British Association of Perinatal Medicine

The British Association of Perinatal Medicine DRAFT Neonatal Airway Safety Standard

Appendix A: Airway Skills Training and Assessment Tools

November 2023

Contents

Background

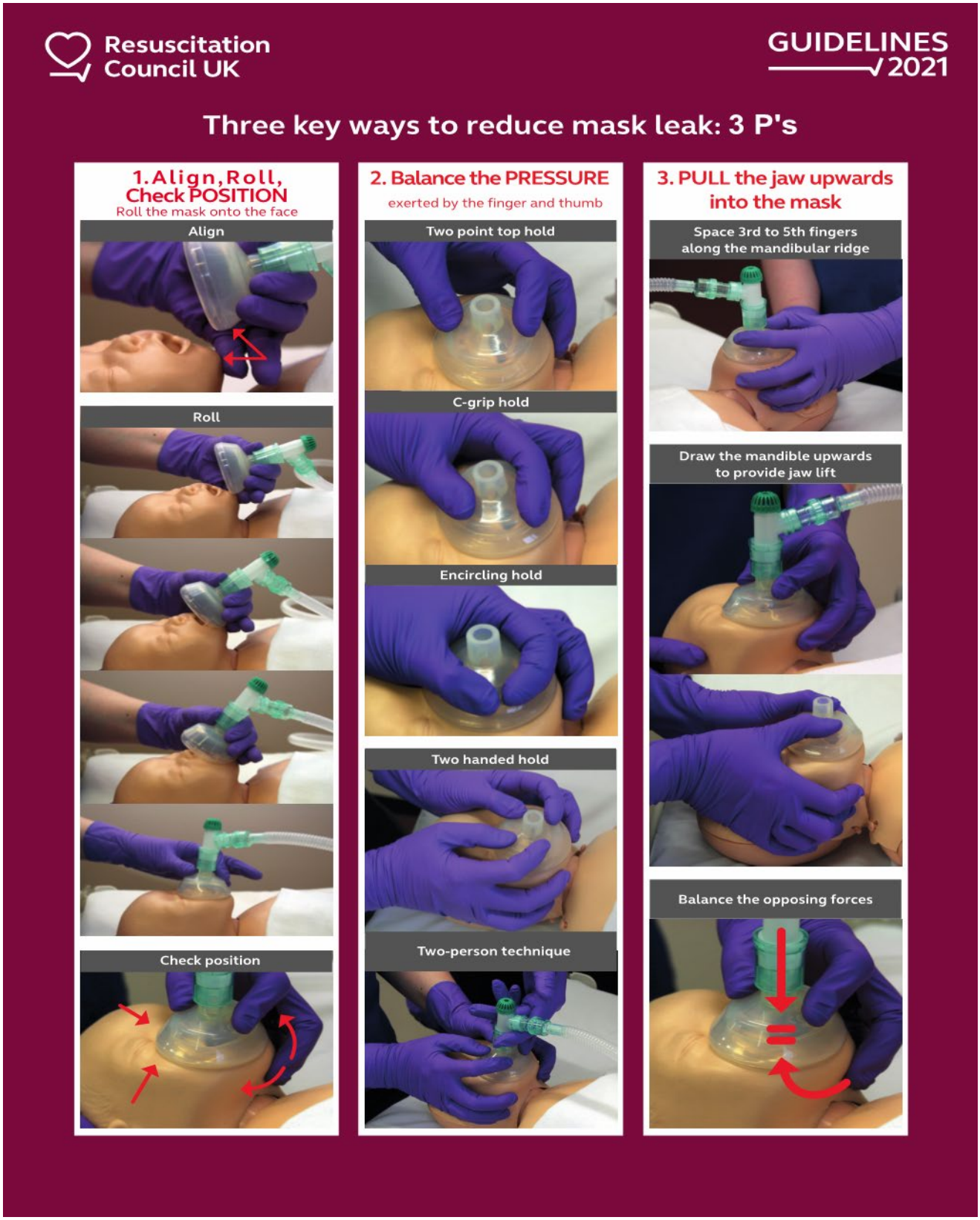
- These resources are intended to support local Neonatal Airway Leads with a structured simulated approach to teaching and assessing the airway skills outlined in this BAPM document.
- For Basic, Standard and Intermediate capability we summarise the key indications, techniques for sizing and insertion of the different airway adjuncts and provide a simulation scenario.
- Training should ideally be delivered using a recognised structured clinical skill teaching method e.g. 3 or 4 stage technique.
- These clinical skills drills are not intended to replace real life experience and are not sufficient in the absence of real-life clinical experience to achieve airway competencies.
- Inexperienced practitioners should continue to be observed, supported, and receive feedback from more experienced colleagues in clinical situations, even if competency is assessed to be satisfactory on a manikin or in a simulation scenario.
- Although there is use of NLS/ ARNI reference materials and principles of airway management to allow consistency of approach, use of this support material does **not** confer NLS or ARNI provider status.

Airway Skills Training

Facemasks

- Position baby with head in neutral position.
- A guide to facemask size based on measurements from preterm infants[1] is shown in Appendix C: Airway Equipment and Initial Respiratory Support Settings.
- This provides a starting point for choosing an appropriately sized facemask, but the position should always be checked using 3Ps technique (see below) to ensure correct individual sizing.
- Demonstrate correct method of applying facemask using 'align, roll, check' method as per NLS guidance[2].
    - Once facemask is in place, demonstrate how position of mask and airway is checked and maintained using 3 Ps- check **position** of mask, **pressure** on facemask (check mask is evenly applied with downward pressure, and jaw thrust is maintained by **pulling** jaw up by placing 3rd, 4th and 5th digits along angle of jaw, being careful not to apply pressure to soft tissues – see 3Ps poster below).
- Allow practitioners to have further practice at applying facemask and maintaining airway position, using both jaw thrust and two-person technique. Take opportunity to critique and correct technique where appropriate.
- Emphasise the importance of removing the facemask entirely and starting the 'align, roll, check' from scratch every time any correction of mask position is required.
- If available, use modified 'leak free' BLS manikin with hardware to measure mask pressure and facemask leak to provide independent feedback on effective mask technique.
- Ensure practitioners are aware that application of a facemask for respiratory support causes apnoea in a large proportion (54%) of preterm infants <32 weeks (possibly by triggering the trigeminocardiac reflex leading to apnoea and bradycardia) and this effect is gestational age dependent. Even in infants >34 weeks, 11% infants were shown to stop breathing following application of a facemask [3, 4]. The response is most pronounced when the facemask is first applied[5].
- A similar rate of apnoea occurs in preterm infants when binasal prongs are applied[6].

Resuscitation Council UK: Three key ways to reduce mask leak: 3 P's



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Laryngeal Mask

Laryngeal masks (Laryngeal mask airways (LMA) or i-gel) create a seal around the glottic opening.

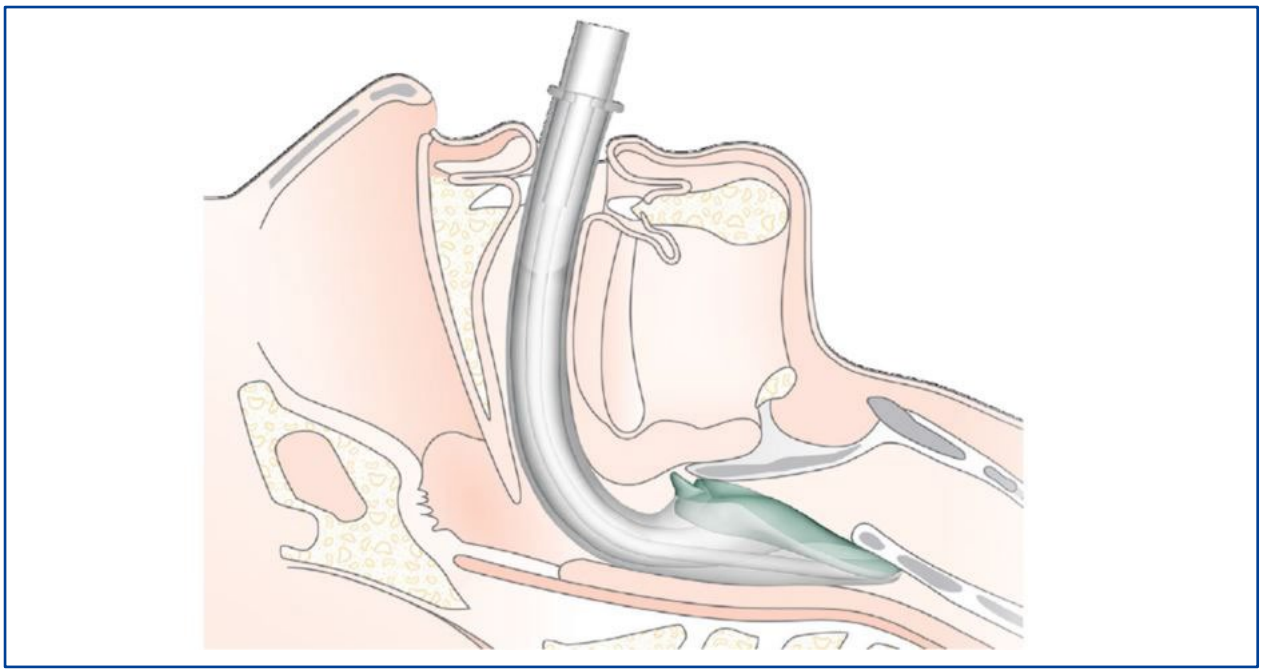

Image © Intersurgical AB.

They are useful when:

- there is difficulty getting chest wall movement with facemask ventilation
- as an alternative to tracheal intubation: LM provides a more secure airway if needed but the personnel immediately available are not competent at intubation OR if intubation is not possible.

It is important to note that Laryngeal masks (LM) are superior to ongoing mask ventilation and LM may often safely avoid the need for emergency intubation[7].

Sizing

- Size 1 LM is recommended (with manufacturers guidance) for use in babies >2kg and/or ≥34weeks.
- Smaller sized LMs are now being manufactured although experience with these devices is very limited currently.
- Studies investigating LM for surfactant administration have included patients down to 1kg with case reports down to 800g[8, 9, 10, 11]. Suggestions for considered use of LM outside manufacturers guidance, where intubation has failed or where advanced intubation skills are not immediately available, are shown in Appendix D: Airway Equipment and Initial Respiratory Support.
- Use of LM in smaller infants may be associated with increased risk of adverse events (see below) but that this must be balanced against the known risks of adverse events associated with attempted intubation or LISA administration, particularly when the operator is less experienced.

Risks of LM

Potential risks of using LM, particularly in smaller babies, include airway obstruction, gastric distension due to inadequate seal, trauma to the oropharynx, upper airway, and oesophagus.

Preparation

- **LMA:**
  - Check the cuff inflates (where applicable) by attaching a syringe and inflating the specified amount of air (found on packaging or side of LMA tube).
  - Then deflate the cuff. The LMA should be inserted with the cuff fully deflated.
  - Some more recent LMA designs do not have a manually inflatable cuff, and are self-pressurising during positive pressure ventilation.
  - Lubricate the cuff of the laryngeal mask (taking care not to obscure the airway).
- **i-gel**
  - An i-gel does not have an inflating cuff.
  - The cuff should be lubricated, taking care not to obscure the airway opening.

Insertion

- Use same technique for insertion of both the LMA and i-gel.
- Hold LM like a pen.
- At delivery a laryngoscope should be used to move the tongue away, optimise mouth opening and allow identification and removal of material in the oropharynx which may cause obstruction.
- Outside the delivery room, use of a laryngoscope is discretionary, provided the airway is known to be unobstructed.
- Insert the LM into the mouth. Slide along the hard palate. Advance the device and it will pass along the soft palate, the posterior pharyngeal wall until it stops just beyond the base of the tongue (you will feel some resistance) with the tip sitting at the top of the oesophagus and the airway orifice of the device anterior to this – over the glottis (see image above).
- A useful tip is that the passage of the LM is akin to it being swallowed and avoiding all the anterior superior airway structures (tongue, epiglottis and glottis).
- The LM cuff should be inflated (where applicable). Upon inflation, the laryngeal mask airway will be seen to protrude slightly further outwards from the mouth. Do not overinflate – this will make the seal worse.

Confirming position

- Exhaled carbon dioxide confirms that the airway device is in the airway and is ventilating the lungs sufficiently that alveolar CO2 is being exhaled. Exhaled CO_2 can be detected by two methods.
  - A CO2 colorimetric detector, most commonly Pedi-Cap® (Nellcor/Medtronic, Minneapolis MN) (1-15kg) and Neo-StatCO2® (Mercury Medical, Clearwater FL) (2.5-6kg) should be used to assess for effective ventilation (remind practitioners that colour change may not be seen if there is very poor cardiac output, even if airway is correctly positioned so other methods will be needed to confirm correct position and lung ventilation). There are other reasons why false positives and negatives may occur.
  - If available, capnography (continuous CO2 waveform measurement over time) can be used instead. Exhaled CO2 should be seen even in low cardiac output states (see Appendix C & D).
- Attach a T-piece or self-inflating bag.
- Observe for chest wall movement, auscultate for equal air entry.
- The LM can be secured using tapes or ties (see image below).

Image showing iGel in position and fixed using tapes.

Image reproduced with kind permission of Joyce O'Shea.

See Additional Resources for link to videos on technique for laryngeal mask insertion.

Oropharyngeal airway

- Used to open the airway from mouth to oropharynx.
- LM is preferred option for a more secure airway in a non-intubated infant, but the oropharyngeal airway may be used as an alternative.
- Cautious use in preterm infants. Be careful with sizing and be aware that oropharyngeal airways have been shown to cause obstruction in infants below 34 weeks. There are no RCTs examining their use in term babies.
- Use of the wrong size or pushing the tongue back may also cause airway obstruction.
- May be useful in maintaining airway patency in babies with orofacial abnormalities.

Sizing
It is very important to size an oropharyngeal airway correctly. Incorrectly sized, it can cause or worsen airway obstruction, or the tube will occlude on the base of the tongue.

Oropharyngeal airways for neonatal use are available in 4, 5 and 6cm.

Size	Length	Colour
00	40mm	green
0	50mm	blue
1	60mm	grey

The airway should measure from the flange at the middle of the lips, with the end of the airway sitting at the angle of the jaw when laid on the face with the convex side up (see image).

The position for measuring the oropharyngeal airway is demonstrated in the image below.

Insertion

- The airway is inserted in a downward curve in the orientation that it will lie within the airway.
- Use a laryngoscope (or tongue depressor if laryngoscope not available) to move the tongue out of the way during insertion.
- Slide the airway over the tongue, following the path of the oral cavity.

Confirming the correct position

- The distal tip of the oropharyngeal airway should reach just beyond the base of the tongue, with the proximal flange sitting just outside the lips.
- Once inserted, reapply the facemask and deliver inflation breaths, checking for chest wall movement and/or improvement in heart rate and oxygen saturations
- If the chest does not move, the oropharyngeal airway must be removed. There is evidence that in some cases in preterm babies, an oropharyngeal airway can cause airway obstruction, even when correctly sized and sited. Therefore, CO2 detection and chest wall movement as evidence of air entry is essential. The oropharyngeal airway must be removed if there is any doubt over ability to ventilate.

Ventilation breaths

- Initial Respiratory settings are shown in Appendix D.
- Maintain head in neutral position and ensure jaw thrust is maintained.
- Assess for chest wall movement continuously during delivery of inflation and any ongoing ventilation breaths.
- If there is a heart rate response and chest wall movement is seen, continue ventilation breaths until baby is breathing regularly and heart rate is >100 bpm.
- Ongoing ventilation breaths should be at a rate of about 30 per minute aiming for a 1 second inflation time. Inflation pressure may be reduced if good chest wall movement.

Troubleshooting airway and ventilation difficulties

If there is no chest wall movement and no improvement in heart rate after initial inflation breaths:

- Reassess airway and facemask position/seal as described above and repeat inflation breaths.
- Consider using a 2-person technique if personnel available.
- Could the airway be obstructed? Use laryngoscope blade to view the pharynx and suction any visible material causing obstruction. Do not do a blind finger sweep.
- Insert LM if ongoing difficulties or need for ongoing ventilatory support.
- Consider whether higher inflation pressures are needed - only increase slowly.
- Could there be a Pneumothorax or bilateral pneumothoraces?
- Check all equipment is working and keep an eye on the gas supply if applicable.
- Call for help/ activate difficult airway pathway.

CPAP/ nHFT

- Firstline support for a preterm baby who is breathing[12].
- Gentle stimulation (stroking the chest or foot) can be helpful to support establishment of regular respiration and is preferable to giving ventilatory breaths.
- Can be given via facemask or nasal prongs/mask.
- Use initial PEEP 6-8 cm H2O / nHFT 6-8L[13, 14] (see Appendix D).
- To be aware that trigeminocardiac reflex may also be stimulated by use of nasal prongs as well as application of facemask[15].
- For extremely preterm infants <29 weeks, using a respiratory support system with low imposed work of breathing and short binasal prongs during stabilization compared with T-piece resuscitator and facemask, decreased delivery room intubation and was safe and feasible[16].
- Use of nHFT during intubation improves the likelihood of successful intubation on the first attempt without physiological instability (NNT 6) and this intervention is strongly recommended during intubation for all neonates[17].
- Oxygen therapy should be used to keep saturations as near the upper end of the normal preterm target range as possible ie 95%. Higher saturations can be targeted where a difficult airway is anticipated.

Tracheal intubation

Indications for tracheal intubation

- If the trachea or larynx is blocked with meconium or particulate matter.
- Provides a secure airway, either in prolonged resuscitation or for transfer.
- To allow delivery of ongoing ventilation.

Knowledge of Anatomical Structures

Intubation failure is most commonly due to failure to recognise anatomical structures and this should be a focus during training. Video recordings of successful and unsuccessful intubations are included in Additional Resources and interactive discussion of the structures seen during these videos may be helpful to support trainee familiarisation with laryngoscopy views.

Use of Video-laryngoscope

- Use of a video laryngoscope is strongly recommended both for supervising inexperienced intubators and in routine clinical practice.
- Use of video-laryngoscopy compared with direct laryngoscopy has a lower risk of tracheal intubation associated adverse events[18, 19, 20, 21] and increases the likehood of success[22, 23].
- See Appendix B: Teaching using the video laryngoscope - Hints and Tips.

Medications for intubation

- Premedication should be used for all non-emergency neonatal intubations as this is a distressing and painful invasive procedure.
- There are very few situations outside of the delivery room that do not allow time for medications to be prepared and administered.
- Premedication consisting of a vagolytic to prevent bradycardia, an analgesic for pain control, and a neuromuscular blocking agent for paralysis improves intubating conditions, decreases the number of intubation attempts and minimises adverse events[24, 25].
- Medication choice should be dictated by local protocols.
- All intubators should have a good working knowledge of the pharmacological properties and side-effects of commonly used premedication drugs. An HEE e-learning module is currently being developed to support this.

Sizing of tracheal tube

- Tracheal tubes are sized by their internal diameter in millimetres.
- There is variation in wall thickness and therefore outside diameter in different tubes from different manufacturers.
- A guide to length and sizes of tracheal tubes is shown in Appendix D.
- Using a checklist has been shown to reduce tracheal intubation related adverse events such as significant hypoxia, bradycardia, airway and pharyngeal damage in neonates[26]. An example intubation checklist is included in Appendix E.

Equipment required

- Appropriately sized tracheal tube with a “back-up” of one size smaller and bigger
- Stylet if it is part of personal/local practice*.
- Videolaryngoscope (strongly recommended) or direct Laryngoscope with bright white light and appropriately sized blade (See Appendix D).
- Exhaled CO_2 detector (colour change or waveform) suitable for neonatal use – most commonly Pedi-Cap® (Nellcor/Medtronic, Minneapolis MN) (1-15kg) and Neo-StatCO2® (Mercury Medical, Clearwater FL) (2.5-6kg) OR Capnograph (see Appendix C and D).

- Stethoscope.
- Method of fixation of tracheal tube.
- Saturation and ECG monitoring.

*If a stylet is used, care should be taken that it is not able to protrude beyond the tip of the tracheal tube, in order to avoid trauma.

Insertion technique

- Position all equipment close to hand.
- Allocate roles to team members present.
- Use the checklist (see Appendix E).
- Position the baby on a flat firm surface. A small roll of blanket under the baby's shoulders *may* help to maintain the baby in the appropriate position.
- Hold the laryngoscope in your left hand. Use a finger of your right hand to open the mouth and protect the upper lip and gum as you insert the laryngoscope blade into the mouth.
- Advance the blade, whilst lifting the tongue out of the way.
- At all times avoid over extension of the baby's neck. The laryngoscope blade should be lifted up and away from the intubator in order to gain the view of the larynx and vocal cords. Force is applied along the handle: it should not be a tilting movement.
- Ensure a midline position. Once the epiglottis is visualised, place the tip of the laryngoscope blade at the base of the epiglottis and use it to lift the epiglottis up, which should bring the larynx into view.
- If there is difficulty visualising the larynx, gentle external downward pressure on the cricoid may help to bring the larynx down into view.
- Bring the tracheal tube into the right side of the mouth and advance toward the larynx, while maintaining the view of the larynx.
- Advance the tracheal tube gently passed the cords. The black vocal cord guide marks on the endotracheal tube act as a guide to judge how far to advance the tube. The distance between the tip of the tracheal tube and the black guide markings will vary depending on the size of the tracheal tube.
- Once the tube is inserted to the appropriate length, gently remove the laryngoscope blade, whilst holding the tracheal tube to the hard palate. Also remove the stylet if used, and check the tracheal tube remains intact.
- Check length of tracheal tube at the lips - compare to chart of expected tracheal tube length for gestation or size of baby (Appendix D).
- Connect the tracheal tube to air/oxygen supply via t-piece resuscitator (or equivalent) with exhaled colorimetric CO_2 detector (or capnograph), and confirm tracheal tube is in position (see below) before fixing in place using whichever fixation method is locally available.

Confirming tracheal tube in the trachea

- Exhaled CO2 detection is the primary means of confirming tracheal tube placement.
- (either colour change or appropriate detection of sustained amounts of CO_2 pn waveform capnography – see Appendix C and D).
- Observe baby's heart rate and oxygen saturations and ensure both are improved/ maintained.
- Observe for bilateral chest wall movement and auscultate for bilateral air entry (these are not as reliable as CO2 detection).
- Auscultate for bilateral air entry.
- Direct visualisation may be used as a means to confirm the tracheal tube has passed into the trachea but it is essential that this is done by a second intubator and not the primary intubator.

- If there is doubt about correct tracheal placement – extubate and ventilate with facemask of LM before deciding what to do next.

A chest X-ray should then be requested to confirm tube depth radiographically (or lung ultrasound in experienced hands).

It is of vital importance that the process of confirming the tube position is emphasised during skills training, and that if there is any uncertainty then the tube should be removed and mask ventilation resumed.

There may be situations where there is no colour change even if the tube is correctly placed in the larynx.

These include:

- In cardiac arrest the exhaled CO_2 is lower than normal and the colour change capnometer may lack sensitivity to detect it.
- Where the CO2 detector has been used, left open, or has been contaminated with liquids.
- If the tube has become blocked or if the trachea is blocked beyond the tube.
- If you are using capnography – expect to see an attenuated CO_2 trace even in cardiac arrest. A flat trace indicates the tube is not in the correct place and should be removed.

Simulation Scenario

BAPM Airway Basic Capability

This scenario is designed to enable assessment of BAPM Basic airway skills.

SBAR Handover

S: You have been called by a junior nurse to assess a 35-week baby in Special Care.
B: Pregnancy had been uncomplicated and onset of labour was spontaneous. Baby is one day old, and had been previously well.
A: The baby is blue and apnoeic with no response to stimulation.
R: Please assess the baby and manage appropriately.

Assessment

Information available to colleague upon their assessment:

- Colour – Blue.
- Tone - Bit floppy.
- Heart rate - 80bpm.
- Breathing - No respiratory effort.

Expected actions:

- Stimulate baby.
- Position baby with head in neutral.
- Select appropriately sized facemask and position correctly on baby's face.
- Deliver 5x inflation breaths at 2-3secs/breath, maintaining head in neutral position and ensuring jaw thrust maintained.
- Assess for chest wall movement during delivery of inflation breaths.
- Reassess heart rate and respiratory effort.
- If no chest wall movement, reassess airway position and ensure it is in neutral position, ensure adequate jaw thrust and reapply face mask. 5x inflation breaths should be repeated.
- If chest wall movement is seen, heart rate increases to >100. Still no respiratory effort
- Deliver ventilation breaths for 30secs.
- Reassess heart rate and respiratory effort.

Progress update:

Baby maintains heart rate >100 after inflation breaths with good chest wall movement. However, the baby continues to have poor respiratory effort for the next 2 minutes and you are finding it hard to maintain a consistently good seal.

Expected Actions:

- Ask for help (any help available is not skilled at tracheal intubation for the purposes of the simulation).
- Recheck head in neutral position.
- May reapply mask, continue ventilation breaths via mask (but seal will not improve without using either 2-person technique or laryngeal mask (LM) use).

- Demonstrate 2-Person technique or use of LM for maintaining airway (if asked, the airway is clear on inspection using the laryngoscope).

- If correctly applied, chest wall movement will be consistently seen during ventilation breaths, HR will remain >100 and baby will start to gasp. Ventilation breaths are continued until the baby maintains regular independent respiratory effort after one minute of ventilation breaths.

At the end of the scenario ask: *"If you hadn't got chest wall movement using this technique what could you have tried next?"***.**

Appropriate responses

- 2-person mask technique or insertion of LM depending on previous action. Note, oropharyngeal airway and nasopharyngeal airway are not as high a priority.

- Oropharyngeal suction under direct vision using laryngoscope only if colleague is trained and competent to use a laryngoscope appropriately (if this is performed there is no particulate matter in the airway in this scenario).

- Intubation should only be accepted as a correct answer if the person is functioning at Intermediate level minimum (intubation below this experience level requires a senior supervisor and optimal conditions and practitioners operating at this level should be actively discouraged from "having a go").

Further skills assessment

- Request demonstration of either insertion of LM and ventilation or 2-person mask technique and ventilation depending on which has already been performed in the scenario, to ensure capability for both skills.

- If appropriate equipment is available and personnel experienced in its use, the simulation scenario can be followed by further assessment of airway technique and mask leak using modified 'leak free' BLS manikin with hardware to measure mask pressure and facemask leak.

Simulation Scenario

BAPM Airway Standard Capability

This scenario is designed to enable assessment of BAPM Standard airway skills.

SBAR Handover

S: You have been called to assess a 29 week gestation baby, who is 12 hours of age. His nurse is concerned about increased work of breathing.

B: The baby was born by SVD after a quick labour and mum received only one dose of dexamethasone. Birthweight 1.1kg. Baby was born in good condition and did not require resuscitation. He was placed on CPAP in the delivery suite and brought to NICU on CPAP P6, FiO2 25%. Baby was commenced on benzylpenicillin and gentamicin on admission to NICU.

A: He is currently on CPAP Pressure 6cm H_2O, FiO2 35% with significant subcostal and intercostal recessions and head bobbing.

R: Please assess and manage him appropriately.

Assessment:

A: No obvious airway deformity, maintaining own airway, grunting.
B: Head bobbing, subcostal and intercostal recessions noted. Sats 82% in FiO2 35%. Air entry equal bilaterally with no added sounds.
C: HR 160, BP 53/26. Cap refil 2-3 seconds.

Expected actions:

- Ensure baby's head is placed in neutral position.
- Increase FiO2 to maintain sats 91-95%.
- If blood gas is asked for, capillary gas shows: pH 7.18, CO2 9.2, BE -4, HCO3- 21, Lac 3.4, Gluc 4.5.
- Colleague should consider appropriate increase in respiratory support- may suggest increased CPAP pressure to PEEP 7 or 8 cm H_2O, trial of BiPAP.
- With the above interventions, oxygen saturations improve to 92% and there is some improvement in work of breathing.
- It is expected that the colleague will move on to assessment of 'C'/circulation. Heart rate 150 with normal heart sounds, blood pressure 53/26, cap refill 2 seconds.
- Whilst making this assessment, the baby becomes apnoeic.
- Colleague should ask for help.
- Colleague should recheck head position and ensure is in neutral position.
- Remove CPAP mask/prongs and select appropriately sized face mask. Connect facemask to neopuff and position correctly on face using 'align, roll, check'.
- Check facemask/ neopuff are delivering appropriate pressures e.g. 25/5.
- Deliver 5x inflation breaths of 2-3 seconds and observe for chest wall movement. If chest wall movement is seen, should proceed to 30 seconds ventilation breaths of 1 second duration.
- If no chest wall movement seen, colleague should recheck head position is in neutral, then may suggest:

  - Observe oral cavity using laryngoscope if trained to do so (airway clear with no particulate matter present to suction).
  - Use two-person technique to deliver inflation breaths.
  - Use of airway adjunct e.g. laryngeal mask, oropharyngeal airway.

- If an airway adjunct is used, it must be observed to be inserted correctly. (See notes for LM/ oropharyngeal airways).
- Chest wall movement must be observed whilst 5x inflation breaths are delivered, before moving on to ventilation breaths.

If LM/iGel not already used:

- As baby remains apnoeic, colleague should consider a more definitive airway.
- If colleague suggests intubation, agree that this would be appropriate at this stage, but ask what other adjuncts could be attempted if no one is skilled at intubation (Intermediate level or higher) or if intubation has been unsuccessful. Answer LM.
- It is expected that the colleague should be able to safely insert a LM.
- ***Crucially, they must demonstrate the ability to confirm appropriate placement of all airway adjuncts, and must remove the adjunct if there is any suspicion of malposition***.

See notes on laryngeal masks and oropharyngeal airways.

Notes for airway lead

This simulation is to assess the aims and competencies of BAPM Standard airway capability level. The intention of the simulation is to give the colleague opportunity to practice and demonstrate insertion of different airway adjuncts.

If one adjunct is used successfully, at the end of the simulation if not all adjuncts have been used, say 'at point X you tried _____, what other airway adjunct could you have used? Please can you demonstrate _____ now'.

While size 1 LMA or i-gel is recommended for use in babies >2000g and/or >34weeks, there are reports of successful use in smaller babies down to 800g. Smaller LMs of size 0.5 and 0 are also starting to be available. This scenario is deliberately written to encourage colleagues to consider use of LM in smaller and more preterm babies, as it may allow safe and stable airway management when there is no one trained to intubate preterm babies or when intubation or airway management by simple bag/mask techniques has proven difficult.

It is crucial that colleagues are aware of the correct insertion technique, and how to confirm the laryngeal airway is appropriately positioned. See notes for insertion and how to confirm positioning.

Simulation Scenario

BAPM Airway Intermediate Capability

This scenario is one of two needed to enable assessment some of BAPM Intermediate airway skills.

Equipment needed

- Preterm intubatable manikin.
- Selection of facemasks used in local unit.
- Resuscitaire or incubator with air and gas supply.
- Suction catheters.
- Appropriately sized tracheal tube with additional size smaller and bigger.
- Stylet if it is part of personal/local practice*.
- Videolaryngoscope/Laryngoscope with bright white light and appropriately sized blade.
- Exhaled CO_2 detector (colour change or waveform) suitable for neonatal use – most commonly Pedi-Cap® (Nellcor/Medtronic, Minneapolis MN) (1-15kg) and Neo-StatCO2® (Mercury Medical, Clearwater FL) (2.5-6kg) or Capnograph.
- Stethoscope.
- Method of fixation of tracheal tube.
- Oximeter and ECG monitoring.
- Surfactant delivery kit.

SBAR Handover

S: You have been called by a nurse to urgently assess a 25 week gestation baby who is 6 hours old.

B: Pregnancy had been uncomplicated and onset of labour was spontaneous. Only one dose of dexamethasone had been given prior to delivery. Baby had been born by normal vaginal delivery and had been born with HR >100 and regular respiratory effort after some stimulation. He was transferred to the neonatal unit on CPAP and had been on CPAP PEEP 6 cmH_20, FiO2 28%, but one hour ago CPAP had been increased to PEEP 7 cmH_20 due to increasing FiO2 to 45% and increased work of breathing.

A: The baby has now become apnoeic and a colleague is attempting to ventilate via facemask

R: Please assess the baby and manage appropriately

Assessment

Information available to colleague upon their assessment:

- Airway: No obvious abnormalities. Head currently in neutral position. Ventilation via facemask being attempted by colleague.
- Breathing: Baby is apnoeic. Saturations are 70% in FiO2 45%.
- Circulation: HR 90bpm.

Expected actions

- Check baby is positioned correctly with head in neutral.
- Ensure appropriately sized mask is being used.
- Apply facemask using align, roll, check method and deliver 5x inflation breaths.

- If using T-piece, ensure appropriate pressures are selected e.g. PIP 20, PEEP 5.
- Observe chest wall for movement and assess baby for response.
- If facemask is applied correctly and chest wall movement is seen in the manikin, baby's heart rate improves to >100. However, baby remains apnoeic.
- With increased FiO2, sats improve to 90%.
- Given ongoing apnoea and extreme prematurity making a laryngeal mask unsuitable, decision should be made to intubate the baby.
- Appropriate team should be assembled and baby intubated safely as per local protocols. (See associated notes for process of intubation). It is expected that the colleague should be aware of checklist, medication policy, equipment and monitoring used during intubation and should secure the tracheal tube using whichever fixation method is used locally. An intubation checklist is advised (see Appendix E). Discuss use of nHFT during intubation procedure.
- Successful tracheal tube placement MUST be confirmed using exhaled CO2 detector/capnography and other confirmatory evidence of equal air entry, equal chest wall movement, physiological response of maintained/ improved heart rate and saturations. See notes in 'Confirming tracheal tube placement' section for full details.
- After successful intubation, Baby's heart rate is 140, but saturations remain 90% in 100% FiO2.
- Decision should be made to give curosurf via the tracheal tube as per local policy. Consider chest X-ray prior to administration of surfactant to confirm tracheal tube length.
- If surfactant is appropriately administered then baby's saturations quickly improve and FiO2 can be titrated down.
- Measure surfactant catheter to ensure it does not protrude beyond tracheal tube.

After the colleague has appropriately administered surfactant, airway lead should ensure colleague is aware of troubleshooting measures that should be undertaken in the event of e.g. an acute desaturation suggesting possible displaced or obstructed tracheal tube. This can be done within the simulation scenario above, or as a discussion with the expectation that the colleague could suggest appropriate actions to identify the cause of deterioration.

Expected knowledge/ actions would be working through **'DOPE'** pneumonic.

Displaced tracheal Tube.
Check tracheal tube is still at appropriate length that it was inserted to at lips, is there still colour change on CO2 detector or appropriate waveform on the capnograph?, is there still equal air entry and chest wall movement?

Obstructed tracheal tube.
Attempt to suction down tracheal tube and assess response. Does the suction catheter pass? Any matter obtained? Is there colour change on CO2 detector or appropriate waveform on the capnograph?

Pneumothorax.
Is there equal air entry and chest wall movement? A chest X-ray is the preferred test for identification of a pneumothorax (or use of lung ultrasound if trained) but depending on the infant's clinical condition, there may not be time to perform one.

Is there positive transillumination test, i.e. an increased or asymmetric halo of light when placing light source on infant's chest?

Note: in a term infant or one with significant odema, transillumination test may be negative and falsely reassuring. Therefore, maintain index of suspicion and consider chest X-ray and/ or needle thoracocentesis depending on other clinical signs and index of suspicion.

Equipment failure.
Check ventilator circuit and ensure all connections are intact with no kinks or obstructions to circuit tubing. Check air/ oxygen source. Check ventilator screen for any error messages.

A cause for deterioration is often identified and rectified by working through the above actions and performing the appropriate corrective measures. However, at all times, colleague should consider if the tracheal tube should be removed, and basic airway manoeuvres used to maintain the airway if any of the criteria (listed below) for confirming appropriate tracheal tube position are not met.

Confirming tracheal tube position

- Ensure exhaled CO_2 detector is showing CO_2 being detected (either colour change or CO_2 waveform).
- Observe for bilateral chest wall movement.
- Auscultate for bilateral air entry.
- Observe baby's heart rate and saturations and ensure both are improved/ maintained.

Simulation Scenario

Intermediate Capability: Managing the difficult airway skills

This scenario is one of two needed to enable assessment of BAPM Intermediate airway skills.

Aims

- Can recognise features where additional support in managing airway is required, and awareness of staff/ specialties that can provide that support (will vary depending on place of work).
- Identify and vocalise a 'difficult airway' scenario.
- Is familiar with the local escalation plan for a difficult airway.
- Awareness of location and contents of Difficult Airway box/ kit (will vary depending on place of work).
- is familiar with equipment used for difficult airway.
- Familiarity and knowledge of the use of different airway adjuncts and manoeuvres to overcome a difficult airway appropriate to an individual's own competence and experience.
- To ensure local pathways and processes run smoothly to allow application of the difficult airway framework and optimised management of a baby with a difficult airway.

Equipment needed

- Term intubatable manikin, modified to restrict opening of mouth (use manikin which has a removable face. Remove face and use tape going under the jaw to over the crown and encircle the head several times to ensure the lower jaw in fixed).
- Resuscitaire or incubator with air and gas supply.
- Equipment locally available for 'standard' airway management.
- Saturation monitor.
- *Difficult airway box- contents may vary depending on local set up but suggested.
- *Local or network difficult airway algorithm.

*Reference BAPM difficult airway guideline and framework.

SBAR Handover

S: Asked to attend delivery of a term baby.
B: Noted on antenatal scans to have small jaw. No concerns during labour or delivery.
A: Midwife has noted breathing difficulties after delivery.
R: Has asked you to attend and manage the baby.

Information available to colleague upon their assessment

- Colour - Blue.
- Tone - Floppy
- Heart rate - 80bpm
- Breathing - Baby is making intermittent gasps, with significant subcostal and intercostal recession.
- If colleague asks about appearance, the jaw is small, with no obvious meconium or particulate matter seen.
- If colleague uses laryngoscope appropriately during scenario to look in mouth, a cleft palate is seen.

Expected actions

- Appropriate consideration of thermal care with drying and use of hat.
- Undertake assessment of airway, breathing and circulation.
- Attempts to manage airway using basic manoeuvres- neutral position, jaw thrust, 2-person technique and facemask/ T-piece.
- Identify difficulty in manipulating and managing airway- call for help early.
- Chest wall movement is not seen (if some chest wall movement is seen on manikin, airway lead should state that for purpose of simulation it has not been seen).
- If saturation probe applied, saturations are in 60's. During scenario, if FiO2 is increased to 100%, saturations rise to 70's.
- Next appropriate step would be to either insert LM or if confident in the procedure, to attempt intubation in view of low saturations in 100% FiO2.
    - LM - saturations improve if sited appropriately and 100% FiO2 delivered.
    - Intubation attempts result in dropping of saturations and heart rate which recover when attempt is terminated and 100% O2 applied by facemask.
- Appropriate reassessment of airway, breathing and circulation after each intervention.
- Recognise intubation attempts to be detrimental and halt and explore alternatives.
- Request Difficult airway box.
- As per local difficult airway algorithm, colleague should request urgent support from senior colleagues and contact ENT/ anaesthetic teams/ refer to transfer team depending on services available at local unit (which will not be immediately available in this scenario).
- Depending on skills/competencies, and as dictated by locally agreed difficult airway guidelines, colleague may attempt use of:
    - Oropharyngeal airway - difficult to insert and not tolerated by this baby.
    - Tracheal tube as nasopharyngeal airway- saturations improve if correctly sited and 100% FiO2 delivered.
    - Intubation via video laryngoscopy using hyper angulated blade (note differences in technique caused by indirect laryngoscopy (see Appendix B).
    - Fibre-optic intubation device for indirect tracheal intubation.

Ongoing progress

Colleague is able to maintain heart rate 80 and saturations in 70's if FiO2 100% delivered by facemask.

Heart rate improves to >100 and saturations improve to 90's if LM is correctly sited with FiO2 100% or if tracheal tube used as nasopharyngeal airway with FiO2 100%

After simulation scenario

Review local difficult airway algorithm. Emphasise the importance of identifying and vocalising 'difficult airway', and working through the algorithm in a stepwise manner.

Review local sources of support in a difficult airway situation.
Review contents of difficult airway box. Staff should have an awareness of the contents so that they can support others in management of a baby with a difficult airway.

Where appropriate to their role/ competencies, demonstrate and/or observe staff in:

- Insertion of LM.
- Sizing and use of oropharyngeal airway.
- Sizing and use of nasopharyngeal airway.

- Insertion of tracheal tube using direct laryngoscopy.
- Insertion of tracheal tube using hyperangulated blade.

See skills exemplars.

Additional Resources

The below link shows the technique for Laryngeal mask insertion:
https://www.seedlinguk.co.uk/learning-centre/videos/laryngeal-mask-airway-lma-insertion-animation/

Intubation

The below links show video resources for intubation technique, and tips for improving intubation success.

The following are videos taken during intubation via videolaryngoscopy
https://www.bapm.org/pages/airway-skills-training-assessment-tools

Seedling resources

https://www.seedlinguk.co.uk/learning-centre/videos/laryngoscope-intubation-animation/

https://www.seedlinguk.co.uk/learning-centre/videos/neonatal-intubation-training-video/

https://www.seedlinguk.co.uk/learning-centre/videos/neonatal-intubation-top-tips-to-improve-success/

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