation, and may subsequently require exogenous surfactant therapy.

The lungs of pre-term babies are more fragile than those of term babies and thus are much more susceptible to damage from over-distension. Therefore, it is appropriate to start with a lower inflation pressure of 2·0–2·5 kPa (20–25 $cmH_2O$) but do not be afraid to increase this to 30 cm $H_2O$ if there is no heart rate response.

Vigorous passive chest movement in preterm babies (especially below 30 weeks) should be avoided as it is usually indicates excessive lung inflation with the possibility of causing extensive lung damage (volume trauma).

## Actions in the event of poor initial response to resuscitation

1. Check airway and breathing.
2. Check for a technical fault.
   (a) Is mask ventilation effective? Observe chest movement.
   (b) Is the tracheal tube in the trachea? Auscultate both axillae, listen at the mouth for a large leak, and observe movement. Use an exhaled $C0_2$ detector.
   (c) Is the tracheal tube in the right bronchus? Auscultate both axillae and observe movement.
   (d) Is the tracheal tube blocked? If there is doubt about the position or patency of the tracheal tube re-place it. Use an exhaled $C0_2$ detector.
   (e) Is a longer inflation time required?
   (f) Is the oxygen connected? This is least likely to be a cause.
3. Does the baby have a pneumothorax? This occurs spontaneously in up to 1% of newborns, but

those needing action in the delivery unit are exceptionally rare. Auscultate the chest for asymmetry of breath sounds. A cold light source can be used to transilluminate the chest – a pneumothorax may show as a hyper-illuminating area. If a tension pneumothorax is thought to be present clinically, a 21-gauge butterfly needle should be inserted through the second intercostal space in the mid-clavicular line. Alternatively, a 22-gauge cannula connected to a three-way tap may be used. Remember that you may well cause a pneumothorax during this procedure. (Chapter 22)

4. Does the baby remain cyanosed despite breathing with a good heart rate? There may be a congenital heart malformation, which may be duct-dependent (Chapter 9), or a persistent pulmonary hypertension.
5. If, after resuscitation, the baby is pink and has a good heart rate but is not breathing effectively, it may be suffering the effects of maternal opiates. Naloxone 200 micrograms IM may be considered. Given IM this should outlast the opiate effect.
6. Is there severe anaemia or hypovolaemia? In case of large blood loss, 20 ml/kg O-negative blood or a volume expander should be given.

## Birth outside the delivery room

Whenever a baby is born unexpectedly, the greatest difficulty lies often in keeping it warm. Skin to skin contact of the baby with the mother or another adult will keep most babies warm if the two are then covered against draughts. Drying and wrapping, turning up the heating and closing windows and doors are all important in maintaining temperature. Special care must be taken to clamp and cut the cord to prevent blood loss.

Hospitals with accident and emergency departments should have guidelines for resuscitation at birth, summoning help and post-resuscitation transfer of babies born within the department.

Babies born unexpectedly, outside hospital, will be at greater risk of being pre-term and of getting cold. However, the principles of resuscitation are identical to the hospital setting. Transport will need to be discussed according to local guidelines.

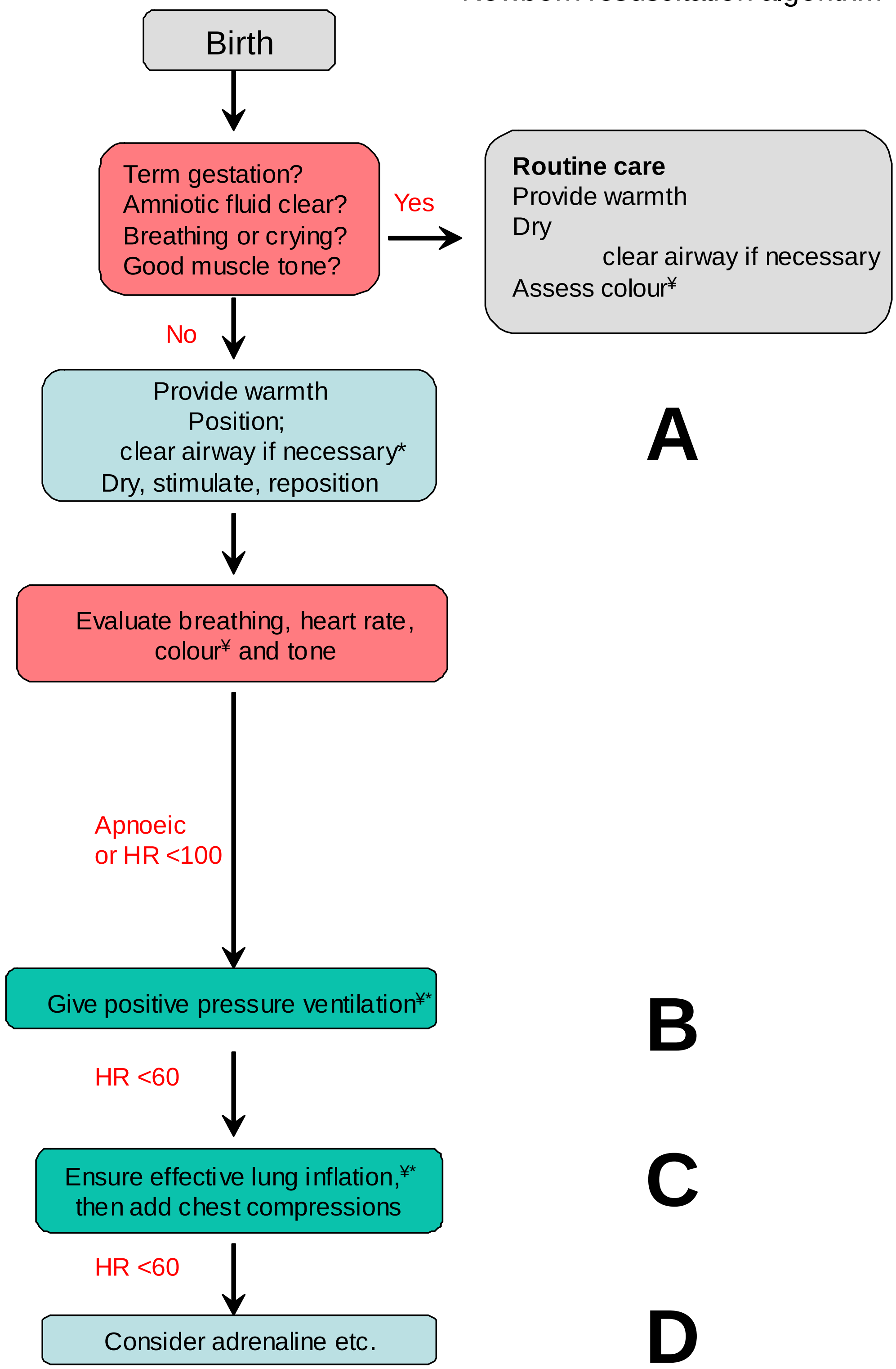
## Discontinuation of resuscitation

The outcome for a baby with no cardiac output after more than 10 minutes of adequate resuscitation is likely to be very poor. Stopping resuscitation early, or not starting resuscitation at all, may be appropriate in situations of extreme prematurity (<23 weeks), birth weight of <400 g, or in the presence of lethal abnormalities such as anencephaly or confirmed trisomy 13 or 18. Resuscitation is nearly always indicated in conditions with a high survival rate and acceptable morbidity. Such decisions should be taken by a senior member of the team, ideally a consultant in consultation with the parents and other team members. This means that help must have been called for.

## Communication with the parents

It is important that the team caring for the newborn baby informs the parents of the progress whenever possible. This is likely to be most difficult in unexpected deliveries so prior planning to cover the eventuality may be helpful. Decisions at the end of life must involve the parents whenever possible. All communication should be documented after the event.

Newborn resuscitation algorithm




*Tracheal intubation may be considered at several steps
¥ Consider supplemental oxygen at any stage if cyanosis persists