ANZCOR Guideline 13.8 – The Resuscitation of the Newborn in Special Circumstances

Guideline

1 Prematurity

1.1 Temperature management

Very premature infants are at particular risk of hypothermia. Close attention to maintaining their body temperature is essential. To prevent burns, care should be taken with external heat sources.

Very premature infants, (especially below 28 weeks gestation) very easily become cold and ANZCOR suggests they are best kept warm after birth by using a radiant warmer and placing the infant immediately after birth (without drying) in a polyethylene bag or under a polyethylene sheet (appropriate size, food or medical grade, heat resistant), up to the neck[1-5]] (CoSTR 2015, weak recommendation, very low quality evidence).[6] The bag or sheet should not be removed during resuscitation and it should be kept in place until temperature has been checked and other measures (e.g. pre-warmed, humidified incubator) are ready to ensure that heat loss does not ensue.

ANZCOR suggests that additional measures that may be needed either alone or in combination (CoSTR 2015, weak recommendation, very low quality evidence)[6] include:

- establishing an ambient temperature of at least 26°C
- exothermic warming mattresses
- warmed humidified resuscitation gases
- covering the head (except the face) with a hat or folded bedding.

1.2 Handling and skin protection

Gentle handling is essential for all infants, but especially premature infants, who are at greater risk of damage, both to skin and to internal organs. If vascular access is required, antiseptic solutions should be applied sparingly, particularly those containing alcohols, which can cause serious damage to immature skin. For umbilical catheterisation, apply antiseptic solution to the cord and only a small area of skin, using a sterile drape to cover other areas. Avoid letting excess solution pool around the infant's groin and flanks. Adherence to good infection control procedures is essential.

1.3 Respiratory Support

Most very preterm infants need some respiratory support immediately after birth, but some uncertainty remains as to the best strategy.

Role of CPAP

For spontaneously breathing preterm infants < 32 weeks gestation who have signs of respiratory distress in the delivery room and require respiratory support, ANZCOR suggests commencing CPAP in the first minutes after birth rather than intubation and ventilation. (CoSTR 2015, weak recommendation, moderate quality of evidence)[6] The evidence suggests reduction of the combined outcome of death and bronchopulmonary dysplasia (BPD) but with no benefit to death, BPD, air leak, severe intraventricular haemorrhage (IVH), necrotising enterocolitis (NEC) or severe retinopathy of prematurity (ROP). When making this suggestion it is noted that risk reduction of adverse outcomes is small and that infants recruited into the trials had a high rate of antenatal steroids but value is placed on this less invasive approach (CoSTR 2015, Values and Preferences statement).

If CPAP is used, pressure of at least 5 cm H_2O should be used. Nasal prongs are a suitable alternative to a facemask to deliver early CPAP. CPAP cannot be administered with a self-inflating bag.

The role of an intubation-surfactant-extubation ("INSURE") approach, or other methods to administer artificial surfactant without endotracheal intubation in order to facilitate early stabilisation on CPAP soon after birth[7] compared to other strategies of respiratory support remains uncertain.[8,9]

Role of Initial Sustained Inflation Breaths

To establish initial lung inflation in apnoeic newborn preterm infants, initiation of intermittent positive pressure ventilation at birth can be accomplished with or without several initial prolonged inflation breaths. Various regimens have been suggested, from 5 breaths lasting 2-3 seconds to one breath lasting 5-10 seconds.

ANZCOR suggests against routine use of an initial sustained inflation (> 5 seconds) in preterm infants but SI may be considered in individual clinical circumstances or in research settings. (CoSTR 2015, weak recommendation, low quality of evidence)[6] Studies indicate a reduced need for intubation at 72 hours after a sustained inflation but the study protocols have varied sufficiently widely that there is a lack of clarity as to how to administer sustained lung inflation. Furthermore no longer-term benefits have been demonstrated. Recent evidence has indicated that in some circumstances, SI may cause unintended glottis closure.[10]

Positive Pressure Ventilation

For infants who do not commence spontaneous breathing within the first minute after birth positive pressure ventilation is required.

For those needing assisted ventilation, the optimal ventilation strategy is not known, but both animal [11] and human studies suggest the benefits of PEEP (at least 5 cm H_2O [12,13]) and avoidance of high tidal volumes. Administration of endotracheal surfactant should be considered very early during the stabilisation of premature infants who have needed intubation for resuscitation [Class A, LOE I[14]].

Oxygen

In studies of premature infants < 32 weeks, initial use of air or 100% oxygen was found to be more likely to result in hypoxaemia or hyperoxaemia (as defined by the investigators) respectively than when initiating resuscitation with blended air and oxygen and titrating according to oxygen saturation[15,16]. There is moderate quality evidence (downgraded for inconsistency, and/or imprecision) from randomised trials that high initial concentrations of oxygen (65-100%) confer no benefit in reducing mortality before discharge, bronchopulmonary dysplasia (BPD), intraventricular haemorrhage (IVH) or retinopathy of prematurity (ROP). Therefore, ANZCOR recommends against initiating resuscitation of preterm infants <35 weeks gestation) in high oxygen concentrations (65-100%)[6] The optimal starting oxygen concentration and the most appropriate time-specific target saturations for preterm infants remain to be determined.

For pre term infants ANZCOR recommends commencing resuscitation either using room air or blended air and oxygen up to an oxygen concentration of 30% (CoSTR 2015, strong recommendation, moderate grade of evidence).[6] We place higher value on reducing oxygen burden on pre term newborns and the absence of benefit of higher FiO2 in reducing mortality, BPD, IVH or ROP. As for term infants, supplemental oxygen should be given judiciously, ideally guided by pulse oximetry [Class A, expert consensus opinion]. Both hyperoxaemia and hypoxaemia should be avoided. If a blend of oxygen and air is not available, resuscitation should be initiated with air [Class B, extrapolated evidence[17-20]].

2 Congenital Upper Airway Obstruction

An infant who is pink when crying but cyanotic, with or without laboured breathing when quiet, should be evaluated for choanal atresia or other upper airway obstruction. An oral airway may provide adequate relief from obstruction. For an infant with a small pharynx, such as occurs when there is a small mandible, prone positioning and/or placement of an endotracheal tube via the nostril into the pharynx, as a mechanical stent to prevent the tongue obstructing the airway, may improve the airway. Infants with compromising craniofacial malformations may require laryngeal mask or tracheal intubation. This can be difficult, and expert assistance may be required.

3 Congenital Diaphragmatic Hernia

Infants with congenital diaphragmatic hernia (CDH) who need respiratory support should not receive bag and mask ventilation. Where respiratory support is needed, early intubation or use of a laryngeal mask is recommended to minimise air entry into the gastrointestinal tract [Class A, expert consensus opinion). Breath sounds following tracheal intubation may be asymmetrical, depending on the location of the CDH (and the ETT). A wide bore orogastric tube should be placed for intermittent suction to avoid air accumulation in intrathoracic small bowel, and minimise lung compression by it. As many of these infants only have one functioning lung the ventilation needs to be gentle with low tidal volumes.

4 Infant with Unexpected Congenital Anomalies

Unless there has been prior discussion and the development of a care plan with the parents, usually all infants should receive a complete and thorough resuscitation.

Those infants with life-limiting congenital anomalies are often best evaluated in the neonatal unit after resuscitation when more information will be available and the parents can be part of management discussions.

5 Pneumothorax

Pneumothorax is a rare cause of failure to respond to resuscitation immediately after birth. Chest recession/retraction, tachypnoea, unilaterally decreased breath sounds, bulging of the chest wall on one side, especially in the setting of deterioration after initial response to resuscitation, may indicate the presence of a pneumothorax. The diagnosis is best confirmed by chest radiograph, but emergency treatment may be required. Transillumination can be helpful in premature infants, but in term infants it may be falsely negative. If the clinical history suggests lung hypoplasia (which can predispose to pneumothorax) is likely, preparation (before birth) of equipment for bedside diagnosis and emergency treatment of pneumothorax may be advisable.

6 Pleural Effusions or Ascites (Including Fetal Hydrops)

Severe body wall oedema, pleural effusions and ascites at birth can cause lung hypoplasia, and interfere with initial lung expansion. Ventilation can usually be established by using higher pressures, allowing thoracentesis to be done after radiographic and/or ultrasound examination, with cardiorespiratory monitoring and with control of ventilation. However, emergency thoracocentesis is sometimes required.

7 Pneumonia/Sepsis

Congenital pneumonia can result in very poor lung compliance, necessitating high ventilation pressures during resuscitation to open the lungs. It presents like severe respiratory distress syndrome.

8 Congenital Heart Disease

Infants who remain cyanotic despite adequate ventilation, oxygenation and circulation may have cyanotic congenital heart disease or persistent pulmonary hypertension. Very rarely, congenital heart block is the cause of persistent bradycardia. Early NICU admission and echocardiographic evaluation in such cases is essential.

9 Abdominal Wall Defects

Infants born with gastroschisis or a large omphalocoele require special consideration to protect the exposed abdominal contents from trauma, drying, heat loss or contamination and to prevent expansion of the extra-abdominal bowel with air. A polyethylene wrap (e.g. food wrap) or bag (e.g. a surgical “bowel bag” used to protect bowel during abdominal surgery) can be used to enclose the abdomen or the whole lower body in order to reduce drying, heat loss or contamination. Care should be taken to enclose the bowel lightly and position it so that blood flow is optimised. Caring for the baby in a side-lying position can be helpful.

An orogastric tube should be inserted to (repeatedly) remove swallowed air.

If respiratory support is needed, CPAP or positive pressure ventilation via a facemask should be avoided because they may increase intra-abdominal gas, which can imperil the blood supply to the exterior gut and can increase the difficulty in reducing the bowel into the abdomen later. If respiratory support is required, a low threshold for endotracheal intubation is suggested in preference to a facemask. There is no literature and little experience in relation to use of a laryngeal mask in these circumstances, but because it promotes tracheal ventilation and oesophageal occlusion, it may be preferable to a facemask if respiratory support is needed and endotracheal intubation is not possible.

10 Multiple Births

Multiple births are more frequently associated with a need for resuscitation because of prematurity, abnormalities of placentation, compromise of cord blood flow, and/or mechanical complications during delivery. Monozygotic multiple fetuses may have discrepant blood volumes from twin-to-twin transfusion syndrome and rarely, one twin may need urgent transfusion, usually after initial resuscitation. There should always be at least one skilled resuscitator for each infant.

11 Fetal Haemorrhage

Maternal vaginal bleeding before birth may be a sign of placental abruption, placenta praevia or vasa praevia as the source of the bleeding. Although most commonly, the majority of blood loss will be maternal, if even a small portion is fetal the baby may be hypovolaemic. Major transplacental haemorrhage into the mother's circulation (feto-maternal haemorrhage) can cause neonatal hypovolaemia with no apparent antenatal bleeding.

Exsanguinated newborn infants are typically very pale even after a good heart rate has been restored. They may be difficult to resuscitate and intravenous fluid is often required before the infant will respond fully to resuscitative measures. As noted in Guideline 13.7, isotonic crystalloid (0.9% sodium chloride or Hartmann's) should be used in the first instance, but may need to be followed with blood suitable for neonatal transfusion. Some infants have lost a large proportion of their blood volume and may require activation of a critical bleeding protocol that addresses both restoration of oxygen carrying capacity and the likely accompanying coagulopathy.

12 Umbilical Artery Cord Blood Gases

Cord blood gases should be measured in every resuscitated newborn infant as the most objective way to assess the condition just before birth [Class A, expert consensus opinion]. They are also one criterion for assessing whether there was an intrapartum cause for subsequent cerebral palsy.[21] Comparison of paired samples drawn from both vein and artery is advisable, because of the risk that the umbilical artery has not been correctly identified. Normal umbilical **artery** values are given in the following table.[22] The effect of deferred cord clamping procedures on these values is uncertain. [23-25]

	2.5th centile	Mean	97.5th centile
pH	7.1	7.27	7.38
Base excess	-11	-4	1
pO_2 (mm Hg [kPa])	6 [0.8]	17 [2.3]	30 [4]
pCO_2 (mm Hg, kPa)	35 [4.7]	52 [6.9]	74 [9.8]

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