

Basic Newborn Resuscitation: a practical guide



MATERNAL AND NEWBORN HEALTH/
SAFE MOTHERHOOD UNIT
DIVISION OF REPRODUCTIVE HEALTH (TECHNICAL SUPPORT)
WORLD HEALTH ORGANIZATION
GENEVA

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By means of direct technical cooperation with its Member States, and by stimulating such cooperation among them, WHO promotes the development of comprehensive health services, the prevention and control of diseases, the improvement of environmental conditions, the development of health manpower, the coordination and development of biomedical and health services research, and the planning and implementation of health programmes.

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S A F E M O T H E R H O O D

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PREFACE

What is this document about?

This document describes a simple method for resuscitating newborn infants, even where resources are limited. It is believed that this basic method of resuscitation - if carried out correctly - can revive more than three-quarters of newborns who do not breathe at birth. The method is especially suitable where only one birth attendant is present at the birth and has to divide her/his attention between the mother and the newborn. This document describes the procedures, that should be carried out, gives the reasons for selecting particular actions and also gives suggestions on how to operationalize the programme.

Who is this document for?

This document is written for health professionals who are responsible for implementing effective newborn resuscitation in health facilities and for national managers responsible for maternal and newborn health.

How should this document be used?

This document is intended as a basis for developing national and local policies, standards and guidelines to be followed by all health professionals who may be involved in resuscitating newborns. It should be regarded not as a rigid protocol but as an effective and safe method that is based on experience, current evidence and research. The document can be used for developing training materials for basic newborn resuscitation.

EXECUTIVE SUMMARY

A survey of health care institutions in 16 developed and developing countries showed that there was often no basic equipment for resuscitating newborns, or that it was in poor condition and health personnel were not properly trained in newborn resuscitation.

According to WHO estimates, around 3% of the 120 million babies born each year in developing countries develop birth asphyxia and require resuscitation. It is estimated that some 900,000 of these newborns die as the result of asphyxia.

A single intervention - resuscitation - deals with the problem of birth asphyxia as it occurs.

The need for resuscitation should always be anticipated. Thus, every birth attendant should be skilled in newborn resuscitation, (including anticipation, preparation, timely recognition and quick and correct action) and should have the necessary equipment and supplies - clean and functioning - to be able to respond quickly and correctly when needed.

Every newborn should be first dried, wrapped in a dry cloth, and assessed for crying/breathing. If the newborn is not breathing, the airway should be opened by positioning the head correctly, the mouth and nose should be quickly suctioned and the lungs ventilated with the self-inflating bag via a soft fitted face mask. The effect of ventilation is assessed by observing the chest rise.

Minimum equipment and supplies for newborn resuscitation include a heat source (preferably a radiant heater) to prevent heat loss (if this is not available, prewarmed towels and an extra blanket can be used to cover the newborn), a mucus extractor for suctioning, a self-inflating bag of newborn size, two masks (for normal and small newborns) for ventilation, and a clock to assess time correctly.

Adequate ventilation is more important than additional oxygen; quick action with the bag and mask is more important than intubation. Therefore resuscitation can and should be initiated virtually anywhere, including those places where oxygen is not readily available. The choice of device for ventilation is not as important as how effectively it is used. The most common causes of failed resuscitation are failure to recognize the problem promptly, not reacting quickly enough and not ventilating effectively. Correct technique and assessment of the effectiveness of ventilation are critical.

Advanced procedures (chest compression, intubation, administration of oxygen, use of drugs) are needed only in a small proportion of cases. These procedures have strict indications and are beneficial only in specific circumstances and if carried out by an experienced person.

In reality, even the simplest equipment is frequently not available and skilled health workers are lacking. In many places only one birth attendant is normally present at the birth, dividing her attention between the mother and the newborn. In such circumstances, the birth attendant can properly carry out only a certain number of procedures in the limited amount of time available for resuscitation.

Basic resuscitation will not help all newborns but, done correctly, it will help *most*, even where only few resources and simple training are available.

The probability of sequelae is low if a newborn infant is resuscitated promptly and correctly and starts breathing spontaneously within 20 minutes. Whether resuscitation succeeds or fails will depend on anticipation, preparation, skills and functioning equipment, timely initiation and correct procedures. Delayed or ineffective action makes resuscitation more difficult and increases the risk of brain damage.

To provide basic newborn resuscitation for all newborns who need it, each health institution needs to introduce it as a practice, to maintain the skills of the staff and to ensure that functioning equipment and supplies are always available. At national level, legislation, standards, training courses and training material will help health workers to carry out the task.

INTRODUCTION

A survey of 127 institutions in 16 developed and developing countries has shown that there was often no basic resuscitation equipment, or that it was in poor condition, and that health personnel were not properly trained in newborn resuscitation.¹ A study in eight African countries showed that, even in central hospitals, resuscitation measures were inappropriate for a significant proportion of newborns with asphyxia.²

In this document birth asphyxia is defined simply as the failure to initiate and sustain breathing at birth.

According to WHO estimates, around 3% of approximately 120 million infants born every year in developing countries develop birth asphyxia requiring resuscitation. It is estimated that some 900,000 of these newborns die each year.^{3,4}

The incidence of birth asphyxia is higher in developing countries than in developed^{5,6} because of a higher prevalence of risk factors, namely: women are in poor health when they become pregnant; the incidence of pregnancy and delivery complications in these women is high; care during labour and delivery is often inadequate or nonexistent; and about 10% of infants are estimated to be born preterm. Thus, resuscitation of newborns is more often needed in developing countries than in developed. However, most newborns do not at present receive adequate care because most birth attendants do not have the necessary knowledge, skills and equipment to help them. Some traditional practices are not only ineffective in reviving depressed newborns but are also harmful to them.

The common worry of health professionals and parents is the permanent brain damage that birth asphyxia can cause and the common aim is to reduce the number of newborns affected. Improving women's health and health care will reduce the risk factors and decrease the number of newborns needing resuscitation. However, as there is no single cause of poor maternal health there is no single intervention that will improve it. Reducing the incidence of birth asphyxia will therefore take time.

Nevertheless, there is one single intervention for dealing with asphyxia when it occurs - resuscitation. The need for resuscitation can sometimes be predicted though very often it cannot. Therefore every birth attendant must be both skilled and equipped to resuscitate newborns who do not start breathing spontaneously. The approach should be feasible even where resources are limited.

Because of the lack of reliable evidence there are still many unanswered questions concerning newborn resuscitation. More research is needed to find the best possible method of resuscitation. However, we already know enough to help most infants who have trouble starting to breathe.

This document does not deal in detail with the physiology and pathophysiology of breathing at birth. It focuses mainly on one method of resuscitation, gives evidence for the effectiveness of this method, raises ethical concerns about it, and describes special situations when the method might need to be modified. The recommendations in this document are based on scientific evidence, where available, and on experience from both developing and developed countries.^{7,8,9} The information provided is intended to facilitate the preparation of national and local standards and guidelines.

1 GUIDELINES FOR BASIC NEWBORN RESUSCITATION

Effective basic resuscitation will revive more than three-quarters of newborns with birth asphyxia. It will not delay deaths or increase the number of disabled children if the steps below are followed.

Anticipate

Be prepared for every birth by having the skill to resuscitate and by knowing the institution's policy on resuscitation. Review the risk factors for birth asphyxia (see Table 1, page 11). Get help if necessary and if possible. Clearly decide on the responsibilities of each health care provider during resuscitation.

Remember that the mother is also at greater risk of complications. Her greatest immediate danger is bleeding.

Prepare for birth

Make sure that the following are available for the newborn: two clean (warm) towels for thermal protection (drying and wrapping/covering the newborn to prevent heat loss) and a draught-free delivery room with a temperature of at least 25°C.

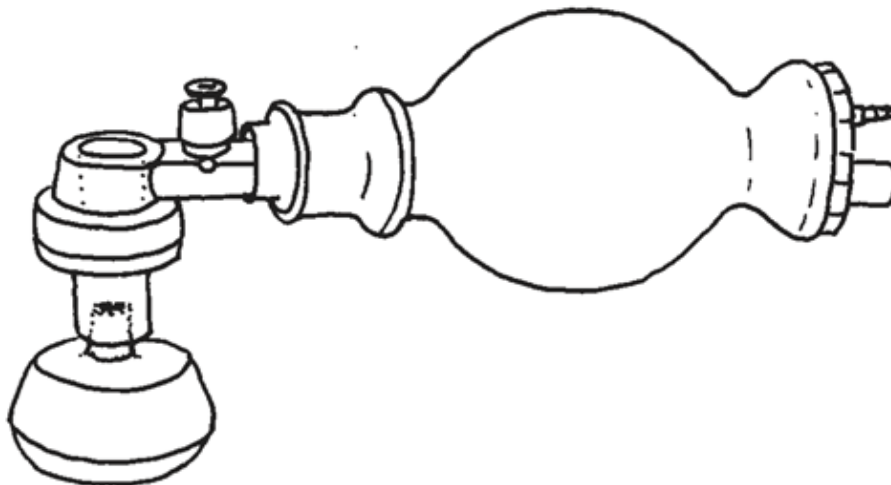


Figure 1: *Self-inflating bag and face mask*

For cleanliness, use water, soap, gloves, a clean surface for the newborn and a clean delivery kit for cord care. For resuscitation, a self-inflating bag (newborn size) (Figure 1), two infant masks (for normal and small newborn), a suction device (mucus extractor), a radiant heater (if available), warm towels, a blanket and a clock are needed.

Always have an additional set of equipment in reserve for multiple births or in case of failure of the first set.

Immediate care at birth

Wash hands with water and soap when preparing for the birth. Use gloves. Deliver the newborn. Remember the time, hour and minute of the birth.

Note that the newborn should be wrapped during the assessment, suction and ventilation to be protected from heat loss. Figures in this document show the newborn naked to make the important details clear. Other details such as the cord are omitted for the sake of simplicity.

Lie the newborn on the mother's abdomen or other warm surface. Immediately dry the newborn with a clean (warm) towel. Remove the wet towel and wrap/cover the newborn, except for the face and upper chest, with a second dry towel. While drying make sure that the head is in a neutral position, neither too flexed nor too extended.

Assess breathing

If the newborn is crying, breathing is normal and no resuscitation is needed. Provide normal care. If there is no cry, assess breathing: if the chest is rising symmetrically with frequency >30 /minute, no immediate action is needed. If the newborn is not breathing or gasping, immediately start resuscitation. Occasional gasps are not considered breathing. If necessary, tie and cut the cord.

Resuscitate - act quickly and correctly

Inform the mother - explain to her quickly what the problem is and what you are going to do. Tell her to watch for vaginal bleeding - if she starts bleeding she should tell you.

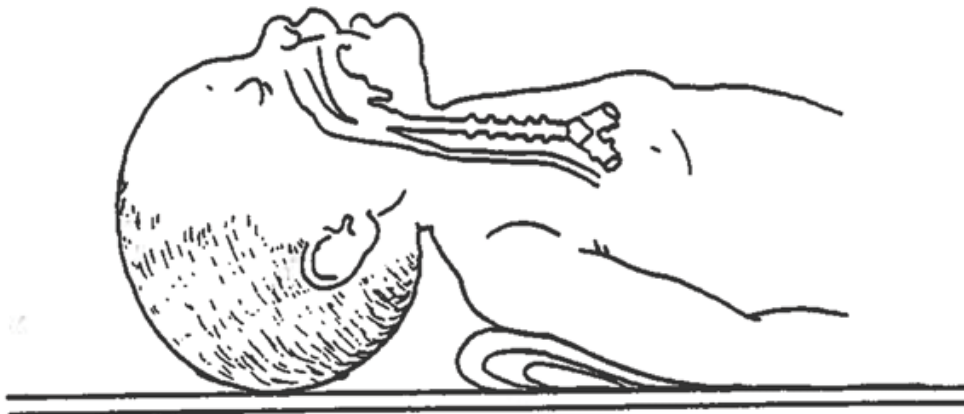


Figure 2: *Correct position of the head for ventilation*

Open the airway

Position the newborn by moving it from the mother's abdomen to a dry, clean and, if possible, warm surface next to her. Put the baby on its back. Position the head so that it is slightly extended (Figure 2). A folded piece of cloth under the shoulders may help accomplish this. Clear the airway by suctioning first the mouth and then the nose (Figure 3). Be especially thorough if there is blood or meconium in the baby's mouth and/or nose. The newborn may start breathing because suctioning provides additional stimulation. If so, no immediate further action is needed. If there is still no breathing, start ventilating.

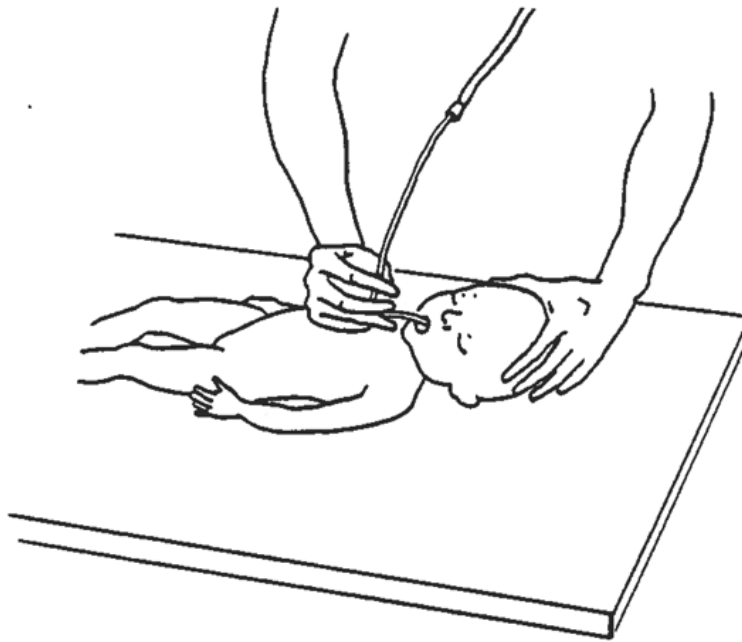


Figure 3: *Suctioning the mouth and nose*

Ventilate

Select the appropriate mask (size 1 for a normal weight newborn, size 0 for a small newborn). Reposition the newborn - make sure that the neck is slightly extended. Place the mask on the newborn's face, so that it covers the chin, mouth and nose (Figure 4). Form a seal between the mask and the infant's face. Squeeze the bag with two fingers only or with the whole hand, depending on the size of the bag and manufacturer's instructions. Check the seal by ventilating two or three times and observing for the rise of the chest (Figure 5).

If the chest is not rising, the most probable obstacles are inappropriate head position, poor seal between the mask and the face, insufficient ventilation pressure or mucus, blood or meconium in the airway. The corrective steps are repositioning of the newborn's head, repositioning of the face mask, increased ventilation pressure by pressing the bag with the whole hand; exactly how much to press will depend on the size of the bag and further suctioning of the upper airway. The first ventilations require higher inflation pressure than later ventilation.



Figure 4: *Fitting the face mask*



Figure 5: *Ventilation with bag and mask*

Once a seal is ensured and chest movement is present, ventilate the newborn with a frequency of around 40 breaths per minute, the range being 30-60 (better more than less). After effectively ventilating for about 1 minute, stop briefly but do not remove the mask and bag and look for spontaneous breathing. If there is none or it is weak, continue ventilating until spontaneous cry/breathing begins. Observe the chest for an easy rise and fall. Hold the head in the correct position to keep the airway open during ventilation and keep a tight seal between the mask and the face. Continue ventilating. If the chest is rising, ventilation pressure is most probably adequate.

If the newborn starts crying, stop ventilating but do not leave the newborn. Observe breathing when it stops crying; if breathing is normal - 30-60/min - and there is no chest or costal indrawing and no grunting for one minute, no further resuscitation is needed. Tie the cord and cut it (if not done earlier). Put the newborn skin-to-skin on the mother's chest to prevent heat loss.

If breathing is slow (frequency of breathing is <30), or if there is severe indrawing, continue ventilating and ask for arrangement for referral if possible. A newborn will benefit from transfer only if it is properly ventilated and kept warm during transport. Two people are needed for the transport of the newborn that requires ventilation: one will ventilate while the other will assist with other tasks. If possible, transfer for the mother should be arranged.

If there is no gasping or breathing at all after 20 minutes of ventilation, stop ventilating. If there was gasping but no spontaneous breathing after 30 minutes of ventilation, stop ventilating.

After resuscitation check the mother, ensure that she is not bleeding or having convulsions. Explain to her what you did and what happened because of your action.

Resuscitation practices that are not effective or are harmful

These include:

- routine aspiration (suction) of the baby's mouth and nose as soon as the head is born, or later when the amniotic fluid has been clear;
- routine aspiration (suction) of the baby's stomach at birth;
- stimulation of the newborn by slapping or by flicking the soles of its feet;
- postural drainage, and slapping the back;
- squeezing the chest to remove secretions from the airway;
- routine giving of sodium bicarbonate to newborns who are not breathing;
- intubation by an unskilled person.

Care after successful resuscitation

Do not separate the mother and the newborn. Leave the newborn skin-to-skin with the mother.

After taking care of the mother's needs, examine the newborn. Measure the newborn's body temperature, count breaths, observe for indrawing and grunting, and observe for malformations, birth injury or other danger signs. (See reference 12.)

Encourage breast-feeding within one hour of birth. The newborn that needs resuscitation is at higher risk of developing hypoglycaemia. Observe suckling - good suckling is a sign of good recovery.

If the temperature is $<36^{\circ}\text{C}$ or the skin feels cold, the baby has hypothermia. Skin-to-skin contact will rewarm the newborn. For rewarming cover the newborn with an additional cloth or blanket. The mother will observe breathing and movement. Check the body temperature every hour until it is normal. Small babies must be observed more carefully since danger signs indicating serious problems are more common and more subtle.

If the newborn has difficulty breathing or there are other danger signs, organize referral for special care.¹⁰ Explain the findings of the examination to the mother. Refer with the mother if possible.

Record the resuscitation and the problems, if any. Examine the newborn before discharge. Signs of the newborn's well-being are normal body temperature, normal breathing, occasional cry, good suckling and movements. Discuss the procedure again with the parents: explain that, although the possibility of complications is low, there is a small probability that the newborn will have problems such as difficulty feeding or convulsions in the first few days. Instruct them to take the newborn to the hospital if these problems occur.

Clean the equipment and prepare it for the next birth (see page 18).

2 TECHNICAL BASIS

Birth asphyxia

Several important things happen to a baby at birth to enable it to make the transition to extrauterine life. Changes take place in the lungs to allow breathing, and changes in the heart and circulatory system switch off circulation through the placenta and redirect it through the lungs.

In most babies these changes occur smoothly; the babies start breathing as soon as they are delivered, within a minute of birth at the latest, and they adapt within just a few minutes. All they need is a **clean and warm welcome**, and **vigilant observation**^{11,12} - to be born in a warm room, to be dried immediately, to be observed for breathing, and to be given to the mother for warmth and breast-feeding. The newborn's cry at birth - one of the most eagerly anticipated events - is commonly considered a cry of health. Studies have shown that a vigorous cry is an important indicator of the health of the newborn.¹³ Other signs of good health at birth are pink skin, good muscular tonus and good reactions. The heart rate in a healthy baby is always normal, i.e. above 100/minute. For most infants nothing more is needed and nothing further is recommended. The mother is the best source of warmth, affection, food and protection from infection, and she is the best observer of the newborn in the days to come.

In a small proportion of newborns (3-5%) the changes do not occur smoothly and the newborns do not start breathing immediately and spontaneously.^{3,14} They have what is called birth asphyxia and they need assistance to initiate breathing. In other words they need resuscitation.

In this document birth asphyxia is defined simply as the failure to initiate and sustain breathing at birth, since there is no agreement among obstetricians and neonatologists on a more precise definition.^{15,16}

In most circumstances, it is not possible to tell with certainty how severe birth asphyxia is by clinical methods.¹⁴ The concept of primary and secondary apnoea is often used in describing what goes wrong but it is not particularly useful in determining the severity of asphyxia and guiding resuscitation. If the newborn that is not breathing is also limp, asphyxia is probably severe. However, resuscitation can always be started in the same way.

Management of the newborn with birth asphyxia

Basic resuscitation

Regardless of the cause of birth asphyxia and how severe it is, the action - at least the initial steps - will be the same: ventilation. The main aim is to ensure oxygenation and to initiate spontaneous breathing. Effective ventilation must be established before any other steps are taken. Too often other more complicated procedures are initiated first. This can be harmful to the newborn. Anticipation, adequate preparation, timely recognition and quick and correct action are critical for the success of resuscitation.¹⁴

Anticipation of resuscitation

Resuscitation must be anticipated at every birth. Every birth attendant should be prepared and able to resuscitate since, if it is necessary, resuscitation should be initiated without delay.

Some maternal and fetal conditions that are risk factors for birth asphyxia are listed in Table 1. Good management of pregnancy and labour/delivery complications is the best means of preventing birth asphyxia. Frequent auscultation of fetal heartbeat, especially during the second stage of labour, may help to diagnose fetal distress and to predict the birth of a baby that will need resuscitation.

Adequate preparation

Risk factors are poor predictors of birth asphyxia. Up to half of newborns who require resuscitation have no identifiable risk factors before birth.¹⁴ Therefore it is not enough to be prepared only in cases where one or more risk factors are present.

Every birth attendant must be trained in resuscitation and must have resuscitation equipment and supplies in perfect condition (see page 16 for equipment and supplies). When no equipment is available, mouth to mouth-and-nose breathing should be done. When a newborn is expected to have severe asphyxia, a second person should be available to assist at the birth.

Assessment and timely recognition of the problem

If the newborn does not cry or breathe at all, or is gasping within 30 seconds of birth, and after being dried, the essential steps of resuscitation should be taken immediately.

The baby's cry is the most obvious sign that there is adequate ventilation after the birth. In a crying newborn the heart rate is normal. Breathing immediately after birth may be irregular but is usually still sufficient for adequate ventilation. However, gasping (occasional breaths with long pauses in between) is not sufficient.

Taking an Apgar score is not a prerequisite for resuscitation. The need for resuscitation must be recognized before the end of the first minute of life which is when the first Apgar score is taken. The most important indicator that resuscitation is needed is failure to breathe after birth so, if the baby does not breathe, resuscitation must be started immediately.

Apgar scoring has been used as a systematic tool to assess and document the clinical status of the newborn at birth, or more precisely at 1 and 5 minutes of life. The newborn is examined for five signs: breathing, heart rate, muscle tone, reflex irritability and colour (see Table 2).

Some maternal and fetal risk factors for birth asphyxia are:

- maternal illnesses such as sexually transmitted diseases
- malaria
- eclampsia (including the treatment)
- bleeding before or during labour
- fever during labour
- maternal sedation, analgesia or anaesthesia
- prolonged rupture of membranes
- breech or other abnormal presentation
- prolonged labour
- difficult or traumatic delivery
- prolapsed cord
- meconium-stained amniotic fluid
- preterm birth
- post-term birth
- multiple birth
- congenital anomaly.

Determining the Apgar score correctly requires good training. The score depends not only on the severity of birth asphyxia but also on other factors such as drugs given to the mother, anaesthetics, fetal infection, fetal anomalies and prematurity.

Table 2: Apgar scoring

Sign	Score		
	0	1	2
Heart rate	Absent	Slow (<100 beats/min)	=>100 beats/min
Breathing	Absent	Slow, irregular	Good, crying
Muscle tone	Limp	Some flexion	Active motion
Reflex irritability	No response	Grimace	Cough, sneeze
Colour	Blue or pale	Pink body with blue extremities	Completely pink

Quick and correct action

The important steps in resuscitation are prevention of heat loss, opening the airway and positive pressure ventilation that starts within the first minute of life.

Prevention of heat loss is critical. Methods should include those that prevent the loss of heat by evaporation, radiation, conduction and convection. Each newborn should be dried first and then covered with a dry towel. The surface on which it is placed should always be warm as well as flat, firm and clean.¹⁷ **Drying provides sufficient stimulation of breathing in mildly depressed newborns and no further stimulation is appropriate.**

Resuscitation should be started immediately. There is no evidence that hypothermia helps to initiate breathing or reduces damage due to birth asphyxia.^{11,12}

To open the airway in a baby that is not breathing, the newborn must be positioned on its back, with the neck slightly extended (Figure 2, page 6). The upper airway (the mouth and nose) should be suctioned to remove fluid if stained with blood or meconium (Figure 3, page 7). Suctioning must be thorough but gentle and quick. It may create additional stimulation for breathing.

When the amniotic fluid is stained with meconium, there is no evidence that suctioning the nostrils and oropharynx before the chest is delivered and before umbilical circulation is interrupted has any important effect on the incidence of severe meconium aspiration syndrome.¹¹ Nevertheless it is practised widely. However, women take different positions for delivery and suctioning before the whole baby is delivered may not be without risk in some positions.

Positive pressure ventilation is the most important aspect of newborn resuscitation for ensuring adequate ventilation of the lungs, oxygenation of vital organs such as heart and brain, and initiation of spontaneous breathing. Ventilation can almost always be initiated using a bag and mask (it is rarely necessary to intubate) and room air.^{18,13} To open the lungs the ventilation pressure required is 30-40 cm of water; later around 20 cm is sufficient for ventilating healthy lungs. Sometimes the initial (opening) pressure could be as high as 50-70 cm of water. Approximately 40 breaths per minute are required.¹⁴ Only a soft mask provides a good seal with

the newborn's face to achieve this pressure.¹⁹ Adequacy of ventilation is assessed by observing the chest movements (Figure 5, page 8). The best indication of adequate pressure is the chest rising and falling easily with ventilation. If two skilled birth attendants are present, the one who is not ventilating can auscultate the lungs for breathing sounds and heart rate.

The above are the essential first steps of any resuscitation. They will, according to experience, establish spontaneous breathing in more than three-quarters of newborns with birth asphyxia.²⁰

Advanced resuscitation

A small proportion of infants fail to respond to ventilation with the bag and mask. This happens infrequently but, when it does, additional decisions must be made and actions taken. Advanced procedures can be introduced in a health care institution if the following criteria are met: (a) trained staff with the necessary equipment and supplies are available; (b) at least two skilled persons are available to carry out the resuscitation; (c) there are sufficient deliveries for the skill to be maintained; and (d) the institution has the capacity to care for or to transfer newborns who suffer severe birth asphyxia since they are expected to have problems after being resuscitated. Guidelines and training materials on advanced newborn resuscitation are available from universities and professional organizations. Below is a brief outline of the procedures.

Endotracheal intubation

This has been shown to provide more effective ventilation in severely depressed/ill newborns. It is more convenient for prolonged resuscitation but is also a more complicated procedure that requires good training. Endotracheal intubation is needed only rarely and can be dangerous if performed by untrained staff. Potential hazards include cardiac arrhythmias, laryngospasms and pulmonary artery vasospasm^{11,12} Usually only newborns that are severely ill will require endotracheal intubation.

Tracheal suction by a skilled resuscitator has been shown to reduce morbidity among depressed infants born with meconium in the pharynx.^{11,12} However, it requires a highly experienced person to do it without causing damage. Despite its potential benefit, tracheal suction is not recommended unless the resuscitator is very skilled, because of the severe hazards associated with it (hypoxia, bradycardia).¹²

Oxygen

Additional oxygen is not necessary for basic resuscitation^{21,22,23} although it has been considered so by some practitioners. Oxygen is not available at all places and at all times. It is also expensive.²⁴ Moreover, new evidence from a controlled trial shows that most newborns can be successfully resuscitated without additional oxygen.²² Research also suggests that high oxygen concentration may not be beneficial in most circumstances.²⁵ However, when the newborn's colour does not improve despite effective ventilation, oxygen should be given if available. An increased concentration of oxygen is needed for severe lung problems such as meconium aspiration and immature lung, or when the baby does not become pink despite adequate ventilation.

Chest compressions

Chest compressions are not recommended for basic newborn resuscitation. There is no need to assess the heartbeat before starting ventilation. Slow heartbeat is usually caused by lack of oxygen, and in most newborns the heart rate will improve as soon as effective ventilation is established. Effective ventilation should be established before chest compressions are started.

It has been shown that it is more difficult to assess the heart rate reliably in newborns than in older children, especially by feeling the beat (pulse) through the chest wall or over big arteries. Therefore a person without experience is highly likely to make a mistake in assessing the heart rate in a newborn.²⁶ Assessing the heart rate without the necessary skill and equipment is a waste of time, and a wrongly assessed pulse may lead to wrong decisions.

However, in newborns with persistent bradycardia (heart rate <80/min and falling) despite adequate ventilation, chest compressions may be life-saving by ensuring adequate circulation.²⁷ A higher mean arterial pressure was observed using the method in which the hands encircle the chest compared to the two-finger method of compressing the sternum.¹⁴ Two people are needed for effective chest compression and ventilation. Before the decision is taken that chest compressions are necessary, the heart rate must be assessed correctly.

Drugs

Drugs are seldom needed to stimulate the heart, to increase tissue perfusion and to restore acid-base balance. They may be required in newborns who do not respond to adequate ventilation with 100% oxygen and chest compressions. Narcotic antagonists and plasma expanders have limited indications in newborn resuscitation.¹²

Practices that are not beneficial

There are many practices, both traditional and modern, that are either harmful or of unproven benefit. They should be replaced by the simple method of newborn resuscitation described in this document.

Traditional practices

Almost none of the traditional resuscitation practices are beneficial, and some are harmful. Slapping the newborn, soaking it in cold water, sprinkling it with water, stimulating the anus, using onion juice, cooking the placenta and milking the cord are a few examples of ineffective and harmful practices still used.⁷

Modern practices

Not all modern practices are beneficial either. Some derive from traditional practices, while others were introduced in good faith by health professionals but without good evidence that they would be beneficial.

Tactile stimulation

Various methods have been used to stimulate newborns that do not breathe immediately after birth. Holding the newborn's head down by holding the baby by the legs has been proved dangerous. Slapping and flicking of the soles, although effective in the experience of many, may

initiate breathing only in mildly depressed newborns. Thorough drying provides enough stimulus for breathing, and also protects against hypothermia. Since it is difficult to predict the severity of birth asphyxia by clinical methods alone, additional stimulation is a waste of time and is not recommended. Instead, assisted ventilation should be started immediately.

Routine aspiration of upper airway

There is no evidence that routine aspiration of the newborn's mouth and nose as soon as the head is born or later is of any benefit if the amniotic fluid has been clear.^{12,28} The procedure is therefore unnecessary in newborns who start crying or breathing immediately after birth. Routine suctioning is associated with hazards such as cardiac arrhythmia.^{11,12}

Routine gastric suctioning

There is also no justification for routine gastric suctioning at birth.¹²

Postural drainage

Postural drainage and slapping the back are not effective and should not be practised. Squeezing the chest to remove secretions from the airway is also dangerous as it may cause fracture, lung injury, respiratory distress and death.

Sodium bicarbonate

Sodium bicarbonate is not recommended in the immediate postnatal period if there is no documented metabolic acidosis. It should therefore *not be given routinely* to newborns who are not breathing.¹²

Prevention of infection

Although universal precautions to prevent infection should be part of routine labour/delivery/newborn care, health providers should be especially cautious during resuscitation to protect the newborn and themselves from agents such as the human immunodeficiency virus (HIV). Precautions to prevent the transmission of HIV and other infections include washing of hands, use of gloves, careful suctioning if using a mucus extractor operated by mouth, careful cleaning and disinfection of equipment and supplies, and correct disposal of secretions. In an emergency situation such as resuscitation it is easy to forget such precautions, so they need to be emphasized during training.

Clamping and cutting the cord

It is not necessary to clamp and cut the cord before starting resuscitation. Resuscitation can start while the newborn is still on the cord, unless clamping and cutting can be done quickly, or the cord is too short to put the newborn safely on a dry, firm and flat surface that is easily accessible for resuscitation, or in case of birth by caesarean section. No time should be wasted to move the newborn to a special place for resuscitation. The mother's bed is usually a warm and suitable place for resuscitation unless it is too narrow.

3 EQUIPMENT AND SUPPLIES

Basic newborn resuscitation requires a bag and a mask for ventilation, a mucus extractor for suctioning, a source of warmth for thermal protection, and a clock. It is important to choose quality equipment that will not fail when it is most needed. A resuscitation trolley is useful but is not absolutely necessary. In the operating theatre where caesarean sections are performed, a corner that is protected from draught and can be kept warm should be prepared for the immediate care of the newborn, including resuscitation when needed.

An institution should have at least two sets of equipment in case of multiple births, or for other births occurring at the same time, or in case one set does not function.

For ventilation

Bag

A self-inflating bag of newborn/infant size is recommended for basic newborn resuscitation (Figure 1, page 5). The bag refills because of its elasticity and does not need compressed gas to work correctly. It can be used simply to deliver air (which contains 21% oxygen).

The volume of the bag should be 250-400 ml. Regardless of the mechanism used for the patient valve, the bag should generate a pressure of at least 35 cm of water. A self-limiting pressure valve is not required when a small bag is used without gas under pressure. Bags should be easy to assemble and disassemble and easy to clean.

Mask

A good mask is critical for a good seal with the face and for effective positive pressure ventilation. Research and experience show that a soft circular mask that adapts its shape to the contours of the newborn's face provides a tight seal with the face and leaks less than other types of masks.²¹ At least two sizes of mask for normal and small newborns are needed per bag.

Bags and masks can be made of different materials: rubber, plastic or silicone. The material should be able to undergo commonly available methods of disinfection and sterilization (boiling, autoclaving, disinfection) to prevent cross-infection. The mask should preferably be made of one piece for easy cleaning. Material that can stand extremes of climate, according to the country concerned, should be chosen.

Various mechanisms are used for one-way patient valves. The most important criteria for selection of the bag are delivery of the required ventilation pressure and frequency and the ability to regulate the pressure.

For suction

It is preferable to use mechanical equipment to generate negative pressure for suction. Negative pressure should not exceed 100 mmHg (130 cm water). The catheter must be wide enough to remove meconium effectively. The recommended size for the catheter is 12F and it should have side holes at the tip.²⁷ A single size can be used for all newborns.

If mechanical equipment is not available, negative pressure can be generated by the resuscitator. The mucus extractor, also called the DeLee suction device, is an independent suction apparatus. It has a catheter leading to a small collection reservoir and a second tube from the reservoir to a mouthpiece placed in the operator's mouth to generate suction (Figure 6). The trap must be big enough (20 ml) to prevent suction of fluids into the resuscitator's mouth.

With the widespread adoption of universal precautions, this type of mucus extractor is not recommended where alternatives exist. A modified version has a filter that prevents aspiration of the contents of the container. Disposable mucus extractors and catheters are recommended. However, if they are reusable, the recommendations for cleaning and decontamination should be followed (see page 18).

A bulb is not recommended for suctioning the mouth and nose unless special cleaning facilities are available because it is difficult to clean. A dirty bulb can become a source of cross-infection.

The least preferred method of clearing the airway is wiping the mouth with a finger and piece of cloth or other absorbent material. There is no evidence that this method is effective in clearing the airway and it may damage the mouth mucosa.

To prevent heat loss

Besides drying and wrapping the newborn the best way to provide extra warmth for resuscitation is to use a radiant heater. However, this will provide sufficient warmth only if it is preheated so that the surface is warm, if it is the correct distance from the infant and if the room is warm. The heater should be selected and used with caution. Focusing warming bulbs are a less expensive alternative. The source of warmth should preferably be mobile so that it can be moved near the place of birth. Instructions about the distance between the source of warmth and the newborn should be carefully followed to avoid overheating, burns or hypothermia. Burns have been described in newborns being resuscitated under radiant heaters despite precautions.

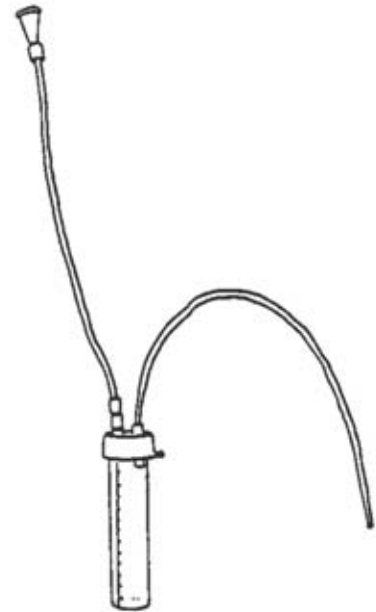


Figure 6: *Mucus extractor*

The use of silver swaddlers and bubble wraps for thermal protection of newborns during resuscitation has not been systematically evaluated and there is no evidence for recommending them. If a swaddler is used, the baby should be dried before being wrapped in it.

Clock

In emergency situations, such as at the birth of a newborn with asphyxia, people often do not have good sense of time. Good practice requires recording the time of birth and, as resuscitation takes place, checking the time often in order to make decisions about modifying or discontinuing it. A large wall-clock with hands indicating both minutes and seconds is therefore needed and should be easily visible in the delivery room.

Cleaning and decontamination of equipment

Equipment and supplies must be cleaned and disinfected after each use. Manufacturers provide specific instructions for cleaning, disinfection and/or sterilization of equipment and these should be followed carefully.

Where instructions are not available, general recommendations are as follows.

Bag and mask

The mask and the patient valve should both be disinfected after each use since they are exposed to the newborn and to expiratory gases. The bag and the inlet valve should be disinfected after use with an infected newborn, and otherwise occasionally.

The valve and the mask must first be disassembled, inspected for cracks and tears, washed with water and detergent and rinsed. Selection of the decontamination method will depend on the material. Silicone and rubber bags and patient valves can be boiled for 10 minutes, autoclaved at 136°C or disinfected by soaking in a disinfectant. Dilution of disinfectant and exposure time should be in accordance with the instructions of the manufacturer. All parts must be rinsed with clean water after chemical disinfection and air-dried before assembling.

After re-assembling, the bag must be tested to check that it works correctly. Most manufacturers give step-by-step instructions for this procedure. If instructions are not available, use the following test: block the valve outlet by making an airtight seal with the palm of the hand. Squeeze the bag and feel the pressure against the hand. Observe if the bag reinflates when the seal is released. If the bag is not functioning correctly, it should be repaired before use. Repeat the test with the mask attached to the bag.

Suction catheter, mucus extractor

Disposable suction catheters and mucus extractors should be disposed of correctly. Reusable ones should be disassembled, washed with water and detergent, boiled and disinfected or sterilized after each use, according to the material they are made of. Washing the catheter requires a syringe to rinse the tube.

4 DOCUMENTING RESUSCITATION

Records

All health care institutions should keep records/logbooks with basic information on every birth. This basic information should include some important details about the condition of the newborn at birth and about resuscitation if this is done. The information should also be recorded in home-based records.

Documenting conditions and procedures at birth is important for several reasons. There are, for instance, medico-legal implications. If any problems arise later thorough documentation can help in understanding the circumstances at the birth. Case reviews also provide a basis for further education and the improvement of practice.

Details of resuscitation to be recorded are:

- identification of the newborn;
- condition at birth;
- procedures necessary to initiate breathing;
- time from birth to initiation of spontaneous breathing;
- clinical observations during and after resuscitation;
- outcome of resuscitation;
- in case of failed resuscitation, possible reasons for failure;
- names of health care providers involved.

An example of a record of newborn resuscitation is shown in Table 3. This is the record of the resuscitation only and does not replace the record of delivery/birth.

Table 3: Neonatal resuscitation record

<p>Newborn name:.....</p> <p>Date of birth: Time of birth:</p> <p>Condition at birth:</p> <p>Immediate cry/breathing</p> <p>Delayed cry/breathing</p> <p>Resuscitation not attempted.</p> <p>Explain why not:.....</p> <p>Resuscitation initiated.</p> <p>* Describe rocedures:.....</p> <p>* When did spontaneous breathing begin?</p> <p>* For how long (minutes) was ventilation needed?</p> <p>* How was the condition (breathing, body temperature, suckling) of the newborn 30-60 min after resuscitation?</p> <p>* If no spontaneous breathing, when did ventilation stop?</p> <p>How would you describe the outcome?</p> <p>a Liveborn infant, resuscitation successful.</p> <p>b Liveborn infant, resuscitation not successful, the newborn died.</p> <p>c Stillborn, resuscitation not successful.</p> <p>d. Stillborn, resuscitation not attempted.</p> <p>Consider ICD-10 codes P21 for options a, b, and c if no other condition.</p>
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ICD codes

Every hospital has a system for coding conditions. WHO recommends use of the International Classification of Diseases, 10th edition (ICD-10). ICD-10 provides codes for conditions, not procedures.

There is no ICD-10 code that matches exactly the definition of birth asphyxia used in this document: a preterm newborn does not necessarily suffer from birth asphyxia as defined in ICD-10 but has difficulty in starting to breathe because of immaturity while a newborn with intrauterine infection will have the same problem because of the disease. However, for all these circumstances, *P21 - Birth asphyxia* is the most appropriate code. The subcodes can be used for different severities of birth asphyxia.

5 SPECIAL CONDITIONS

When to start resuscitating

There is a lot of concern that simple resuscitation only delays death or results in a severely disabled infant, thus draining scarce resources, especially when the newborn has a severe malformation, is extremely preterm or has extremely low birth weight, or is an apparently stillborn fetus.

There are no clear guidelines on when to start and when to stop newborn resuscitation. The most frequently asked questions are whether the baby will be damaged if it is resuscitated and survives, and whether it will be a burden for the family and the society. Too often the decision not to start resuscitating and the decision to terminate are left to the person caring for the newborn.

Instead of leaving these difficult decisions to individuals, each health care institution needs a clear policy for such cases. The policy can be developed through organized groups of lay, medical and legal personnel. These groups should take into consideration several important issues:

- Even if resuscitation is not initiated the newborn may not die. Withholding or delaying resuscitation at birth may result in a poor outcome due to the consequences of hypoxic/ischaemic encephalopathy and multisystem organ injury. No advanced care at a later stage can substitute for effective resuscitation at birth and repair the damage due to delayed or incorrect procedures.
- The concern may not be whether resuscitation will be successful or not but whether, if it is successful, the infant will be severely damaged. The decision to resuscitate involves a long-term commitment to the care of the child.^{11,14,29}
- A determinant of when to start or to stop resuscitation is the capacity of the institution/country for the management and further care of malformed, very preterm or severely damaged newborns.
- The decision to resuscitate newborns of low gestational age should take into consideration the likelihood of survival, the major initial obstacles to survival that the newborn is likely to encounter outside the womb, and the possible long-term sequelae of prematurity that include chronic lung disease, hearing and visual impairment, and neurodevelopmental delay. It is important to base decisions on local data on survival at different gestational ages.

Whenever a doubt exists a liberal policy of newborn resuscitation is recommended.^{11,12}
In individual cases parents must be consulted as soon as possible, and their wishes should be respected. If it is unclear what to do, it is better to resuscitate since a mild disability or malformation (e.g. cleft lip) will be aggravated by brain damage if the newborn is not resuscitated properly but nevertheless survives.

Apparently stillborn fetus

If after delivery the fetus does not breathe and shows no other evidence of life (such as beating of the heart, pulsation of the umbilical cord, definite movement of voluntary muscles) or shows signs of maceration, it is considered stillborn. However, in a fresh stillborn newborn it is difficult to determine how long before birth the death occurred unless the fetal heartbeat has been checked frequently during the second phase of birth. The policy on when to initiate resuscitation will depend on the practice of monitoring fetal well-being. If the fetal heartbeat was heard shortly before birth, resuscitation should begin.

Malformations

If the newborn has a severe malformation that is lethal, resuscitation should not be attempted. A list of identifiable malformations that are incompatible with life is shown in Table 4 (adapted from reference 30). These malformations have either a lethal outcome, or vegetative survival, or the defect requires major corrective surgery. Most can be easily diagnosed at birth. Less severe malformations such as big omphalocele can be added to the list if there are no facilities for their correction and care. However, most malformations are not lethal. If the newborn with a malformation is not resuscitated correctly, it may survive with a double disability - the malformation and brain damage due to prolonged asphyxia.

Table 4: Malformations incompatible with life and identifiable at birth

Severe hydrocephaly
Anencephaly
Holoprosencephaly
13 Trisomy syndrome
18 Trisomy syndrome
Sirenomelia
Short-limb dwarfism syndromes
Multiple defects syndromes
Renal agenesis (potter syndrome)

Abnormalities that also cause serious difficulties for resuscitation, such as diaphragmatic hernia, hypoplastic lung, or cardiac defects, are not visible and therefore cannot be easily diagnosed at birth. They are rare (<1/1000 births).³⁰ Such a malformation could be suspected if the condition of the newborn does not improve despite correct resuscitation procedure. However, the recommended procedure should not be changed.

Extremely low gestational age

Viability of the newborn in terms of gestational age may differ according to local circumstances. Even with the best resources available, the rate of survival of newborns below 26 weeks of gestational age or 1000 g is low. Local data on survival by gestational age are very useful in determining a policy on the gestational age at which resuscitation should be initiated.

However, it is difficult to base the decision to resuscitate on gestational age alone. The assessment is imprecise especially when time to carry out the evaluation is very limited. The uncertainty of estimating gestational age should direct the birth attendant to evaluate other variables, such as the size of the uterus and the size of the fetus compared to the body parts of the resuscitator.

When to stop resuscitating

The decision of when to stop resuscitation of newborns who fail to show signs of life at birth is a major dilemma for health professionals and parents.

There is no clear information as to the maximum duration of resuscitation that should be recommended. A newborn that does not start breathing after 20 minutes of adequate ventilation has probably suffered severe asphyxia. It will probably require intensive care if it survives. If such care is available, the ventilation could continue for 30 minutes while admission to the intensive care unit is being arranged. If such care is not available (i.e. in most circumstances) ventilation can be discontinued if there is no response (no spontaneous breathing) after 20 minutes of ventilation. A period as short as 10 minutes has been proposed by some practitioners, but there is no evidence to support such a recommendation.³¹

Failed resuscitation

Not every resuscitation will be successful in reviving the newborn. It is very important to inform parents fully about failed resuscitation, explaining to them in a way they can understand the circumstances and probable causes of failure. Details of failed resuscitation must be recorded thoroughly. Death must be reported as required by the authorities. Disposal of the body should be arranged according to the regulations and parents' wishes. Parents may need counselling to deal with the newborn's death. The circumstances of the failed resuscitation must be discussed and analyzed with the staff soon after the event. Any problems should trigger further investigation and proper action.

Other special conditions

The recommendations on basic resuscitation are suited to most newborns who need it. Some situations need special consideration.

Caesarean section

Resuscitation may be needed more often in newborns delivered by caesarean section because of the complications that made the procedure necessary and the drugs given to the mother for analgesia and anaesthesia. It is very important to have a warm corner for the care and resuscitation of the newborn. A radiant heater is preferable. The cord is cut before initiating the resuscitation.

Preterm and/or low birth weight infant

Resuscitation is also needed more often if the newborn is preterm and/or growth-retarded. The lower the gestational age, the more difficulties the newborn may have in starting breathing spontaneously. The principles of resuscitation are the same as for term infants, but preterm newborns often take longer than term infants to start breathing spontaneously and their breathing may be difficult, as shown by the chest and costal indrawing. These newborns are more likely to require referral to a special care unit.

Apnoea after birth

Breathing of preterm newborns may be irregular with frequent pauses that may last 20-30 seconds. Usually breathing resumes spontaneously. In rare cases a newborn stops breathing for a longer period, or does not resume breathing at all. In such cases, begin resuscitation immediately. Resuscitation in preterm newborns is the same as in term infants, as follows:

- clear the airway;
- reassess breathing;
- position the head;
- ventilate with positive pressure.

Infection is often a cause of apnoea in a newborn. As soon as possible after resuscitation the newborn must be examined for the cause of apnoea by a health care provider who is skilled in the care of sick newborns.

6 SPECIAL CIRCUMSTANCES

Mouth to mouth-and-nose breathing

Newborn resuscitation is always feasible, even in situations where no bag, mask or mucus extractor are available. Every birth attendant should be trained in mouth to mouth-and-nose ventilation in case there is no equipment or the equipment fails.

The principles are the same: anticipation, preparation, timely recognition, and quick and correct action by opening the airway and ventilation. In summary, the newborn should be dried first, wrapped in a dry cloth, and assessed for crying/breathing. If the newborn is not breathing, the airway is opened by positioning the head and ventilated by blowing air into the baby's airway and the effect assessed by observing the chest rise. If there is blood in the mouth or the amniotic fluid was meconium stained, the airway can be cleared by wiping the mouth with a dry cloth around the finger.

For ventilation, the resuscitator covers the newborn's nose and the mouth with her/his mouth and blows air at a frequency of around 40 breaths per minute. The amount of air blown into a newborn's lungs is much less than that needed for children or adults. During blowing the chest should be observed to see if it rises. The position of the newborn's head must be checked and corrected frequently since it is more difficult to hold it in the correct position during mouth to mouth-and-nose ventilation than when ventilating with the bag. Evaluation and duration of the ventilation are the same as when equipment is used.

This method requires as much training as the use of the bag and mask. Training should include practising achieving the correct ventilation pressure, the frequency and assessment of ventilation, and keeping the head in the correct position.

Mouth to mouth-and-nose resuscitation in the newborn has some risk for the person resuscitating though this has not been quantified. There is a risk of infection for both the newborn and the resuscitator, and the risk for the newborn of lung injury if the resuscitator blows too hard into its mouth. A piece of cloth can be put between the newborn's mouth and the resuscitator's mouth in an emergency and probably reduces the risk of some infections, though it is not sufficient to prevent HIV transmission. There are many commercial products - face shields - that serve as a barrier between the resuscitator's mouth and that of the newborn. They are in the form of a face mask with a filter, or a piece of plastic with a filter that does not allow viruses to pass through. Most are disposable and relatively expensive. They can be a useful alternative on rare occasions.

Mouth-to-mask ventilation

Although many health workers are trained in newborn resuscitation, it is not carried out because the bag and mask are expensive and there is some risk of infection for both the newborn and the resuscitator.

A simple and inexpensive device/tool has therefore been developed and tested for its effectiveness in a laboratory³² and in hospital.²³ In small maternity clinics, testing with health workers and traditional birth attendants has shown that if proper training is given, it is easy to use.

The device is made up of a mask, valve and tube. The mask has the same characteristics as the mask for the bag. The valve prevents the newborn re-breathing expired air and the tube connects the mask with the resuscitator's mouth. Figure 7 shows the device and Figure 8 shows how it is used.

The principles are the same for both the bag and mask or tube-to-mouth resuscitation. The only difference is that the resuscitator blows air via the tube and mask into the newborn's lungs, instead of into the bag. Experience has shown that health workers tend to blow too little rather than too much and too slowly (less than 30 breaths per minute). Blowing at correct ventilation rate (30-40 per minute) and good blowing pressure can easily make them dizzy (hyperventilation). Therefore it is important that additional training be given in order to know the correct amount and pressure of air. A simple tool has been developed for this training.

The advantages are that this mask provides a good seal while the tube allows the newborn's head to stay in a good position and allows the resuscitator to observe the newborn's chest for rising.

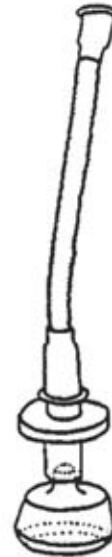


Figure 7: Tube and mask device



Figure 8: Ventilation of the newborn using tube and mask device

Although the device protects the resuscitator from any infection from the newborn, it does not protect the newborn from infection by the resuscitator. The device that was tested did not have a filter and therefore the main concern is the risk of infection with tuberculosis.

7 OPERATIONAL GUIDELINES

Implementation of resuscitation in practice

Recognition of birth asphyxia in a newborn and immediate resuscitation require the immediate availability of a qualified person, appropriate equipment and organized action. The following steps are suggested for a country that wishes to strengthen newborn resuscitation. Since resuscitation is needed relatively seldom - at an incidence of 3-5%, a birth attendant who delivers 20 women a year will need to resuscitate probably once a year - it is worth considering training first those birth attendants who deliver more than 20 women a year. In practice, this means that health care institutions should introduce basic newborn resuscitation first. Basic resuscitation should also become part of the pre-service training of health care providers trained in midwifery.

National level

At national level the following activities and policies will help health care institutions improve resuscitation practices:

- legislation that allows every birth attendant to perform newborn resuscitation;
- national recommendations and standards for newborn resuscitation describing the minimum required practices and equipment, for different levels of care (home, health centre, hospital);
- recommendations for selection and purchase of equipment and supplies;
- putting basic newborn resuscitation on the curricula of midwifery, nursing and medical training;
- development of training materials and courses for pre-service and in-service training for different levels of care;
- development of capacity for training;
- licensing.

Local level

Every health care institution that provides delivery care must develop its own policies and standards for newborn resuscitation. The manager or supervisor is responsible for ensuring that the institution has a plan of action that includes:

- a written policy, standards, protocol and training course for newborn resuscitation;
- a list of necessary equipment and supplies with instructions on cleaning and maintenance;
- a list of maternal and fetal complications that require the presence of persons specially qualified in newborn resuscitation, agreed by all staff;
- a contingency plan for multiple births and unusual situations;
- instructions on how to document (record) the process and outcome of resuscitation;
- a monitoring and evaluating process;
- a programme for staff training (doctors, midwives, nurses, auxiliary midwives) through initial and refresher courses.

The policy on resuscitation, the protocol and the procedures for recording and evaluation will be observed to be better if they are developed with the participation of the staff. Local conditions and the availability of equipment must be taken into account when developing standards of care. For instance, precise thermal protection procedures will depend on the local climate and warming/cooling facilities, while methods of suctioning will depend on the suction

devices available. Stop points (when to stop resuscitation) need to be part of the policy. Resuscitation details should become a part of the patient's record.

Training

Gaining skills in newborn resuscitation cannot be left to the real-life situation and therefore training using manikins is recommended. It is very important that training in newborn resuscitation concentrates on the essential facts, skills and attitudes, and uses appropriate teaching methods and teaching aids (dolls/manikins). Training must focus on decision-making and problem-solving skills in emergency situations, as well as on manual skills and on counselling skills for communicating with parents. It must emphasize the urgency of the situation and the need for coordinated activities by members of the health care team or, in case of a single health worker, on decision-making skills in dividing attention between the mother and the newborn.

The appropriate level of competence should be achieved through continuing efforts to maintain resuscitation skills by practising the technique and by completing appropriate refresher courses. Regular training sessions help to update present staff and train new ones.

After training, evaluation is needed to see if the standards/guidelines are being implemented in the work situation and if the health workers are doing what they have been trained to do. Re-certification should be institutionalized, with the optimal intervals determined locally. Because newborn resuscitation is a relatively rare procedure, more frequent updating of skills should be considered.

A generic training course with supporting training material on basic and advanced newborn resuscitation should be developed at national level. Locally, training courses and materials should be adapted in accordance with the results of a situation analysis (training needs assessment) carried out before the training.

Monitoring and evaluation

Resuscitation can seldom be observed directly to assess the quality of care provided. The most frequent method of assessment is demonstration using different case scenarios. This method allows for observing both manual and decision-making skill. Actual clinical practice can be evaluated by comparing the skills demonstrated against checklists developed on the basis of local standards and protocols.

Practices should also be evaluated after a resuscitation fails. Staff discussions can provide useful ideas for improving practices. A checklist can be helpful. If problems are found the team should analyse present practice, compare it to standards, make recommendations, and plan and implement them.

8 GLOSSARY

Birth asphyxia	In this paper the term is used for failure to initiate and sustain breathing at birth. It is not used as a predictor of outcome.
Birth attendant	A trained person with midwifery skills providing delivery care for mother and newborn.
Birth weight	The first weight of the newborn, measured to the nearest five grams. It is usually obtained within the first hours of birth.
Cleaning	The physical removal of most microorganisms and contamination, using detergent and water.
Disinfection	Treatment of objects or surfaces to remove or inactivate organisms such as vegetative bacteria, viruses and fungi, but not spores. Disinfection can be achieved by heat, by immersion in boiling water or by applying certain antiseptics.
Evaluation	The process of collecting and analysing information at regular intervals about the effectiveness and impact of the programme.
Gasping	Occasional breaths with long pauses in between, not sufficient breathing.
Health care institution	An institution where delivery care is provided by health workers with midwifery skills (health centre, maternity unit, hospital).
Malformation	Also congenital anomaly or birth defect. Any defect present at birth, probably of developmental origin.
Low birth weight	A birth weight of less than 2500 g.
Very low birth weight	A birth weight of less than 1500 g.
Live birth	The complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life.
Monitoring	The ongoing process of collecting and analysing information about the implementation of the activity such as newborn resuscitation.
Neonatal death	Death of a live-born infant during the first 28 completed days of life. May be subdivided into early neonatal death, occurring during the first seven days of life, and late neonatal death, occurring after the seventh day but before 28 completed days of life.
Perinatal death	Death of a fetus or a newborn in the perinatal period that commences at 22 completed weeks (154 days) of gestation (the time when birth weight is normally 500 g) and ends seven completed days after birth.

Policy	A written statement used to guide and determine present and future decisions about standards of care.
Post-term	42 completed weeks or more (294 days or more) of gestation.
Pre-term	Less than 37 completed weeks (less than 259 days) of gestation.
Standard of care	Professionally developed detailed written statement used to guide procedures.
Sterilization	The complete destruction of all microorganisms, including spores. It can be achieved by dry heat or steam under pressure.
Stillbirth*	The complete expulsion or extraction from its mother of a product of conception, of at least 22 weeks gestation or 500 grams, which after separation did not show any signs of life.
Term	From 37 completed weeks to less than 42 completed weeks (259 to 293 days) of gestation.

* For the purposes of this document the official WHO definition was modified.

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