Neonatal Resuscitation

Clinical Guideline Presentation v6.0

45 minutes
Towards CPD Hours
## Abbreviations

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Abbreviation</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>&lt;</td>
<td>Less than</td>
<td>GA</td>
<td>General anaesthesia</td>
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<tr>
<td>&gt;</td>
<td>Greater than</td>
<td>Hb</td>
<td>Haemoglobin</td>
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<tr>
<td>AP</td>
<td>Anteroposterior</td>
<td>HR</td>
<td>Heart rate</td>
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<tr>
<td>BP</td>
<td>Blood pressure</td>
<td>IV</td>
<td>Intraventricular</td>
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<tr>
<td>bpm</td>
<td>Beats per minute</td>
<td>IVH</td>
<td>Intraventricular haemorrhage</td>
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<tr>
<td>CDH</td>
<td>Congenital diaphragmatic hernia</td>
<td>LMA</td>
<td>Laryngeal mask airway</td>
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<tr>
<td>CHD</td>
<td>Congenital heart disease</td>
<td>PEEP</td>
<td>Positive end expiratory pressure</td>
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<tr>
<td>CPAP</td>
<td>Continuous positive airway pressure</td>
<td>PIP</td>
<td>Positive inspiratory pressure</td>
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<tr>
<td>CTG</td>
<td>Cardiotocograph</td>
<td>PPH</td>
<td>Postpartum haemorrhage</td>
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<tr>
<td>ETT</td>
<td>Endotracheal tube</td>
<td>PPV</td>
<td>Positive pressure ventilation</td>
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<tr>
<td>FGR</td>
<td>Fetal growth restriction</td>
<td>ROM</td>
<td>Rupture of membranes</td>
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Objectives

• Outline preparation for neonatal resuscitation
• Identify maternal, fetal and intrapartum risk factors
• Outline best practice for management of airway, breathing and circulation
• Recognise ethical considerations for neonatal resuscitation
• Outline care after resuscitation
Clinician skills/responsibilities

• All births
  ◦ At least one clinician responsible for baby with basic neonatal resuscitation skills present
  ◦ Clinician with advanced skills available

• High risk births
  ◦ Clinician with advanced skills present
  ◦ More than one clinician present

• Caesarean
  ◦ Same as vaginal births
Maternal risk factors

- Prolonged ROM (>18 hours)
- Bleeding in second or third trimester
- Hypertension in pregnancy; diabetes mellitus; chronic illness
- Substance use; prescribed medication; heavy sedation
- Pyrexia; infection; chorioamnionitis
- Previous fetal or neonatal death
- No/minimal antenatal care
Fetal risk factors

- Multiple gestation
- Preterm; post term
- FGR; large for dates
- Polyhydramnios; oligohydramnios
- Haemolytic disease; hydrops fetalis
- Reduced fetal movements
- Congenital abnormalities
- Infection
Intrapartum risk factors

• Abnormal CTG
• Abnormal fetal presentation; cord prolapse
• Prolonged labour; precipitate labour
• Antepartum haemorrhage
• Meconium in liquor
• Narcotic administration within 4 hours of birth; GA
• Assisted vaginal birth
Communication and information sharing

- Maternal history—pre-existing or pregnancy related conditions, medication
- Fetal/neonatal—assessments of wellbeing, reason if high risk
- Parents—discuss proposed plan, include in decision making, respond to questions, debrief
- Documentation—contemporaneous
Cord clamping

Vigorous baby ≥ 34 weeks gestation

• Clamping for ≥ 60 seconds associated with:
  ◦ Increased placental transfusion
  ◦ Increased cardiac output
  ◦ Higher and more stable BP
  ◦ Higher Hb and iron status in infancy
  ◦ Increased incidence of jaundice
Cord clamping

Vigorous baby < 34 weeks gestation

• Clamping for at least 30 seconds associated with:
  ◦ Improved neonatal survival risk
  ◦ Increased blood volume
  ◦ Reduced need for inotropes
  ◦ Increased and stabilised BP during stabilisation and at 4 hours of age
  ◦ Improved haematology—reduced need for transfusion
Cord clamping

Compromised baby any gestation

• Resuscitation takes precedence
• Consider maternal, fetal and placental conditions:
  ◦ Relative contra-indications to delaying clamping—severe PPH, twin anaemia polycythaemia syndrome
Cord milking

- ≥ 34 weeks—insufficient evidence of benefit to recommend
- 28–33+6 weeks and if/when? immediate resuscitation not required—may be a reasonable alternative
- < 28 weeks gestation not recommended
Newborn Life Support

At all stages ask: do you need help?

Term gestation? Breathing or crying? Good tone?
- **YES**: Stay with Mother
- **NO**: Maintain normal temperature, Ongoing evaluation

Maintain normal temperature. Ensure open airway, Stimulate

HR below 100? Gasping or apnoea?
- **YES**: Positive pressure ventilation, SpO₂ monitoring
- **NO**: Laboured breathing or persistent cyanosis?
  - **YES**: Ensure open airway, SpO₂ monitoring, Consider CPAP
  - **NO**: Post-resuscitation care

HR below 100?
- **YES**: Ensure open airway, Reduce leaks, Consider: Increase pressure & oxygen, Intubation or laryngeal mask
- **NO**: Targeted pre-ductal SpO₂ after birth
  - 1 min: 60-70%
  - 2 min: 65-85%
  - 3 min: 70-90%
  - 4 min: 75-90%
  - 5 min: 80-90%
  - 10 min: 85-90%

HR below 60?
- **YES**: Three chest compressions to each breath, 100% oxygen, Intubation or laryngeal mask, Venous access

HR below 60?
- **YES**: IV Adrenaline, Consider volume expansion

Targeted pre-ductal SpO₂ after birth

IV Adrenaline 1:10,000 solution

<table>
<thead>
<tr>
<th>Gestation (weeks)</th>
<th>Dose</th>
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<tr>
<td>23-26</td>
<td>0.1 mL</td>
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<tr>
<td>27-37</td>
<td>0.25 mL</td>
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<tr>
<td>38-43</td>
<td>0.5 mL</td>
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</table>

10-30 microg/kg (0.1-0.3 mL/kg)
If heart rate, oxygenation, breathing & tone do not improve or baby is deteriorating

Correct any problems with the airway and/or assisted ventilation then

Progress to the next step of resuscitation
Initial assessment

• Tone
  ◦ Good tone, moving limbs and flexed position—less likely to require resuscitation
  ◦ Poor tone/floppy, not moving, extended position—more likely to need active resuscitation

• Breathing

• HR
Oxygen saturation monitoring

More accurate than visual assessment of colour

- HR and oximetry can be achieved within 90 seconds of birth
- Pre-ductal right hand or wrist:
  - Measures brain and coronary artery blood supply
  - Obtained more rapidly—pre-ductal vessels better perfused, have higher blood pressure and higher oxygenation
Attaching pulse oximeter

- Use an oximeter designed to reduce movement artefact
- Use a neonatal sensor
  - Attach to baby as soon as possible after birth
- Attaching the cable:
  - Plug cable into machine without sensor lead attached and turn on
  - Attach sensor to cable
## Target oxygen saturation levels

<table>
<thead>
<tr>
<th>Time from birth</th>
<th>Target oxygen saturation</th>
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<tbody>
<tr>
<td>1 minute</td>
<td>60–70%</td>
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<tr>
<td>2 minutes</td>
<td>65–85%</td>
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<tr>
<td>3 minutes</td>
<td>70–90%</td>
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<tr>
<td>4 minutes</td>
<td>75–90%</td>
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<tr>
<td>5 minutes</td>
<td>80–90%</td>
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<tr>
<td>10 minutes</td>
<td>85–90%</td>
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<tr>
<td>After 10 minutes of age</td>
<td>Term baby: 94%</td>
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<tr>
<td></td>
<td>Preterm baby: 90–95%</td>
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</table>
Care of baby

Drying and stimulation are assessment and resuscitative measures

• Support head in neutral position
• Careful handling and protection of skin
  o Preterm at greater risk of skin and internal organ damage
• Use alcohol containing solutions sparingly
Thermoregulation

• Target normal body temperature for all babies
  ◦ 36.5 °C–37.5 °C

• Oxygen consumption increased when:
  ◦ Cold stressed–temperature < 36.5 °C
  ◦ Hypothermic–temperature < 36.0 °C
Airway management

Effective ventilation is key to successful resuscitation

• Commence PPV by one minute of age if:
  ◦ Effective spontaneous respirations not established
  ◦ HR does not increase to above 100 bpm
Manual ventilation devices

• Facemask—appropriate size, seal around mouth and nose
• Laryngeal mask airway—size 1 for ≥ 34 weeks gestation (up to 5 kg)
• T-piece device—requires pressurised gas source; have self-inflating bag available
• Self-inflating bag—cannot effectively deliver CPAP, PEEP or sustained inflation breath
• Flow inflating (anaesthetic bag)—requires pressurised gas source
Supplemental oxygen

• Commence PPV:
  ◦ Term: in air (21% O₂)
  ◦ Preterm: in air–30% oxygen
• Titrate oxygen based on SpO₂
• If chest compressions commenced, increase oxygen to 100%

Practice tip
Use a oxygen/air blender if available
Positive pressure ventilation

• Rate:
  ◦ 40–60 breaths per minute

• Pressures:
  ◦ PEEP 5 cmH₂O
  ◦ PIP
    ▪ Term: 30 cmH₂O
    ▪ Preterm: 20–25 cmH₂O
Effectiveness of PPV

• Confirmed by observing:
  ◦ HR >100 bpm
  ◦ Slight rise in chest and upper abdomen with each inflation
  ◦ Improvement in oxygen saturation
CPAP

• Indicated for baby
  ◦ Breathing spontaneously with laboured breathing/respiratory distress
  ◦ Breathing but not meeting oxygen saturation targets

• Use 5–8 cmH₂O
  ◦ Use facemask or nasal prongs
Endotracheal intubation

• Indications:
  ◦ Unsuccessful face mask or supraglottic airway (e.g. LMA™ ventilation)
  ◦ HR remains low
  ◦ Oxygen saturations falling or failing to rise
  ◦ Prolonged mask ventilation
  ◦ Special circumstances (e.g. diaphragmatic hernia)
  ◦ Baby has no detectable heart rate at birth
ETT position correct

- Chest moves with each inflation
- HR increases to above 100 bpm
- Oxygen saturations improve
- Other:
  - Visualisation of ETT passing through cord
  - Condensation on inside of ETT on exhalation
  - Colour change with paediatric end tidal CO₂ detector
  - Symmetrical air entry over lung fields on auscultation
Chest compressions

- Not substitute for effective ventilation
- Increase oxygen to 100%
- Insert UVC or IV

- Two thumb technique preferred (two clinicians) or two fingers over lower third of sternum (single clinician)
- Depth one third of AP diameter of chest
- Rate 90 per minute
- Ratio 3:1 (90 compressions:30 breaths per minute)
Medications and fluids

- Rarely indicated for neonatal resuscitation
- Continue PPV and chest compressions
- UVC is preferable route
Adrenaline (epinephrine)

- Indication:
  - HR < 60 bpm

- Route:
  - UVC (preferred route)

Dose (vascular):
- 1:10,000
- 0.01–0.03 mg/kg (equates to 0.1–0.3 mL/kg)

- Repeat:
  - Every 3–5 minutes as indicated

**Practice tip**
ETT route has different dose and administration recommendations from vascular route.
Volume expanding fluids

- Use isotonic crystalloid (0.9% sodium chloride)
- Indications:
  - Suspected blood loss
  - Shocked baby (pale, poor perfusion, weak pulses) and not responding to other resuscitative measures
Blood products

• Rarely required
• Blood products (Group O RhD negative) blood
• Indications:
  ◦ Critical blood loss
  ◦ Baby not responding to resuscitation (may be occult blood loss)
Preterm baby

Temperature management

• If < 28 weeks
  ◦ Do not dry
  ◦ Place in polyethylene/plastic bag (up to neck)
  ◦ Cover head with hat/bonnet
Preterm baby

Initiation of respiratory support

• Sustained inflation breath not recommended

• If breathing spontaneously and showing signs of respiratory distress
  ◦ Commence CPAP in baby < 32 weeks
  ◦ Use at least 5 cmH$_2$O (no more than 8 cmH$_2$O)

• Air or oxygen–air blend up to 30%
  ◦ Titrate to SpO$_2$
Special circumstances

• Consider other special requirements for:
  ◦ Multiple pregnancy
  ◦ Pneumothorax
  ◦ Pleural effusion/ascites/fetal hydrops
  ◦ Pneumonia/sepsis
  ◦ Fetal haemorrhage
  ◦ Congenital anomalies—(e.g. upper airway obstruction, CDH, CHD, abdominal wall defects)
Cord blood gas sampling

• Cord blood gas sampling when:
  ◦ Baby has required resuscitation
  ◦ Apgar < 4 at one minute or < 7 at 5 minutes
  ◦ Fetal blood sampling in labour

• Collect paired samples (umbilical vein and umbilical artery)

• Interpretation:
  ◦ If cord arterial pH is low, relative risk of neonatal encephalopathy increased
Ethical considerations

• Initiating resuscitation:
  ◦ Consistent approach by all clinicians
  ◦ Discuss with parents and involve them in decision making

• If in doubt or unexpected anomalies—initiate resuscitation until full clinical picture available and discussions occur with parents
Initiating resuscitation

Clinicians and parents together decide to withhold or withdraw treatment based on futility and best interests of baby

<table>
<thead>
<tr>
<th>If <strong>high</strong> rate of survival and <strong>acceptable</strong> morbidity</th>
<th>Resuscitation usually indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>If <strong>borderline</strong> survival and <strong>high</strong> rate of morbidity with prognosis uncertain and burden to child high</td>
<td>Support parent’s views</td>
</tr>
<tr>
<td>If almost <strong>certain</strong> death and <strong>unacceptable</strong> high morbidity as indicated by gestation, birth weight or congenital anomaly</td>
<td>Resuscitation not indicated</td>
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</table>
“If, despite provision of all the recommended steps of resuscitation and excluding reversible causes, a newborn baby requires ongoing cardiopulmonary resuscitation (CPR) after birth, [ANZCOR] suggests discussion of discontinuing resuscitative efforts with the clinical team and family.... a reasonable timeframe to suggest this change in goals of care is around 20 minutes after birth”

Discontinuing resuscitation

• May be influenced by:
  ◦ Presumed diagnosis
  ◦ Gestation of baby
  ◦ Presence or absence of complications
  ◦ Parent(s) views regarding acceptable risk of morbidity
Withholding/withdrawing resuscitation

• Care in the best interests of baby
• Focus on baby’s dignity, and comfort if signs of life present
• Support parents
Support for family

• Keep parents informed during and after resuscitation
• Facilitate early and regular contact with baby
• Facilitate referrals to support services/groups as indicted
• Provide relevant written parent information (e.g. QCG *Newborn resuscitation*)