

Neonatal resuscitation

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In the last ten years, the practitioners of obstetric care in New Zealand have changed drastically. The GP obstetrician is now virtually extinct. The majority of obstetric care now is in the hands of either District Health Board derived services, private obstetricians or independent midwife practitioners. This latter group, numbering some 3000 practitioners, has essentially replaced the service previously given by GPs. There is no equivalent group in Australia.

In 2000, the NZ Resuscitation Council (NZRC) approached the New Zealand Paediatric Society and New Zealand College of Midwives to develop a national neonatal resuscitation course that would satisfy the requirements of all those involved in the New Zealand obstetric and neonatal fields. The all encompassing philosophy was that at every birth, no matter where it takes place, there should be a minimum of one person credentialed to give at least basic resuscitation to the compromised newborn. Basic resuscitation was defined as the ability to perform interventions up to chest compressions with adequate bag/mask ventilation. The course, however, would need to cater for a wide range of practice requirements. It should be able to provide for those whose practice requires them to go beyond this basic level and therefore include: intubation, the administration of drugs, and insertion of umbilical catheters.

Australia has tried to get a nationally unified course in place but has been defeated by differences between practitioners in different states and perhaps, the sheer size of the country. However, we have now achieved this in New Zealand. In early 2007, after many trial courses, the first official course will be run, followed by a 'train the instructors' day. The process should then snowball across the country, under the umbrella of the NZRC.

Every five years, the International Liaison Committee of Resuscitation (ILCOR)¹ convenes to review guidelines across all age groups and debate alterations to resuscitation guidelines based on the latest literature. The most recent review has seen some radical changes, primarily in non-neonatal areas of resuscitation. The controversy over the changing ratio of chest compressions to breaths in adults and children has even made it to the popular press. The area of neonates has similarly been reviewed. Much of what we practice in clinical medicine is thinly evidence-based and the field of resuscitation is no exception. What areas that are researched in some detail have thrown into doubt many of the things once considered fundamental to the wellbeing of a newborn during resuscitation. An excellent example of this is the use of oxygen. There is an accumulating body of evidence that 100 per cent oxygen used during resuscitation of

term, but especially pre-term, newborns may not be ideal. While the final recommendations await further evidence, this is just one area that ILCOR is monitoring.

So, what are the basics of neonatal resuscitation? It is difficult to give too much detail here and I will give a very abridged version of our resuscitation guidelines. Definitive textbooks, from which the New Zealand course will be taught can be purchased from the NZRC (<http://www.nzrc.org.nz/>). In Australia, a similar guideline can be accessed from the Australian Resuscitation Council (<http://www.resus.org.au/>).

A newborn, compromised during labour and delivery, transitions through stages of fetal breathing followed by periods of breathing cessation. These periods of cessation are termed primary and secondary apnoea. After primary apnoea, breathing will recommence; after secondary apnoea, it will not without assistance. There is no way of knowing at which of these stages an apnoeic newborn is at and a stepwise assessment process should be followed that determines whether active resuscitation should occur or whether simple observation and minimal support would suffice. The NZRC follows a standard algorithm – simplified by remembering the letters A, B, C and D – to proceed through this assessment process. Each assessment stage is separated by 30 second intervals (see Figure 1, courtesy of NZRC).

It must be remembered that neonatal resuscitation is a respiratory focussed resuscitation, unlike the adult equivalent which often has a cardiac problem as the underlying pathology. If the ventilation administered is adequate, the heart, within limits, will look after itself or need only modest support. The hypoxic neonatal myocardium is unique in that it appears able to support anaerobic metabolism for a limited time, a clever skill we rapidly lose after leaving the womb. The ischaemic neonatal myocardium is not so tolerant but following short periods of ischaemia, will function almost as well as before the event, again quite unlike the adult

A – Assessment of the Airway

Drying the newborn with a warm towel provides stimulation that should initiate regular breathing. A compromised newborn infant will be floppy and the natural tendency for the newborn neck is to flex when tone is low and thus occlude the airway. Simply holding the head in the so-called neutral position (slight extension) will keep the airway open and allow rudimentary respiratory effort to gain ground and evolve into regular normal respiration. If the baby is centrally cyanosed but breathing, give blow-by oxygen.

B – Breathing

If, after 30 seconds of assessment and drying, normal breathing does not appear, then a period of assisted ventilation is required. The standard tool for this is the bag and mask. There are a number of devices to deliver these assisted breaths. Devices include: anaesthetic bags; T piece systems; such as the Neopuff™; and the most common instrument, the self inflating

bag, such as the one produced by Laederl. The latter device has the two major advantages over the others. It doesn't need an air or oxygen source to operate and it is user friendly. Its major disadvantages include an inability to provide positive end expiratory pressure (PEEP) unless another device is attached to it, and a trend to deliver very high peak inspiratory pressures in the hands of the inexperienced or overzealous resuscitator. This can occur even when a manometer (to measure delivered pressure) is attached and can be disastrous, especially when used in the pre-term infant.

Ventilation should be administered for 30 seconds at a rate of 40 to 60 breaths per minute. There are two signs that adequate ventilation has been achieved. Chest movement (beware if it is too excessive) and a rise in heart rate. This may be apparent before the more obvious sign of a baby changing from being centrally blue to pink occurs. Manoeuvres to consider if ventilation does not appear adequate include (not necessarily in this order): suctioning debris from the naso/oropharynx; ensuring the mask has a good seal over the mouth and nose; repositioning of the neck; and whether the pressure being used high enough.

C – Cardiac or Chest Compressions

After 30 seconds of effective bag/mask ventilation, check the heart rate. The best way to do this is to either palpate the base of the umbilicus or auscultate the chest. Count the heart rate over six seconds and multiple by ten to give a rate per minute. If the rate is less than 60 beats per minute, chest compressions need to be added to the bag and mask ventilation. The aim of chest compressions is to push blood that has been oxygenated by your bag and mask efforts from the left ventricle into the ascending aorta to perfuse the coronary arteries. Once that is achieved, the heart should look after itself. The ratio of chest compressions to ventilations is 3:1. To put it a verbal form: one and two and three and breathe (you should administer them at the same rate you speak them). That cycle should take about two seconds in theory.

Cease chest compressions while the breath is being given. There are two methods to perform chest compressions. The finger placement for the two methods is the same. Image a horizontal line between the nipples and go just below that in

the sternum midline. The preferred method is to stand at the feet of the baby and place ones hands around the chest wall with the thumbs overlapping on the landmark described above. The chest should be depressed approximately one third to one half the anterior-posterior diameter of the chest diameter. This method assumes two people doing the resuscitation; one to look after the airway and one to perform the chest compressions. The second method involves standing to one side of the patient and with two fingers pressing on the landmark and depressing the chest that way. This can be used in the unfortunate situation when you are the solo resuscitator and the airway is also your responsibility.

At this point, resuscitation goes beyond what would normally be deemed basic. The next stage assumes either the baby has been intubated and/or has large bore venous access with the only viable, easily accessible vessel being the umbilical vein. Intubation is rarely necessary as adequate ventilation can be given by bag and mask in almost all cases.

D – Drugs

The decision to advance to this point on the resuscitation algorithm is based on an assessment after 30 seconds of efficient chest compression (plus bag and mask ventilation) and still a heart rate less than 60 beats per minute. There is essentially only one drug of resuscitation and that is adrenaline (epinephrine). Adrenaline is supplied in ampoules labelled with a strength of 1:10,000 and ampoules with 1:1000. Only 1:10,000 should be available for newborn resuscitation to minimise chances of error. Adrenaline is given in doses of ten to 30 micrograms/kg. This equates to 0.1 to 0.3 ml/kg of a 1:10,000 solution. The initial intravenous (IV) dose is 0.1 ml/kg. There is insufficient data to recommend the intratracheal route, but if no IV access is possible, a dose of 1.0 ml/kg of 1:10,000 solution (100 micrograms/kg) may be tried.

Intravenously, the drug is given rapidly as a bolus, and may be repeated every three to five minutes if heart rate remains less than 60 beats per minute, with 0.1 – 0.3 ml/kg each subsequent dose. Other drugs to be considered are sodium bicarbonate (1mmol / kg IV) and volume replacement if the baby is suspected of having lost blood volume during delivery. Ten ml/kg of 0.9 per cent NaCl is the most easily accessible and appropriate fluid which can be repeated if thought necessary.

At this point, it should be noted that the opioid antagonist Naloxone is not strictly a drug of resuscitation. The dose is 0.1 mg/kg best given intramuscularly (im) (assuming muscle perfusion) or IV if respiratory depression is assumed to be the result of maternal opioid administration.

Lastly, a mention about meconium exposure. Randomised trials have clearly shown that there is no advantage in sucking out meconium from the mouth or airway of a vigorous baby during and immediately after birthing. In fact, it may be detrimental. Consequently, this practice is now discouraged. The obtunded neonate born through meconium is a different story. These still do warrant airway toileting under direct vision, if that is within the skill set of the attending staff. It should be noted, however, that there are no well designed randomised trials to see whether this practice makes any difference.

Remember: Call for help early.

Reference

1. International Liaison Committee on Resuscitation. The International Liaison Committee on Resuscitation (ILCOR) consensus on science with treatment recommendations for pediatric and neonatal patients: neonatal resuscitation. *Pediatrics* 2006; 117(5): e978-88. Epub 2006 Apr 17

