



European Resuscitation Council Guidelines 2000 for Newly Born Life Support

A statement from the Paediatric Life Support Working Group and approved by the Executive Committee of the European Resuscitation Council

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1. Introduction

The European Resuscitation Council (ERC) last issued guidelines for the resuscitation of the newly born infant in 1999 [1]. This was an 'Advisory Statement' of the International Liaison Committee on Resuscitation (ILCOR). Following this, the American Heart Association and the Neonatal Resuscitation Programme Steering Committee of the American Academy of Paediatrics and representatives of the World Health Organisation, together with representatives from ILCOR, undertook a series of evidence based evaluations of the science of resuscitation which culminated in the publication of 'Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care' in August 2000 [2,3]. The Paediatric Life Support Working Party of the European Resuscitation Council has considered this document and the supporting scientific literature and presents the ERC Newly Born Guidelines in this paper. Readers will find few changes to the ILCOR Advisory Statement recommendations as the new evidence that has emerged since its publication in 1999 has been confirmatory of the ILCOR recommendations.

2. Background to newly born life support

In the following text the masculine includes the feminine.

The need for resuscitation at birth can be predicted with more readiness than at any other time of life. The condition of the baby may be considered at risk if he is known to be showing signs of fetal distress or is significantly pre-term. Many delivery units will have a policy that a paediatrician should attend any complex delivery including caesarian sections, multiple births etc. However, whatever guidelines are used some babies will be born who unexpectedly require resuscitation. It is therefore important that everyone who is involved in delivering babies should be trained in resuscitation of the newly born.

The frequency with which babies require resuscitation at birth will vary from country to country but useful population based information has come from a Swedish study. This showed that of nearly 100 000 babies studied ten babies per 1000 weighing 2.5 kg or more received mask inflation or intubation. Of these babies eight per 1000 responded to mask inflation and only two per 1000 seemed to require intubation at birth [4].

In newly born babies the problem is almost always initially a respiratory one. The newly born is designed to undertake the passage through the birth canal, pushed by uterine contractions that intermittently interrupt respiration.

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The brain can withstand the lack of oxygen for very much longer than at any other time of life. The heart continues to function even when there is so little oxygen present that cerebral respiratory drive has failed. After the initial cessation of normal breathing (primary apnea) a newly born infant will start a period of slow, gasping breaths that are spinally induced. These breaths may be sufficient to re-oxygenate the brain, if the airway is open, and will save some babies even if no resuscitation is provided. If the gasping breaths are unsuccessful, the baby is no longer able to generate any respiratory effort (secondary apnea). However, the heart of the newborn baby can keep beating for 20 min or more on its own, and for quite a time after normal breathing and the reserve system of gasping, have both ceased to function. Therefore, in resuscitation of the newborn baby it is usually only necessary to inflate the lungs with air or oxygen. The heart and circulation are usually still functioning, albeit less well than normal, and will respond to oxygenation and ventilation. Chest compressions are not often required. Drugs are rarely required and the need for their use suggests a poor prognosis [5].

Keeping the baby warm is an essential part of newborn care. Because of their small size and relatively large surface area babies get cold very quickly. Ideally the baby should be born into an environment that is warm enough to allow him to maintain his body temperature within the normal range without effort. A wet baby rapidly loses heat and an anoxic, small baby can quickly become hypothermic. Babies subjected to cold stress in the period immediately after birth have a lower oxygen tension and an increased metabolic acidosis.

The lungs of the newborn baby have never been inflated and are filled with lung fluid. At the onset of normal labour the fetal lung switches from secreting to absorbing fluid. A small amount of fluid, perhaps 35 ml or so in a term baby, is expelled from the airways during the passage through the birth canal but more than 100 ml is rapidly reabsorbed into the blood stream and the lymphatics within a few mins of birth.

Babies who are delivered by Caesarian section prior to the onset of labour are at a disadvantage in this respect and this may go some way to explaining why they have a higher incidence of respiratory problems. A healthy baby can generate

a very high negative inspiratory pressure within the chest (greater than -100 cm H₂O) to draw air into the lungs. Intrathoracic pressure is often further raised by crying, which helps to drive lung fluid into the lymphatics during the first few breaths. In this way fluid is rapidly removed from the lungs and a normal resting (residual) lung volume is achieved.

Babies who need resuscitation at birth need help in achieving a resting (residual) lung volume. A relatively long inflation time is needed to adequately inflate the lung of a newborn baby using positive pressure inflation. A pressure of 40 cm of water sustained for half a second can be effective, but an inflation pressure of 30 cm of water applied for 2–3 s and repeated half a dozen times will adequately aerate the lungs of most babies at birth [6].

3. Sequence of actions

In the following text the masculine includes the feminine.

1. At delivery collect the baby in a clean, warm towel.

2. Clamp the cord

The cord can usually be clamped about a min after delivery, the baby being kept at approximately the same level as the mother's uterus until this time. Very early clamping, and clamping while the baby is held above the level of the placenta can cause hypovolaemia.

3. Dry the baby and wrap in a clean, warm towel.

4. Assess the baby's condition by checking:

- Colour — look at the colour of the trunk, lips and tongue;
- Tone — check whether the baby is well flexed with good tone or is hypotonic;
- Breathing — look for the rate and depth of respiration. Breathing may be irregular to start with but should soon become regular;
- Heart rate — listen for the heart rate with a stethoscope or feel for a pulse at the base of the umbilical cord. Even in a healthy baby the cord does not always pulsate so if you cannot feel

pulsation of the cord check with a stethoscope before assuming that there is no effective heart beat.

- These four features should be reassessed regularly during any subsequent resuscitation.
- A baby who is breathing regularly, with a fast heart rate (100 beats/min or more), who is centrally pink and who has good tone needs no further intervention and should be given to the mother.
- A baby who is not breathing adequately, who has a slow heart rate or one who is blue or white or floppy requires intervention and resuscitation starting with opening of the airway.

5. Opening the airway

- Hold the head in the neutral position. In newborn babies the occiput is prominent, so the neck flexes if the baby is placed on its back. To correct this, place the baby's head in the neutral position with the neck neither extended nor flexed. This position can be stabilised by placing a small pad under the baby's shoulders.
- Lift the chin or perform a jaw thrust manoeuvre. Care must be taken to avoid damage to the soft tissues under the chin.
- Positioning the head and performing a jaw thrust are most easily accomplished by a two handed approach, placing one hand on each side of the head, fixing the neutral position and performing jaw thrust.

6. Clear the airway

- Remove any blood, vernix, meconium, mucus or vomit if present. The removal of debris requires gentle direct examination and suction using a laryngoscope and a soft suction catheter rather than blind suction. Stimulation in the region of the posterior pharynx and larynx should be kept to a minimum because it can produce vagal bradycardia. Do not apply suction unless it is necessary.
- *Meconium aspiration*

The vigorous baby with possible meconium aspiration does not require suctioning of the trachea. The baby with absent or depressed respirations and (heavy) meconium aspiration should have direct laryngoscopy and tracheal intubation and suctioning, using the tracheal tube as the suction catheter [7].

7A. If the infant is now breathing regularly, with good chest movement and is pink

- Keep the infant warm and continue supportive care and regular re-assessment

7B. If the infant is not breathing, is breathing irregularly or shallowly or is blue

- Provide five inflation breaths with 100% oxygen, if available, at 30–35 cm H₂O pressure, each sustained for 2–3 s with either
 - a pressure limited device with a blow off valve and an over-ride for higher pressure if necessary
 - a pressure bag-valve-mask device (a minimum bag volume of 450–500 ml may be necessary)
 - mouth to mouth and nose ventilation (if no equipment is available) Providers must be aware, however that this method carries a risk to the provider of infection from blood and birth canal materials. In areas of high HIV infection prevalence this risk may be substantial. If the method is used, the provider should wipe obvious material from the baby's mouth and avoid swallowing or inhaling material.
 - watch for chest expansion

8A. If the infant's chest is expanding with the inflation breaths:

- Continue with ventilations at 40–60 breaths per min and reassess the heart rate by auscultating the precordium or feeling for a pulse at the base of the umbilical cord.

8B. If the infant's chest is not expanding with the inflation breaths:

- Re-position the airway: try a jaw thrust manoeuvre if this has not been used or perhaps an oropharyngeal airway if this has not been used and attempt the inflation breaths again. Consider using two people to control the airway and deliver breaths.

9B. If the infant's heart rate is more than 60 beats per min and rising:

- Continue with ventilation at a rate of 40–60 breaths per min and continue to monitor colour, tone, breathing and heart rate.

9B. If the infant's heart rate is less than 60 beats per min:

- Start chest compressions using the following method:
 - Locate the sternum and place both thumbs flat side by side on the lower sternum Place them so that the thumbs are just below an

imaginary line joining the infant's nipples. The rest of both hands should be spread with the fingers together to encircle the lower part of the infant's rib cage with the tips of the fingers supporting the infant's back.

– Press down on the lower sternum with the two thumbs to depress it about one third of the depth of the infant's chest.

– Release the pressure, then repeat at a rate of about 120 times a min (with interspersed ventilations the actual number of compressions per min will be less than 90).

• If there is only one provider, the two-finger method of chest compressions will have to be used

– Locate the sternum and place the tips of two fingers, just below an imaginary line joining the infant's nipples.

– With the tips of two fingers, press down on the sternum to depress it approximately one third of the depth of the infant's chest.

– Release the pressure, then repeat at a rate of about 120 times a min (with interspersed ventilations the actual number of compressions per min will be less than 90).

10. Co-ordinate chest compressions and ventilations

They should be in a ratio of 3:1 with about 90 compressions and 30 breaths per min. The actual number of events may be less than this because the interspersed breaths must be sufficient to expand the lungs. The quality of ventilations and compressions is more important than attaining the exact number each minute.

11A. If the heart rate is rising after 30 s of chest compression and ventilation

Chest compressions may be stopped once the spontaneous heart rate is over 60 beats per min and rising. Continue ventilations until the infant is breathing adequately and is pink.

11B. If the heart rate is not rising after 30 s of compression and ventilation

Administer epinephrine 0.1–0.3 ml/kg of a 1:10 000 solution via

– A venous catheter inserted into the umbilical vein.

– A tracheal tube into the trachea.

– The intraosseous route. The intraosseous route is not normally used in newborn resuscitation

because the umbilical vein is more accessible and the newborn's small bones are fragile. This route can be used if umbilical or other direct venous access is not readily attainable.

Continue chest compressions and ventilations and consider the following further actions:

• Establish a definitive airway.

Attempt tracheal intubation and verify the position of the tracheal tube.

• Establish vascular access.

Gain access to the circulation by:

Umbilical venous access

Intraosseous access

• Give epinephrine every 3 min by direct vascular access or via the tracheal route.

• Consider giving bicarbonate to correct a severe acidosis: 1–2 mmol/kg as a 4.2% solution of sodium bicarbonate intravenously.

• Drugs should not be given until good lung inflation and chest compressions have been established.

• Correct reversible causes:

Hypovolaemia (give 10 ml/kg of crystalloid or blood),

Hypothermia,

Hypoglycaemia,

Tension pneumothorax.

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