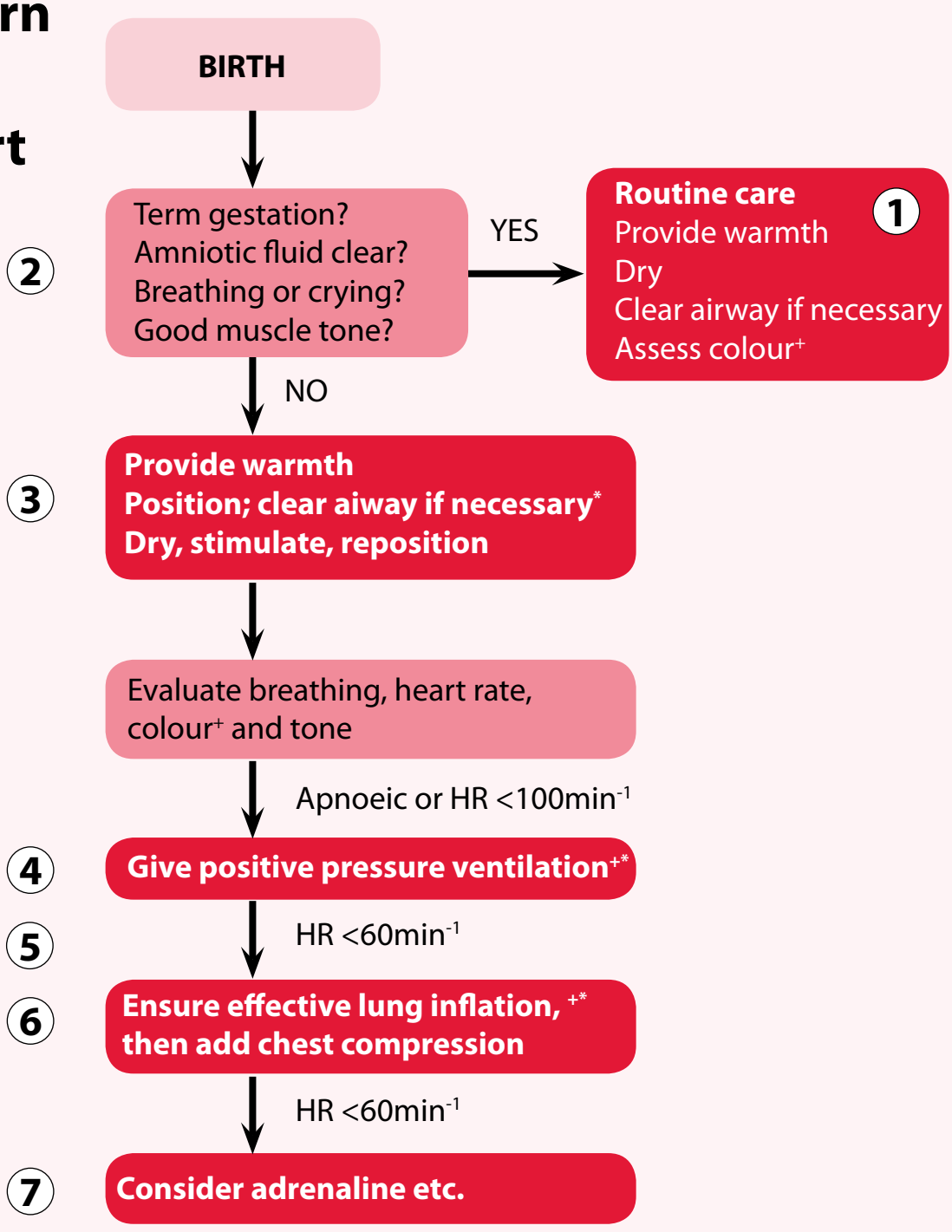
Resuscitation Council (UK)

Newborn Life Support



* Tracheal intubation may be considered at several steps

+ Consider supplemental oxygen at any stage if cyanosis persists

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Figure 1. *Reproduced by kind permission of the European Resuscitation Council and available at*: www.resus.org.uk/pages/nlspost.pdf

Update in
Anaesthesia

Resuscitation at birth

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Summary

A floppy baby is unconscious - a baby with good tone is not.

Good airway management and effective rescue breaths are key to achieving oxygenation of fluid-filled lungs.

Chest compressions and drug administration are rarely needed.

INTRODUCTION

Resuscitation of a newborn infant at birth is straightforward and much more likely to be successful than resuscitation of a collapsed adult. The principles underlying the approach are simple and the issue is not complicated by a need to interpret ECGs or manage arrhythmias. Babies are well adapted to withstand the periods of intermittent hypoxia which are a feature of normal labour and delivery. At term their hearts are packed with glycogen and, by switching to anaerobic respiration, can – in extremis - maintain some circulation for up to about twenty minutes in the face of anoxia. Of those few who get into difficulties, the vast majority will recover rapidly once their lungs have been successfully inflated. However, it is necessary to be aware of some important differences between babies at birth and adults. It is equally necessary to maintain a logical approach, evaluating and completing each step before proceeding to the next.

NEONATES COMPARED TO OLDER CHILDREN

One obvious difference between babies and older children or adults is that babies are small and have a large surface area to weight ratio. They are also always born wet which means they are particularly prone to rapid evaporative heat loss. The initiating insult will virtually always be an interference with placental respiration but the condition that a baby is born in can vary from healthy to extremely sick and all shades between. However, perhaps the most important difference to remember is that a baby at birth is in transition from placental to pulmonary respiration. It will therefore have fluid-filled lungs that have never yet been inflated with gas.

COMMENTARY ON ALGORITHM

Let us now approach the algorithm shown in Figure 1.[1] This algorithm deals primarily with term infants and to some extent this approach can be extended to preterm infants in similar difficulty. The management of transition in significantly preterm infants is beyond the scope of this article even though this process is also often referred to as "resuscitation".

1. Heat loss

The first item addresses the issue of minimising heat loss. The baby should be received into warm towels, rapidly dried, the now wet towels removed, and the baby then covered in warm dry towels and, ideally, placed on a flat surface under a radiant heater. This will take 20 to 30 seconds during which time one can also begin to assess the condition of the baby.

2. Assessment

The baby then needs to be rapidly assessed. A healthy baby will adopt a flexed posture with good tone, will have a normal heart rate which rapidly rises to above 100 beats per minute (bpm), will cry and breathe normally within about 30 seconds of delivery. Although born blue, he will rapidly become pink even though the extremities will remain somewhat cyanosed. An asphyxiated baby will be very floppy with a slow or even absent heart rate, will make no attempt to breathe or may give only a shuddering gasp. He will remain blue or maybe appear very pale due to restriction of blood flow to the skin in an attempt to maintain central circulation. You will certainly need help if the baby is like this.

Of these four attributes the most indicative of a serious problem is tone.

A floppy baby is in serious difficulty, a baby with good tone is not.

A floppy baby with a low heart rate is in serious difficulty whereas a baby with a slow heart rate but good tone is probably OK.

The next most important attribute is heart rate. In a baby in difficulty the heart rate will almost instantly respond as soon as oxygenated blood reaches the heart. This will therefore give you the first sign that your resuscitative efforts are having a positive effect. You therefore need to know what the heart rate is at the start so as to be able to judge whether it has later improved.

A B C D

From here on the algorithm follows a familiar pattern – Airway, Breathing, Circulation and Drugs. However, it is vital that these items are dealt with in sequence.

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Whereas in adult collapse 'compression only' CPR may be effective, the reason for this is that in adults one is usually dealing with a cardiac problem. In babies the problem is a respiratory one and performing chest compressions before inflating the lungs merely attempts to circulate blood through fluid filled lungs where it has no hope of acquiring oxygen. This is a time-consuming distraction.

3. Airway

An unconscious baby placed on its back will tend to obstruct its airway due to loss of tone in the oropharynx and jaw, resulting in the tongue falling back to obstruct the oropharynx. This tendency is exacerbated by the relatively large occiput of the newborn baby which will tend to flex the neck. In order to open the airway of a baby the head is best held in the neutral position with the face supported parallel to surface on which the baby is lying. Over-extension of the neck is likely to obstruct the airway, as is flexion.

Supporting the jaw and, in very floppy babies, providing formal jaw thrust, is sometimes necessary. Given the relatively large size of the newborn baby's tongue compared to size of the mouth an oropharyngeal airway may also be helpful.

Special case - meconium aspiration

Some babies who get into difficulties before delivery may pass meconium in utero. If insulted further, they may inhale this meconium into the oropharynx or airways during episodes of anoxic gasping before birth. Therefore, if a baby is born through heavily meconium stained liquor and if the baby is unresponsive at delivery – and only if unresponsive[2,3] - it is worth inspecting the oropharynx and removing any thick particulate meconium by means of a large bore suction device. If the infant is unresponsive and the operator has the appropriate skill then intubating the larynx and 'hoovering out' the upper trachea by applying suction to the tracheal tube during withdrawal may remove a potential blockage. Attempting to remove meconium or other endotracheal blockages by passing a suction catheter down through the tube itself is unlikely to be successful as the bore of the catheter will be too small for the purpose.

4. Breathing

If the baby has not yet responded then the next step is to ventilate the lungs. Remember the lungs will be fluid filled if the baby has made no attempts to breathe. Apply a well fitting mask to the mouth and nose and then attempt to inflate the lungs with air at a pressure of around 30 cm of water aiming for an inspiratory time of 2 to 3 seconds. Five such 'inflation breaths' will usually be successful in aerating the lung to an extent that will allow any circulation to bring some oxygenated blood back to the heart producing a rapid increase in heart rate.

5. Circulation - re-evaluate heart rate

Having given five inflation breaths you should then assess whether the heart rate has increased. If it has, then this is a firm indication that you have aerated the lung and it also tells you that all that is necessary is for you to gently ventilate the baby until it starts to breathe normally. A rate of 30 or so 'ventilation breaths' per minute each with an inspiratory time of around one second will usually be sufficient to maintain the baby's heart rate above 100 bpm during this period.

However, if the heart rate has not improved you still need to know whether this is because your attempts at lung aeration have not been successful – which is the most likely reason – or have you actually succeeded in aerating the lungs but the circulation has deteriorated to such an extent that this alone is not going to be sufficient. The only way to judge this is to see if you can detect passive chest movement in response to attempts at lung inflation. Is the chest moving when you try to inflate it?

Initial chest movement is likely to be subtle and you may have to stoop down and look carefully from the side during further attempts at inflation to be sure on this point. The commonest error is to assume successful chest inflation when it is not present. It is, however, absolutely crucial that this question is answered correctly. If you assume that you have inflated the lungs when you have not, then proceeding to chest compressions will not have any hope of success and you are merely wasting time. Equally, if you assume you haven't inflated the chest when you have, then you will fail to initiate chest compressions when they are necessary and will also waste precious time. If you have inflated the chest but not recognised this, then the rapidly improving chest compliance will make chest movement easier to see with subsequent breaths, so chest movement should eventually become obvious.

If chest movement is not seen, then the airway is the problem and this must be addressed before going any further. Unless and until the lung is successfully inflated nothing else will have any chance of success. Apart from checking for obvious problems such as failing to switch on the oxygen supply, or a big leak from the mask, check the following issues:

Consider:

- Is the baby's head truly being supported in the neutral position?
- Is jaw thrust necessary?
- Would use of an oropharyngeal airway be helpful?
- Might you achieve better airway control if two people were employed controlling the airway?
- Are you actually delivering an appropriately long inspiratory time?
- Might there be a blockage in the oropharynx or trachea?

Though the presence of meconium on a collapsed baby may give a clue to a blocked airway it is well known that other less obviously visible substances such as blood clots, lumps of vernix or thick mucus plugs can equally be inhaled and block the airway in exactly the same way.[4]

Once chest movement has been achieved – and only then – consider chest compressions if the heart rate remains slow or absent.

6. Chest compressions

If the heart rate has not responded to lung inflation alone, then a brief period of chest compressions may be all that is necessary to bring a little oxygenated blood from the lungs back to the coronary arteries which will then produce a rapid cardiac response. The most effective way to perform chest compressions is with both hands encircling the chest. Place the thumbs together centrally over the lower sternum with the fingers overlying the spine at the back and briskly compress

the chest between fingers and thumbs at a rate of about 120 beats per minute. Current advice is that one should intersperse breaths at a rate of one breath for every three beats during this manoeuvre, though there is no clear evidence as to the most appropriate compression: inflation ratio.

The need to proceed as far as this is relatively rare – probably around 1 in 1000 births. The length of time compressions are needed is also relatively short – a few minutes at most.[5]

Having given 30 to 60 seconds of chest compressions one should look for a response. Once again you are looking for an increase in heart rate indicating successful delivery of oxygenated blood to the heart. Virtually all babies will have responded by this stage. Because this is the expectation it is important to check once again that lung inflation has definitely been successful and that chest compressions are being delivered as expected before deciding that further intervention is needed. However, if the heart remains slow – less than about 60 per minute - or is absent, then further intervention should be considered.

7. Drugs

What else is available? There is very little published evidence to support any of the drugs which have been suggested for use at this stage. Epinephrine (adrenaline) is traditional in these situations and, if given centrally – ideally via an umbilical venous cannula – does improve coronary artery perfusion pressure in animal experiments. Early animal studies also appear to show a possible place for the use of alkalinising agents such as bicarbonate (with dextrose) - again given centrally - in boosting a failing circulation at this point. Intuitively one might also expect that babies who are seriously hypovolaemic, perhaps from blood loss, would respond to appropriate fluid expansion.

If any of these manoeuvres are to be employed then it is necessary to rapidly establish central venous access. This is easily done by inserting a catheter into the umbilical vein.

It must be said, however, that babies who appear to require this degree of help are at very high risk of permanent and severe neurological damage, if they survive. Those with the least risk will be those who have undergone a severe but sudden and recent insult rather than those whose insult has been intermittent and chronic.

SUMMARY

Resuscitation of babies at birth boils down to good airway management and effective lung inflation with the need to add chest compressions on very rare occasions. Air is almost certainly all that is necessary for lung inflation[6] and drugs have a very limited place.

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