NEONATAL RESUSCITATION GUIDELINES AT DELIVERY

This LOP is developed to guide clinical practice at the Royal Hospital for Women. Individual patient circumstances may mean that practice diverges from this LOP.

1. OPTIMAL OUTCOMES
   • Appropriate resuscitation of the newborn infant

2. PATIENT
   • Any neonate requiring resuscitation

3. STAFF
   • Medical officers
   • Neonatal intensive care nurses
   • Midwives

4. EQUIPMENT
   • Ensure all equipment is in working order
   • Fully stocked resuscitaire

Warming
   ✓ Overhead heater
   ✓ Warm towels/wraps
   ✓ Plastic bag and bonnet for neonates <32 weeks gestation

Suctioning
   ✓ Mechanical suction/tubing – negative pressure source not to be >100mmHg!!
   ✓ Suction catheter (6F, 8F, 10F or 12F)
   ✓ Feeding tubes for gastric decompression
   ✓ Meconium aspirator

Ventilation
   ✓ T piece resuscitator (Neopuff)
   ✓ Ventilating bags
   ✓ Appropriate size mask
   ✓ Pulse Oximeter and probe
   ✓ Blended oxygen/gas supply
   ✓ Intubation equipment (laryngoscopes and blades, endotracheal tubes, stylets, Magill forceps, securing tapes)
   ✓ Oropharyngeal (e.g. Guedel) airways or laryngeal mask airways for difficult airway
   ✓ CO2 detector (Pedicap) for confirmation of endotracheal placement
   ✓ Infant sized stethoscope

Circulatory Access/Support
   ✓ Peripheral cannulation insertion equipment
   ✓ Umbilical catheters for emergency access – 3 way tap attached, saline primed
   ✓ Intraosseous needles – 50mm length
   ✓ Blood gas syringe for Cord pH
   ✓ Resuscitative medications (Adrenaline, Atropine), volume expanders (NS and blood). Emergency O-neg blood is available in the fridge in Operating Theatre.
5. CLINICAL PRACTICE

- Recognise high risk deliveries where neonates may require resuscitation, summon appropriate level of assistance. (Table 1)
- Prepare equipment for resuscitation.
- For neonates >32* weeks gestation: Dry the neonate and keep warm (skin temp 36.0-37.0°C or rectal temp 36.5-37.5°C).
- For neonates <32* weeks gestation: DO NOT DRY neonate. Place the neonate in a plastic bag immediately after birth and put a bonnet on. *Gestational age of 32 weeks was determined as cut off at RHW due to inability to regulate delivery suite/theatre temperature to >25°C as per ILCOR recommendations.
- Assess the neonate within 30 seconds of birth for respiration, heart rate (auscultation with stethoscope is more reliable than palpation of cord pulsations) and tone. (Figure 1)

- If respirations are regular and heart rate is >100 bpm
  - Routine care

- If respirations are irregular but HR >100 bpm
  - Ensure open airway
  - Provide assisted ventilation (consider CPAP)
  - Use pulse oximetry (apply probe onto neonate’s right wrist prior to connecting to monitor) for assessment of oxygenation and HR

- If respirations are irregular and/or HR <100 bpm
  - Maintain the airway by re-positioning the head
  - Provide positive pressure ventilation. Start at PIP of 30cmH2O (term neonates), PIP of 20-25cmH2O (preterm neonates) and PEEP of 5, at 40-60 breaths/min
  - Assess chest movement, adjust pressure to achieve adequate ventilation or assess mask fit
  - Use pulse oximetry for assessment of oxygenation and HR
  - Provide blended oxygen and titrate it to maintain the baby’s preductal (right wrist preferred) oxygen saturations as per ARC guidelines (table 2)
  - Re-evaluate after 30 seconds

- If heart rate is persistently <60 bpm despite adequate assisted ventilation for 30 secs
  - Start cardiac compressions (90 chest compressions to 30 breaths per minute (3:1) “one-and-two-and-three-and-breathe” with two thumb-encircling hands method (preferred over two-finger technique)
  - Increase blended oxygen to 100% oxygen if lower concentration was used
  - Consider endotracheal intubation if adequate ventilation not achieve with mask ventilation
  - Re-evaluate after 30 seconds, continue if HR remains <60 bpm

*If there is no improvement of HR within 1 minute of adequate ventilation with chest compressions, the on-call Neonatal Fellow must be called – Activate a CODE BLUE Call (Dial 777)
NEONATAL RESUSCITATION GUIDELINES AT DELIVERY  cont’d

- If after 30s of positive pressure ventilation and chest compressions; and HR is still <60bpm
  - Administer adrenaline (1 in 10,000) 0.1 –0.3 mL/kg via ET or IV (IV route is preferred)
  - Emergent umbilical venous lines should be placed at this time for preferred route of drug administration (low lying UVC should be used in emergency cases; insert to ~5cm from stump for term infants and may be used when blood returned freely upon aspiration)
  - Continue chest compressions after administration of adrenaline in order to ensure circulation of drug to achieve response
  - Consider volume expansion (NS or blood if history of blood loss/anemia in utero)

- In the presence of meconium-stained liquor:
  - NO NEED for intrapartum suctioning prior to delivery of shoulders
  - If neonate is vigorous (good respiratory effort, tone and HR>100bpm) – routine care
  - If respiratory effort and muscle tone are poor or absent, and/or heart rate is <100 bpm, direct laryngoscopy should be performed. Visualise vocal cords and suction via ET tube with a meconium aspirator or direct insertion of large bore suction (10 or 12FG) suction catheters
  - NOT NECESSARY to repeat endotracheal suction as may delay interventions

- Tracheal suctioning is indicated when there is inability to inflate the chest due to obstruction. It must be done before spontaneous respiration and must not deter from the immediate steps to provide resuscitation.

Blended Oxygen Use
- Regardless of gestation, the goal of oxygen administration is to aim for oxygen saturation that resembles that of a healthy term baby (Table 2).
- Supplemental oxygen should be used judiciously and guided by pulse oximetry.

Table 2 : Target saturations for newborn during resuscitation in relation to time from birth

<table>
<thead>
<tr>
<th>Time from birth</th>
<th>Acceptable saturations for newborn infants during resuscitation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 min</td>
<td>60</td>
</tr>
<tr>
<td>2 mins</td>
<td>65</td>
</tr>
<tr>
<td>3 mins</td>
<td>70</td>
</tr>
<tr>
<td>4 mins</td>
<td>75</td>
</tr>
<tr>
<td>5 mins</td>
<td>80</td>
</tr>
<tr>
<td>10 mins</td>
<td>85</td>
</tr>
</tbody>
</table>

- For term infants not known or suspected to have lung pathology:
  - Air is to be used at the commencement of resuscitation
  - 100% oxygen via a blender should be available for use if there is no appreciable response in heart rate by 90 seconds
NEONATAL RESUSCITATION GUIDELINES AT DELIVERY  cont’d

- For preterm infants or those with lung pathology:
  - Predectal (right wrist preferred) pulse oximetry is to be used at the commencement of resuscitation
  - There is no current conclusive evidence on the initiating FiO2 at delivery for preterm infants. But current ILCOR guidelines suggest FiO2 of 0.3-0.9 as the initial FiO2 for resuscitation of preterm infants whereas UK and European RC guidelines suggest air as the initial FiO2 even for preterm infants. * In infants enrolled in ongoing TO2RPIDO trial, trial protocol should be followed.
  - Use oxygen via a blender if required according to baby’s oxygenation guided by pulse oximetry
  - Target blended oxygen concentration every minute according to clinical response

Tracheal Intubations:
- Indicated when: non-vigorous infant exposed to meconium-stained liquor, inadequate ventilation via face mask, undetectable heart rate or need for chest compression, prolonged apnea or insufficient respiratory effort (eg. Extreme low birth weight)
- Endotracheal tube size ~ gestational age divided by 10 (Table 3)
- Laryngoscope straight blade: size 1 for term, 0 for preterm, 00 for extremely low birth weight infants (Table 3)
- Depth of insertion of ETT ~ weight in kg + 6cm (Table 3)
- Signs of successful intubation: Visualization of tube passing through larynx, colour change on CO2 detector, condensation mist within ETT, auscultation of equal breath sounds, chest movement with each breath, improved HR and O2 saturations

<table>
<thead>
<tr>
<th>Gestation (weeks)</th>
<th>Actual weight (kg)</th>
<th>ETT internal diameter (mm)</th>
<th>ETT at lip (cm)</th>
<th>Laryngoscope Blade size</th>
</tr>
</thead>
<tbody>
<tr>
<td>23-24</td>
<td>0.5-0.6</td>
<td>2.5</td>
<td>5.5</td>
<td>00</td>
</tr>
<tr>
<td>25-26</td>
<td>0.7-0.8</td>
<td>2.5</td>
<td>6.0</td>
<td>00</td>
</tr>
<tr>
<td>27-29</td>
<td>0.9-1.0</td>
<td>2.5</td>
<td>6.5</td>
<td>00</td>
</tr>
<tr>
<td>30-32</td>
<td>1.1-1.4</td>
<td>3.0</td>
<td>7.0</td>
<td>0</td>
</tr>
<tr>
<td>33-34</td>
<td>1.5-1.8</td>
<td>3.0</td>
<td>7.5</td>
<td>0</td>
</tr>
<tr>
<td>35-37</td>
<td>1.9-2.4</td>
<td>3.0 or 3.5</td>
<td>8.0</td>
<td>0</td>
</tr>
<tr>
<td>38-40</td>
<td>2.5-3.1</td>
<td>3.5</td>
<td>8.5</td>
<td>1</td>
</tr>
<tr>
<td>41-43</td>
<td>3.2-4.2</td>
<td>3.5</td>
<td>9.0</td>
<td>1</td>
</tr>
</tbody>
</table>

Drugs for Resuscitation:
- Adrenaline (1:10,000 solution; 0.1ml contains 10mcg of adrenaline) is indicated when the heart rate remains <60 after 30 seconds of adequate ventilation and chest compressions
  - Dose: 0.5 - 1mL/kg of 1:10,000 solution administered via the endotracheal route until the intravenous route is established.
  - Dose: 0.1 - 0.3mL/kg of 1:10,000 solution administered intravenously and repeat when indicated. Repeat intravenously, when indicated at 3-minute cycle. Flush 1 mL Normal Saline after each intravenous administration
NEONATAL RESUSCITATION GUIDELINES AT DELIVERY  cont’d

• **Volume expanders** in an infant where there is suspected blood loss or the infant appears pale, poor perfusion, weak pulse and has not responded adequately to other resuscitative measures
  - **Dose:** 10ml/kg of normal saline given by slow intravenous (optimally via free-flowing umbilical venous catheter) push over 5-10 minutes.
    - May need to be followed by blood suitable for emergency transfusion in the setting of massive blood loss. *Emergency O-neg blood is available in the fridge in Operating Theatre.*

• **Naloxone** is indicated for reversal of respiratory depression in a newly born infant whose mother received narcotics within 4 hours of birth. It is important to establish and maintain adequate ventilation and circulation before administration of naloxone.
  - **Dose:** 0.1mg/kg of a 0.4mg/mL solution given intramuscularly or intravenously
  - **DO NOT** administer Naloxone to infants born to women suspected of narcotic dependence. This may cause abrupt withdrawal and seizures.

• **Bicarbonate** is only used in the case of prolonged resuscitation, unresponsive to other therapy. It should be given only after establishment of adequate ventilation and circulation. Treatment of persistent metabolic acidosis should be directed by arterial blood gas level or serum chemistries,
  - **Dose:** 1-2 mEq/kg of a 0.5mEq/mL solution. Dilute in equal volume with water for injection, give by slow intravenous push over at least 2 minutes.
  - **DO NOT** give bicarbonate via endotracheal tube.
  - Sodium Bicarbonate is not routinely stocked in the resuscitation trolley. If needed, it would need to be retrieved from the medication room in the nursery.

• **Post Resuscitation Care**
  - Report and record events accurately
  - Obtain cord arterial pH for neonates needing active resuscitation
  - Report immediately to neonatal registrar/Paediatric RMO if arterial gas is <7.15
  - Newborns Intubated and extubated at delivery or cord arterial pH less than 7.10 requires admission to Newborn Care Centre for formal observations for at least 2 hours and may be discharged after documented review by the medical staff
  - Newborns who received Naloxone at birth require observation for at least 4 hours in Newborn Care Centre
  - Newborns who required resuscitation are at risk for delayed perinatal adaptation of multiple organs (monitor respiratory status, monitor hypoglycaemia, consider need for antibiotics)
  - Insert an orogastric tube (Size 8FG) to aspirate and decompress the stomach of any newborn that required prolonged ventilation
  - Invite the father (if present) of the newborn to accompany the resuscitation team and newborn to Newborn Care Centre
  - Consult with the Medical Fellow/Consultant and consider discontinuation of resuscitative efforts if the infant with cardiorespiratory arrest does not result in spontaneous circulation (measurable heart rate) by 15 minutes of adequate resuscitation after discussion with consultant on call. Recommendation from latest ILCOR guidelines: Appropriate to consider stopping resuscitation in a newborn baby with no detectable heart rate for 10 minutes (decision to continue resuscitation for longer than 10 mins may be influenced by infant’s gestation, etiology of arrest, potential reversibility of situation and parental feelings about acceptable risk of morbidity). Insufficient evidence to guide duration of continued resuscitation for newly born infants with heart rate <60bpm persisting after 10 or 15 minutes.

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NEONATAL RESUSCITATION GUIDELINES AT DELIVERY   cont’d

6. HAZARDS/SUB-OPTIMAL OUTCOMES
   • Inappropriate or inadequate level of resuscitation to neonates
   • Neonatal mortality and morbidity
   • Delayed reaction to calling neonatal resuscitation team
   • Delayed response to code blue calls

7. DOCUMENTATION
   • Neonatal resuscitation record
   • Progress notes
   • Neonatal notes
   • Partogram (if at time of birth)
   • Obstetric database

8. EDUCATIONAL NOTES
   • It is mandatory for all health care professionals involved in the direct care of neonates to attend a teaching and assessment session annually
   • Drugs are rarely indicated in resuscitation of the newborn infant as bradycardia is usually the result of inadequate lung inflation or profound hypoxia. Adequate ventilation is the most important step in correcting bradycardia
   • Vigorous and prolonged tracheal suctioning of the infant with meconium stained fluid does not improve clinical outcomes and may cause complications
   • Preventing heat loss in the newborn is vital because cold stress can increase oxygen consumption and impede effective resuscitation
   • Tracheal route may be used for administration of adrenaline only
   • The umbilical vein is the most accessible intravenous route for volume expansion, adrenaline and bicarbonate
   • This guideline is based on the Australian Resuscitation Council (ARC) guideline and the International Liaison Council On Resuscitation (ILCOR) guidelines

9. RELATED RHW POLICIES/ PROCEDURES
   • Care of the baby in Delivery Suite
   • Observations of the Newborn
   • Admission of the Newborn to the postnatal ward

10. REFERENCES
    • Australian Resuscitation Council Guidelines, (December 2010). Resuscitation of the newborn.
    • International Guidelines for Neonatal Resuscitation (2011) (BOOK)
NEONATAL RESUSCITATION GUIDELINES AT DELIVERY  cont’d

- NSW Health Circular 2002/30. Framework for area health services to develop policy and procedures relating to clinical care and resuscitation of the newly born infant.
- NSW Health Circular 2002/73. Observation and management of newborn infants with respiratory maladaptation to birth, including infants exposed to intrapartum opioids administered to the mother during labour.
- Wyllie J. Recent changes to UK Newborn Resuscitation Guidelines. Arch Dis Child ADC-FNN Online First, published on November 9, 2011 as 10.1136/archdischild-2011-300586

……./tables,figures
### Table 1. LEVEL OF PAEDIATRIC ATTENDANCE AT BIRTH

<table>
<thead>
<tr>
<th>RISK FACTOR</th>
<th>MINIMAL LEVEL OF ASSISTANCE REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antepartum and/or Intrapartum haemorrhage</td>
<td>Paediatric Registrar</td>
</tr>
<tr>
<td>Abnormal amniotic fluid index and/or abnormal Doppler flow studies</td>
<td>Paediatric Registrar</td>
</tr>
<tr>
<td>Anaemia or isoimmunization</td>
<td>Paediatric Registrar</td>
</tr>
<tr>
<td>Cardiotocograph (CTG) Suspicious Pathological</td>
<td>Paediatric RMO Paediatric Registrar</td>
</tr>
<tr>
<td>Chorioamnionitis</td>
<td>Paediatric RMO</td>
</tr>
<tr>
<td>Chronic maternal illness</td>
<td>Attending midwife</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>Paediatric Registrar</td>
</tr>
<tr>
<td>Elective Caesarean, non general anaesthetics</td>
<td>Resuscitation nurse</td>
</tr>
<tr>
<td>Emergency caesarean according to risk factor</td>
<td>Depends on indication for caesarean – at least Paediatric RMO</td>
</tr>
<tr>
<td>Fetal abnormality (minor)</td>
<td>Paediatric RMO unless other risk factors</td>
</tr>
<tr>
<td>Fetal abnormality (major)</td>
<td>Paediatric Registrar</td>
</tr>
<tr>
<td>Fetal Blood Sampling of &lt;7.20</td>
<td>Paediatric Registrar</td>
</tr>
<tr>
<td>General anaesthesia</td>
<td>Paediatric RMO</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Attending midwife</td>
</tr>
<tr>
<td>Instrumental delivery</td>
<td>Paediatric RMO</td>
</tr>
<tr>
<td>Intra uterine growth restriction</td>
<td>Paediatric RMO</td>
</tr>
<tr>
<td>Malpresentation</td>
<td>Paediatric RMO</td>
</tr>
<tr>
<td>Maternal diabetes</td>
<td>Attending midwife</td>
</tr>
<tr>
<td>Maternal drug therapy eg. Magnesium Sulphate</td>
<td>Attending midwife</td>
</tr>
<tr>
<td>Maternal substance abuse</td>
<td>Attending midwife</td>
</tr>
<tr>
<td>Meconium &gt; Grade 1 <em>(Grade 1 = non-particulate meconium present in a good volume of amniotic fluid)</em></td>
<td>Paediatric RMO</td>
</tr>
<tr>
<td>Multiple gestation</td>
<td>Paediatric RMO and Paediatric Registrar and neonatal intensive care nurse if other risk factors</td>
</tr>
<tr>
<td>Narcotics administered to mother within 4 hours of birth</td>
<td>Attending midwife</td>
</tr>
<tr>
<td>No antenatal care</td>
<td>Attending midwife</td>
</tr>
<tr>
<td>Placental and cord accidents (eg. cord prolapse or placental abruption )</td>
<td>Paediatric Registrar</td>
</tr>
<tr>
<td>Pre-eclampsia</td>
<td>Attending midwife</td>
</tr>
<tr>
<td>Prematurity &lt;32 weeks</td>
<td>Neonatal Consultant or Fellow and Paediatric Registrar and Neonatal Intensive care Nurse</td>
</tr>
<tr>
<td>Prematurity 32 weeks to 37 weeks</td>
<td>Paediatric Registrar and Paediatric RMO</td>
</tr>
<tr>
<td>Prolong rupture of membranes at term</td>
<td>Attending midwife</td>
</tr>
<tr>
<td>Prolonged second stage of labour (&gt;2 hours)</td>
<td>Attending midwife</td>
</tr>
<tr>
<td>Shoulder dystocia</td>
<td>Paediatric registrar</td>
</tr>
<tr>
<td>Hydrops Fetalis</td>
<td>Paediatric Registrar and Fellow/consultant</td>
</tr>
<tr>
<td>Assisted delivery with Forceps/Vacuum</td>
<td>Paediatric RMO</td>
</tr>
</tbody>
</table>
Figure 1. Algorithm for resuscitation of the newborn infant

Figure 2. Algorithm for difficult airways where extra assistance is needed from SCH

EMERGENCY AIRWAY MANAGEMENT
Beyond Code Blue at RHW

In the event of needing further airway assistance from SCH, please follow this plan.

As requested by RHW Registrar:-

1. Dial 777 "Code Blue Paediatric" RHW, stating location details

2. Nursing Staff to contact both CICU Registrar (on Ext 21140 or Page on # 44182) and SCH Anaesthetic Registrar (Page on # 44166) to request urgent airway assistance at RHW and state exact location.

In the event of CICU Registrar needing help with urgent resuscitation of preterm, the CICU Team Leader may

1. Call RHW Neonatal Registrar direct on Ext 26174 or Page on # 44063